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Characterization of the environmental attitudes and practices of the urban population of Puno, Andean Plateau

Actitudes y prácticas ambientales de la población urbana de Puno, Altiplano Andino

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Abstract

During the last decades in Puno, Peru, the problem of contamination has worsened due to the combined action of the disorderly growth of the urban population, poor management of solid waste, discharge of untreated sewage into the bay of Lake Titicaca and practices of inadequate sanitation and hygiene, severely affecting the environment and human health. The objective of the study was to characterize the pro-environmental attitudes and behaviors of the city's population of Puno in relation to sanitation, pollution and environmental management. The research is non-experimental, quantitative, cross-sectional, descriptive, correlational and micro level of analysis. The universe of study was the population over 18 years of age in the urban area, which comprises 97,264 inhabitants; the sample, determined at simple random, was 382 people. A structured questionnaire was applied. Descriptive and inferential analysis and hypothesis testing were performed with SPSS statistical software. The results indicate that the environmental attitudes of the majority of the population are positive regarding factors and sources of pollution and effects on human health. On the contrary, environmental practices are inadequate in environmental management in the home and health and hygiene conditions in the home. It is concluded that the sustainable improvement of pro-environmental attitudes and behaviors demands a new public policy of environmental education, whose implementation incorporates the effective participation of civil society based on an incentive system.

Keywords: Environment, behavior, concern, contamination, sanitation.

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Resumen

Durante las últimas décadas en Puno, Perú, la problemática de la contaminación se fue agudizando por la acción combinada del crecimiento desordenado de la población urbana, gestión deficiente de residuos sólidos, descarga de aguas servidas sin tratamiento en la bahía del lago Titicaca y prácticas de sanidad e higiene inadecuadas; situaciones que afectan severamente el ambiente y la salud humana. El objetivo del estudio fue caracterizar las actitudes y comportamientos proambientales de la población de la ciudad de Puno en relación al saneamiento, la contaminación y la gestión ambiental. La investigación es no experimental, cuantitativa, trans¬versal, descriptiva, correlacional y nivel de análisis micro. El universo de estudio fue la población mayor de 18 años del área urbana, que comprende 97.264 habitantes; la muestra, deter¬minada al azar simple, fue de 382 personas. Se aplicó un cuestionario estructurado. El análisis descriptivo, inferencial y prueba de hipótesis se realizó con el software estadístico SPSS. Los resultados señalan que las actitudes ambientales de la mayoría de la población son positivas respecto a factores y fuentes de contaminación y efectos en la salud humana; contrariamente, las prácticas ambientales son inadecuadas en gestión ambiental en el hogar y condiciones de sanidad e higiene en la vivienda. Se concluye, que la mejora sostenible de actitudes y comportamientos proambientales, demanda de una nueva política pública de educación ambiental, cuya implementación incorpore la participación efectiva de la sociedad civil con base a un sistema de incentivos.

Palabras clave: Ