

How does sustainable water consumption in the shower relate to the perception of well-being?

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Abstract

Water scarcity is already a worrying issue and it is predicted to get worse in the future. This creates an imperative to use water efficiently and sustainably. In the domestic sphere, one of the main uses of water is showering, not only for hygiene reasons but also as a wellness activity. In order to gain insight into the implications of sustainable shower use, in this paper we analyse the relationship between subjective well-being and water consumption in the shower. We thus provide the first quantitative evidence on water consumption and subjective well-being taking into account a specific use of this resource. Specifically, we aim to answer the following questions: 1) How does shower water consumption relate to subjective well-being, 2) Does this relationship with subjective well-being differ depending on showering habits (time spent in the shower, and number of showers per week), and 3) Does this relationship differ depending on the season (winter and summer). The dataset contains information on 937 students from different disciplines at the University of Granada, Spain. The different interpretations of subjective well-being considered are life satisfaction, affect, and vitality. Results suggest that there is a negative relationship between water consumption and subjective well-being, in line with the literature that identifies a well-being dividend from green behaviour (being pro-environmental helps the environment and increases happiness). All subjective well-being dimensions are negatively related to time spent in the shower, regardless of the season. In contrast, the frequency of showering is not significantly related to well-being. Therefore, it appears that higher water consumption does not translate into higher perceived well-being, indicating that there is no conflict between efficient shower water use and individual well-being.

Keywords

Subjective well-being; Shower water use; Water consumption; Pro-environmental behaviour

Reference

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1. Introduction

Global freshwater use has increased six-fold in the last 100 years, mainly due to population growth, economic development, and changing consumption patterns (United Nations, 2021). In the coming decades, water demand will continue to grow, which, coupled with the effects of climate change, will result in water becoming an even scarcer resource (Burek et al., 2016).

To tackle water scarcity, it is important to promote water efficiency in all sectors. In particular, Sustainable Development Goal 6 aims to ensure that all people have access to water and sanitation (United Nations, 2015). In the domestic sphere, one of the main uses of water is for personal hygiene, which accounts for around one third of indoor household water consumption (Makki et al., 2015; Matos et al., 2013; Willis et al., 2011, 2013). As such, personal hygiene practices are an interesting target for water-saving policies.

Thanks to the development of technology and domestic infrastructure, along with the evolution of social norms on grooming and lifestyle changes, daily showering has become established as the most common personal hygiene practice (Hand et al., 2005). At the same time, the purpose of showering has also evolved, with it becoming common to shower not only for hygienic reasons, but also as a wellness-generating activity (Quitau & Røpke, 2009). These changes often mean more frequent, longer showers, which implies higher water consumption (see, for example, Gram-Hanssen et al., 2020; Lindsay & Supski, 2017; Quitau & Røpke, 2009).

Unsustainable water use associated with the hedonic aspect of showering is explained by the fact that people tend to prioritise pleasure over water and energy conservation (Quitau & Røpke, 2008). But to what extent does higher water consumption in the shower have an impact on the perception of well-being? Does sustainable use of water resources in the shower really have a cost in terms of well-being? Previous research has shown that, in general, adopting pro-environmental behaviours positively influences well-being (Zawadzki et al., 2020). Furthermore, there is evidence that higher household water consumption is not associated with improved well-being (Chenoweth et al., 2016). However, there are no related studies that analyse the particular case of showering.

Given the different possible applications of water, its relationship to subjective well-being is strongly determined by the specific use under consideration. Therefore, as a novelty, this study builds on previous evidence on water consumption and well-being by taking

into account a specific application of this resource. In this paper, we explore the relationship between shower water consumption and subjective well-being by considering showering habits (i.e., frequency and duration) in winter and summer, and including several measures of well-being. Specifically, we use life satisfaction, positive and negative affect, and subjective vitality to cover, respectively, the cognitive, affective, and eudaimonic dimensions of subjective well-being. For the analyses, we use data from a sample of 937 students from the University of Granada (Spain).

The results of the regression analyses show that higher water consumption in the shower is significantly and negatively related to subjective well-being. Specifically, it is associated with lower life satisfaction, lower subjective vitality, and higher negative affect. On further analysis of the relationship, we find that frequency of showering is not associated with subjective well-being. However, longer duration is negatively related to all dimensions of well-being. The results remain the same regardless of the season considered. Adapting daily habits to mitigate environmental problems is an essential part of the transition to a sustainable society. It is particularly important to adopt sustainable showering habits, given how water- and energy-intensive this activity is. The research results are therefore promising, as they suggest that efficient showering is not detrimental to individual subjective well-being, which in turn will facilitate the implementation of public policies aimed at water conservation.

The rest of the article is structured as follows: Section 2 reviews previous literature that provides some insight into the relationship between shower water consumption and subjective well-being, providing arguments that support both directions of this relationship. Section 3 describes the method and materials. Section 4 presents the results of the analyses. Section 5 discusses the results. Finally, section 6 highlights the conclusions of the research.

2. Literature review

Water is closely linked to well-being. As well as being essential to physical health, it also plays a key role in subjective well-being. A number of studies have found that better access to fresh water is associated with greater life satisfaction (Guardiola et al., 2013, 2014; Nadeem et al., 2018; Nadeem et al., 2020). In fact, the influence of satisfaction with

water on subjective well-being may be more important than satisfaction with other domains of life, such as money or leisure (Guardiola et al., 2013). In this regard, it has also been found that the introduction of piped water leads to an increase in people's happiness (Devoto et al., 2012; Mahasuweerachai & Pangjai, 2018).

While water is a key factor in subjective well-being, once basic needs are met, higher water consumption does not necessarily contribute to greater well-being. DeLeire and Kalil (2010) analysed the relationship between different components of consumption expenditure and life satisfaction using an American sample, and found that consumption of utilities and housing - which includes water consumption - is not related to this dimension of subjective well-being. For a British sample, Chenoweth et al. (2016) found that in general there is no association between well-being and water consumption, although they reported negative correlations between water use and some individual well-being parameters. Similar conclusions have been drawn from research exploring the relationship between water-saving behaviour and subjective well-being. In this vein, Kaida and Kaida (2016) found that domestic water- and energy-saving behaviours were positively correlated with life satisfaction in a Swedish sample. These findings are in line with those of Suárez-Varela et al. (2016), who found in a Spanish sample that actions aimed at saving water in the household are positively or non-significantly related to life satisfaction. Likewise, the study by Buhl et al. (2017) using a German sample shows a negative relationship between natural resource consumption and life satisfaction.

Although the above findings decouple higher consumption from higher well-being, none of this evidence specifically addresses the relationship between shower water consumption and subjective well-being. Despite the fact that several studies have found a positive relationship between the adoption of pro-environmental behaviours and well-being (e.g., Ambrey & Daniels, 2017; Guillen-Royo, 2019; Kaida & Kaida, 2016; Schmitt et al., 2018; Xiao & Li, 2011; Zannakis et al., 2019), some research has identified exceptions, indicating that the association between the two concepts depends on the type of behaviour considered. For example, Verhofstadt et al. (2016) showed that some activities (e.g., consuming fresh and seasonal products) reduce individuals' ecological footprint while increasing their well-being, while other actions that shrink the ecological footprint (e.g., limiting meat and fish consumption or living in a small house) are detrimental to subjective well-being. Similarly, Lenzen and Cummins (2013) found that some actions are beneficial for well-being and the environment (e.g., living with other

people), whereas others entail trade-offs between well-being and environmental impact (e.g., using the car).

In the case of water consumption in the shower, some studies suggest that higher consumption may be associated with greater well-being. However, scientific evidence in this regard is scarce and limited to qualitative research. For example, Quitzau & Røpke (2009) analysed the transformations in the use and meaning of Danish bathrooms over the last decades, finding that the concept of showering has evolved from merely washing to an activity that also provides pleasure and well-being, which in many cases has led to a change in showering habits. Based on their qualitative interviews in Danish households, Gram-Hanssen et al. (2020) reported that some people prolong shower time as a form of relaxation, accompanying it with music or the use of certain products. In response to the stresses of modern life, showering becomes an activity that offers peace and quiet, an opportunity to take time for oneself and enjoy a moment of privacy (Quitzau & Røpke, 2008). Lindsay and Supski (2017) used focus groups to study the water consumption practices of people in different Australian cities, highlighting the therapeutic value of showering and its use as a tool for managing stress and emotions. Other benefits of showering that have been reported in the scientific literature include its potential to improve sleep (Whitworth-Turner et al., 2017) and even the possibility of using it as a treatment for depression (Shevchuk, 2008).

In sum, what has been presented in this section underlines the complexity of the relationship between water consumption and subjective well-being. Water is a resource with different functions, and can be considered a basic necessity or a luxury good, depending on the case. Therefore, in order to study the relationship between water consumption and subjective well-being, it is necessary to distinguish between the different uses. In this study, we focus specifically on the shower, as it is where most water is typically consumed in households (Makki et al., 2015; Willis et al., 2011, 2013). Thus, we provide the first quantitative evidence on shower water consumption and subjective well-being.

3. Material and Methods

3.1. Data

This research is based on information from a survey of 1150 students at the University of Granada, Spain, who habitually had showers instead of baths. The fieldwork was carried out in March and April 2019. A research team visited classrooms in different faculties to conduct the questionnaire. Specifically, students from the disciplines of economics, political science, sociology, social work, pedagogy, medicine, environmental sciences, and computer science were surveyed. The students accessed the questionnaire online via the Qualtrics platform and did not receive any payment for their participation.

Before running the analyses, observations with missing or nonsense values for the variables of interest were removed. Observations with extreme values (5 participants who reported taking showers lasting between 45 and 60 minutes) were also removed to avoid distorting the results. Thus, the final sample consists of 937 observations. This sample size is a case study, but it is large enough to be representative of the young population of Granada. In 2019, when the fieldwork was carried out, Andalusia, where the University of Granada is located, had 1,211,589 people aged between 18 and 30 years old (Institute of Statistics and Cartography of Andalusia, 2020). With a confidence level of 95% and a margin of error of 5%, the sample size needed to ensure the representativeness in the region of Andalusia equals to 385 people, a figure that is well exceeded.

3.2. Measures

3.2.1. Subjective well-being

We use several indicators to assess subjective well-being in order to take into account different dimensions of the experience of being well. Specifically, we incorporate measures of life satisfaction (cognitive), positive and negative feelings (affective) and subjective vitality (eudaimonic).

The measure of life satisfaction is related to the judgements and evaluations a person makes about his or her life in general (Dolan et al., 2008). Participants answered the question "How satisfied are you at this moment with your life as a whole?" on a scale from 0 (very dissatisfied) to 10 (very satisfied).

Respondents' affective state was assessed using the Positive and Negative Affect Schedule (PANAS, Watson et al., 1988), which consists of two separate 10-item scales, one for positive affect and one for negative affect. The former includes feelings of achievement, enthusiasm and commitment (e.g., motivation, alertness, determination, pride), while the latter includes feelings of distress and discomfort (e.g., irritability, shame, guilt, insecurity). Participants indicated the degree to which they had experienced these feelings in the past 7 days using a 5-point Likert scale (from 1, "very slightly or not at all" to 5, "extremely"). *Positive affect* and *Negative affect* variables were calculated as the sum of their respective item scores.

Subjective vitality, understood as the feeling of energy and aliveness derived from full physical and psychological functioning, was measured using the Subjective Vitality Scale (Ryan & Frederick, 1997). Respondents rated 6 items related to feeling full of life (e.g., "I feel alive and vital", "I get excited every new day") on a 5-point Likert scale (from 1, "totally false" to 5, "totally true"). We calculated the variable *Vitality* as the mean of these scores.

3.2.2. Shower use

We captured shower habits through four questions. First, respondents had to answer two questions about how many times they shower per week, one referring to the summer and one to the winter months (variables *Number Summer* and *Number Winter*). Secondly, participants were asked about how long they stay under the water each time they shower, again with separate answers for each season (*Time Summer* and *Time Winter*). We made this distinction between seasons because previous research has shown that weather is a determinant of shower water use (Rathnayaka et al., 2015).

From the shower frequency and duration variables, we calculated the time spent in the shower per week and created two variables that reflect the weekly shower water consumption in hectolitres for summer and winter (*Consumption Summer* and *Consumption Winter*). To approximate consumption, we multiplied the weekly time spent in the shower by 14, which is the average number of litres per minute consumed in the shower in the region (Watson, 2017). Note that although the consumption indicator we used is not very precise, multiplying by a scalar does not affect the relationships we aim to study.

3.2.3. Control variables

We also used a set of sociodemographic variables to control for their effect on subjective well-being in order to avoid spurious regressions. We asked about the parents' monthly income, proposing eight intervals as possible answers (the lowest category being less than €499 and the highest €5000 or more). We estimated income as the midpoint of the selected range, except for the highest category, which we estimated at €6000. We calculated per capita income by dividing by the number of inhabitants in the household and took the natural logarithm of this amount to account for the diminishing marginal effect of income on subjective well-being (Diener et al., 1993; Easterlin, 1974). Also, we included in the analyses the respondents' age and age squared, given the U-shaped relationship between age and subjective well-being reported by previous studies (Dolan et al., 2008). To capture participants' social relationships, we asked how often they are in contact with their family, friends and neighbours. Respondents indicated the frequency for each group using a 5-point Likert scale (from 1, “never” to 5, “every or almost every day”) and we calculated the variable *Relationships* as the average of the three scores given. Respondents indicated their health status by selecting one of the proposed categories (0, “major problems”; 1, “moderate problems”; 2, “mild problems”; 3 “no problems”). In addition, dummy variables were included to indicate gender (equal to 1 if female), marital status (equal to 1 if single), and employment status (equal to 1 if working as well as studying).

3.3. Method of Analysis

Regression analyses were used to explore the relationship between showering practices and subjective well-being, providing information on the nature and strength of the relationship. We tested whether subjective well-being is explained by individuals' shower habits and socio-economic characteristics, using the general specification of the estimated equation, as follows:

$$SWB_{ij} = \beta_0 + \beta_1 SU_{il} + \beta_2 X_i + \varepsilon_i$$

where i refers to the i -th individual in the sample ($i = 1, \dots, 937$), SWB_{ij} represents the variables ($j=4$) we use as measure of subjective well-being (life satisfaction, positive affect, negative affect and subjective vitality), SU_{il} corresponds to the six shower use variables (estimated consumption, shower duration, and shower frequency, in summer

and winter, denoted by l), X_i denotes the set of socio-economic variables, and ε_i is the error term.

We used several model specifications to incorporate the different well-being dependent variables and the different shower use variables. All these model specifications were estimated using ordinary least squares (OLS). Although the ordinal nature of the life satisfaction variable makes it more appropriate to use ordered probit or ordered logit techniques for this dependent variable, we applied OLS for ease of interpretation and because there is evidence that the results yielded by both methods are very similar (Ferreri-Carbonell & Frijters, 2004). Indeed, when repeating the analyses for life satisfaction using ordered probit regressions, we obtained identical results for all models (these results are not presented in the paper). The analyses were performed using Stata 15 statistical software.

4. Results

Table 1 shows the descriptive statistics of the study variables. Of the 937 people included in this study, 62.86% were female, 64.35% reported being single and 25.19% were working as well as studying. The average age of the respondents was around 20 years old. Shower use variables indicate that participants' showering behaviour is quite unsustainable, with the estimated shower water consumption exceeding 1100 litres per week in both seasons. The average shower duration exceeds eight minutes in summer and eleven minutes in winter, while the average number of showers per week is around seven in winter and nine in summer. It is particularly striking that certain extreme behaviours, such as 30-minute showers or showering up to 16 times a week, are not entirely uncommon among the study participants.

Table 1. Descriptive statistics.

Variables	Mean / %	Std. Dev.	Min	Max
Subjective wellbeing				
<i>Life satisfaction</i>	7.045	1.674	1	10
<i>Positive affect</i>	31.057	6.724	10	49
<i>Negative affect</i>	23.011	7.215	10	49
<i>Vitality</i>	3.309	0.735	1	5
Shower use				
<i>Consumption Summer</i>	11.027	7.538	0.84	67.2

<i>Consumption Winter</i>	11.867	7.463	0.7	67.2
<i>Time Summer</i>	8.687	4.888	1	30
<i>Time Winter</i>	11.537	6.008	1	40
<i>Number Summer</i>	9.031	3.003	2	16
<i>Number Winter</i>	7.326	2.195	2	16
Control variables				
<i>Income</i>	6.201	0.785	3.22	8.70
<i>Age</i>	20.677	2.861	18	54
<i>Female</i>	62.86%		0	1
<i>Single</i>	64.35%		0	1
<i>Relationships</i>	3.479	0.761	1	5
<i>Health</i>	2.445	0.674	0	3
<i>Work</i>	25.19%		0	1

The results of the estimations including weekly shower water consumption (Table 2), shower duration (Table 3), and the number of showers taken per week (Table 4) are presented below. The models in (a) include the shower use variables for the summer months, and the models in (b) those for the winter months. For all estimated models, the joint significance test indicates that they are globally significant. The coefficients of determination range from 8% to 15%, with the models for subjective vitality having the best fit, and those for negative affect the worst. Although these R² values are quite low, they are within the range of the typical values found in studies of subjective well-being and do not pose a problem for the purpose of the study (OECD, 2013).

When we consider the relationship between subjective well-being and shower water consumption, we find the same results for both seasons. The more water a person consumes in the shower, the lower their life satisfaction ($b = -0.0146$, $p < 0.1$ in (a); $b = -0.0215$, $p < 0.01$ in (b)), the more negative emotions they experience ($b = 0.0790$, $p < 0.01$ in (a); $b = 0.0794$, $p < 0.05$ in (b)), and the lower their subjective vitality ($b = -0.00614$, $p < 0.1$ in (a); $b = -0.00754$, $p < 0.05$ in (b)). In contrast, positive affect is not significantly related to shower water consumption.

Table 2. Linear regression models for subjective well-being and shower water consumption by season.

	(a)				(b)			
	<i>Life satisfaction</i>	<i>Positive affect</i>	<i>Negative affect</i>	<i>Vitality</i>	<i>Life satisfaction</i>	<i>Positive affect</i>	<i>Negative affect</i>	<i>Vitality</i>
<i>Consumption Summer</i>	-0.0146*	-0.034	0.0790***	-0.00614*				
	(0.008)	(0.028)	(0.028)	(0.003)				
<i>Consumption Winter</i>					-0.0215***	-0.0442	0.0794**	-0.00754**
					(0.008)	(0.030)	(0.033)	(0.004)
<i>Income</i>	0.101	0.862***	-0.379	0.0653**	0.106	0.874***	-0.403	0.0673**
	(0.066)	(0.271)	(0.298)	(0.030)	(0.066)	(0.270)	(0.298)	(0.030)
<i>Age</i>	0.00292	0.541**	0.111	0.0854***	0.000893	0.536**	0.123	0.0845***
	(0.065)	(0.262)	(0.279)	(0.027)	(0.065)	(0.262)	(0.280)	(0.027)
<i>Age²</i>	0.000339	-0.00593	-0.00521	-0.00112***	0.000291	-0.006	-0.00515	-0.00113***
	(0.001)	(0.0040)	(0.0042)	(0.0004)	(0.001)	(0.0039)	(0.0042)	(0.0004)
<i>Female</i>	0.0893	-1.672***	-0.423	-0.0197	0.122	-1.614***	-0.488	-0.0105
	(0.109)	(0.445)	(0.489)	(0.048)	(0.111)	(0.447)	(0.490)	(0.048)
<i>Single</i>	-0.436***	-0.686	0.452	0.00267	-0.434***	-0.688	0.484	0.00178
	(0.106)	(0.445)	(0.487)	(0.046)	(0.105)	(0.442)	(0.485)	(0.045)
<i>Relationships</i>	0.348***	1.956***	-1.038***	0.289***	0.346***	1.952***	-1.023***	0.288***
	(0.071)	(0.286)	(0.303)	(0.032)	(0.071)	(0.285)	(0.303)	(0.032)
<i>Health</i>	0.568***	0.744**	-2.484***	0.183***	0.563***	0.732**	-2.463***	0.181***
	(0.080)	(0.319)	(0.361)	(0.033)	(0.080)	(0.319)	(0.361)	(0.033)
<i>Work</i>	-0.113	0.302	0.595	-0.00259	-0.11	0.311	0.57	-0.000845
	(0.128)	(0.501)	(0.594)	(0.052)	(0.128)	(0.501)	(0.594)	(0.052)
<i>Constant</i>	4.026***	10.28**	33.98***	0.255	4.146***	10.50**	33.71***	0.29
	(1.059)	(4.306)	(4.535)	(0.452)	(1.063)	(4.330)	(4.543)	(0.455)
N	937	937	937	937	937	937	937	937
R ²	0.111	0.102	0.084	0.147	0.115	0.102	0.084	0.149
F	13.25	11.65	11.79	18.45	13.86	11.82	11.27	18.49

All models are statistically significant at 1%. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In table 3 we further investigate the relationship between water consumption in the shower and subjective well-being, separately analysing individuals' habits regarding duration and frequency of showers. We observe a statistically significant relationship between prolonged showers and poorer levels of well-being. Again, the results are the same in both seasons: shower duration is negatively related to life satisfaction (b= -0.0294, p < 0.01 in (a); b= -0.0343, p < 0.01 in (b)), positive affect (b= -0.0828, p < 0.1 in (a); b= -0.0813, p < 0.05 in (b)), and vitality (b= -0.0146, p < 0.01 in (a); b= -0.0128,

$p < 0.01$ in (b)), and positively associated with negative affect ($b = 0.119$, $p < 0.01$ in (a)); $b = 0.135$, $p < 0.01$ in (b)).

Table 3. Linear regression models for subjective well-being and time spent showering by season.

	(a)				(b)			
	<i>Life satisfaction</i>	<i>Positive affect</i>	<i>Negative affect</i>	<i>Vitality</i>	<i>Life satisfaction</i>	<i>Positive affect</i>	<i>Negative affect</i>	<i>Vitality</i>
<i>Time Summer</i>	-0.0294*** (0.011)	-0.0828* (0.0439)	0.119*** (0.0432)	-0.0146*** (0.0046)				
<i>Time Winter</i>					-0.0343*** (0.009)	-0.0813** (0.0362)	0.135*** (0.0378)	-0.0128*** (0.0038)
<i>Income</i>	0.0902 (0.0664)	0.831*** (0.272)	-0.339 (0.301)	0.0597** (0.0297)	0.0982 (0.0662)	0.856*** (0.269)	-0.372 (0.296)	0.0644** (0.0296)
<i>Age</i>	-0.00597 (0.065)	0.517** (0.262)	0.15 (0.279)	0.0812*** (0.027)	-0.00952 (0.065)	0.511* (0.263)	0.163 (0.279)	0.0806*** (0.027)
<i>Age²</i>	0.00045 (0.001)	-0.0056 (0.004)	-0.0058 (0.0042)	-0.0011*** (0.0004)	0.00042 (0.001)	-0.0057 (0.0039)	-0.0056 (0.0042)	-0.0011*** (0.0004)
<i>Female</i>	0.0956 (0.109)	-1.640*** (0.443)	-0.405 (0.488)	-0.0142 (0.048)	0.155 (0.111)	-1.516*** (0.445)	-0.632 (0.493)	0.00333 (0.049)
<i>Single</i>	-0.433*** (0.106)	-0.665 (0.444)	0.471 (0.488)	0.00602 (0.046)	-0.432*** (0.105)	-0.675 (0.441)	0.47 (0.485)	0.0032 (0.045)
<i>Relationships</i>	0.339*** (0.071)	1.934*** (0.286)	-0.993*** (0.304)	0.285*** (0.032)	0.335*** (0.071)	1.927*** (0.286)	-0.980*** (0.302)	0.284*** (0.032)
<i>Health</i>	0.576*** (0.080)	0.765** (0.318)	-2.515*** (0.360)	0.187*** (0.033)	0.571*** (0.080)	0.751** (0.317)	-2.496*** (0.36)	0.184*** (0.033)
<i>Work</i>	-0.114 (0.128)	0.298 (0.501)	0.586 (0.594)	-0.00327 (0.052)	-0.1 (0.128)	0.333 (0.501)	0.532 (0.591)	0.00269 (0.052)
<i>Constant</i>	4.328*** (1.067)	11.18** (4.350)	32.90*** (4.576)	0.413 (0.452)	4.488*** (1.065)	11.38*** (4.375)	32.32*** (4.587)	0.424 (0.455)
N	937	937	937	937	937	937	937	937
R ²	0.114	0.104	0.084	0.152	0.121	0.105	0.089	0.154
F	14.09	11.87	11.77	19.12	15.29	12.11	12.51	19.54

All models are statistically significant at 1%. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Finally, as table 4 indicates, we find no significant association between the number of showers and subjective well-being. The negative relationship between water consumption and well-being is explained only by the time spent in the shower and not by the frequency of showers.

Table 4. Linear regression models for subjective well-being and weekly number of showers by season.

	(a)				(b)			
	<i>Life satisfaction</i>	<i>Positive affect</i>	<i>Negative affect</i>	<i>Vitality</i>	<i>Life satisfaction</i>	<i>Positive affect</i>	<i>Negative affect</i>	<i>Vitality</i>
<i>Number Summer</i>	-0.0049 (0.019)	0.102 (0.073)	0.0866 (0.079)	0.0053 (0.008)				
<i>Number Winter</i>					-0.00565 (0.026)	0.0511 (0.099)	0.0796 (0.109)	0.000168 (0.012)
<i>Income</i>	0.105 (0.066)	0.843*** (0.272)	-0.418 (0.300)	0.0652** (0.030)	0.105 (0.066)	0.857*** (0.273)	-0.415 (0.304)	0.0665** (0.030)
<i>Age</i>	0.00192 (0.065)	0.499* (0.261)	0.0953 (0.283)	0.0824*** (0.028)	0.00152 (0.065)	0.523** (0.261)	0.107 (0.282)	0.0842*** (0.028)
<i>Age²</i>	0.00038 (0.001)	-0.0052 (0.0039)	-0.0051 (0.0043)	-0.0011** (0.0004)	0.00038 (0.001)	-0.0055 (0.0039)	-0.0052 (0.0043)	-0.0011** (0.0004)
<i>Female</i>	0.0597 (0.109)	-1.790*** (0.443)	-0.288 (0.484)	-0.0353 (0.048)	0.0575 (0.109)	-1.746*** (0.442)	-0.25 (0.483)	-0.0331 (0.048)
<i>Single</i>	-0.458*** (0.106)	-0.783* (0.444)	0.54 (0.487)	-0.00937 (0.046)	-0.459*** (0.106)	-0.748* (0.444)	0.564 (0.486)	-0.00713 (0.046)
<i>Relationships</i>	0.343*** (0.072)	1.903*** (0.287)	-1.037*** (0.308)	0.284*** (0.033)	0.342*** (0.072)	1.931*** (0.286)	-1.020*** (0.306)	0.286*** (0.033)
<i>Health</i>	0.567*** (0.080)	0.782** (0.319)	-2.454*** (0.362)	0.185*** (0.033)	0.568*** (0.080)	0.755** (0.319)	-2.470*** (0.361)	0.183*** (0.033)
<i>Work</i>	-0.106 (0.127)	0.322 (0.503)	0.558 (0.593)	0.000596 (0.052)	-0.107 (0.127)	0.325 (0.502)	0.565 (0.594)	0.000468 (0.052)
<i>Constant</i>	3.934*** (1.052)	9.888** (4.262)	34.38*** (4.556)	0.205 (0.451)	3.943*** (1.053)	9.900** (4.301)	34.29*** (4.565)	0.213 (0.452)
N	937	937	937	937	937	937	937	937
R ²	0.107	0.102	0.079	0.144	0.107	0.10	0.078	0.143
F	12.28	12.02	10.69	18.88	12.33	11.57	10.57	18.68

All models are statistically significant at 1%. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

5. Discussion

In this research, we explored the relationship between shower use and people's individual well-being. Our regression results suggest that higher levels of water consumption in the shower are associated with lower subjective well-being (lower life satisfaction and subjective vitality, and higher negative affect). When we studied showering habits in more depth, we found that the duration of showering is significantly and negatively

related to all dimensions of subjective well-being considered, while the frequency of showering is not a significant predictor of any of the well-being measures. These associations appear to be robust and hold for the different seasons, as we found no differences between summer and winter habits in terms of their relationship with well-being.

In line with some previous research, we found that caring for the environment and people's well-being are compatible goals. Positive associations between commitment to pro-environmental actions and well-being have been demonstrated for a variety of behaviours, such as purchasing behaviour (e.g., Xiao & Li, 2011), environmental volunteering (e.g., Binder & Blankenberg, 2016), or waste behaviour (e.g., Jacob et al., 2009). However, this is the first time that evidence has been provided for water consumption in the shower. The results reported in this study add to the evidence supporting the double dividend theory (Jackson, 2005), which holds that pro-environmental behaviour is beneficial for both the environment and the person engaging in it.

The findings of this study are policy-relevant and can guide the design of public awareness and education campaigns aimed at encouraging efficient water use. In the fight against the climate crisis, it is essential to develop environmental policies that do not adversely affect, or that even improve, citizens' welfare as such measures are likely to enjoy greater public support (Lenzen & Cummins, 2013). Previous research on showering practices has identified showering as a wellness-generating activity, with long showers being defined as a form of daily therapy "necessary for a good life" (Lindsay & Supski, 2017). Nevertheless, our results contradict this idea. As Kasser (2002) argued, sometimes certain aspects of personality and environmental circumstances lead people to try to meet their needs in ways that do not ultimately satisfy them. Unsustainable long showers are an example of a social trend that does not really meet the needs it is supposed to. People are unlikely to change their showering habits if they believe that such actions are beneficial to them. Therefore, policy-makers should convey the message that increased water consumption in the shower, and especially prolonged showers, are negatively associated with well-being. It should be emphasised that it is not a good idea to use showering as a leisure and relaxation activity that improves well-being; rather, there are other more appropriate practices that should be adopted for these purposes, such as meditation (Dhandra, 2019) or spending time with loved ones (Becchetti et al., 2011).

Citizens should also be made aware of the potential gains of adopting sustainable showering practices, both for subjective well-being and for physical well-being, in terms of the associated skin health benefits.

This study was carried out using a sample of students, mostly young people (the average age of the participants was around 20 years old). It is interesting to study this age group because young people have previously been identified as some of the highest users of water in the shower and have also been found to be less willing to reduce the duration and frequency of their showers (Lindsay & Supski, 2017; Stanes et al., 2015). The results of this study could help to lessen resistance to the necessary change in showering habits. Future research could extend the analyses carried out here to samples with a more varied profile to see if the findings of the present research hold.

On the other hand, the fieldwork for this study was conducted in the city of Granada, southern Spain. The fact that it is in an area of high water stress makes it an interesting context for research. Nevertheless, future studies could test whether the relationship between showering habits and well-being is different in areas with other characteristics. It would also be worth studying this relationship in other countries with a different cultural context, as culture may be an influential factor in this relationship.

Finally, it should be noted that the data used in this study are cross-sectional, which limits the ability to make causal interpretations. For this reason, the results of the regression analyses have been interpreted as correlations. The negative relationship between water consumption in the shower and subjective well-being could plausibly be a case of reverse causality. In other words, it could be that people with lower well-being make less sustainable use of the shower; for example, unhappy people might spend more time in the shower as a form of escape, using the shower as a refuge. In any case, regardless of the direction of causality, the results of the study seem to disprove the idea that higher water consumption in the shower is associated with higher well-being, implying that using the shower in a sustainable way is compatible with achieving a high quality of life.

6. Conclusion

Moving towards an environmentally sound future requires us to change our daily practices. Showering is a water- and energy-intensive activity and is one of the main uses

of water in the household, making sustainable shower use particularly important. In this paper, we examined the relationship between efficient shower water use and subjective well-being. To our knowledge, this is the first study to empirically link shower habits and well-being. Using regression analyses with a sample of university students, we found that shower water consumption is negatively associated with life satisfaction and subjective vitality, and positively associated with experiencing negative emotions. Decomposing water consumption into shower duration and frequency habits, we found that the negative relationship between consumption and well-being seems to be explained by the time spent in the shower. Shower duration is associated with worse levels of all the indicators of well-being used (life satisfaction, positive and negative affect, and subjective vitality). In contrast, the frequency of showering is not significantly related to any dimension of well-being. Although showering habits are different in summer and winter, both in terms of frequency and duration, there are no differences in their relationship with subjective well-being, with the same results being obtained for both seasons. The results run counter to the growing tendency to view showering (especially long showers) as a wellness activity, since higher water consumption does not translate into higher perceived well-being. The fact that there is no conflict between efficient shower water use and well-being makes it easier to implement public policies aimed at reducing water consumption in the shower.

Statements and declarations

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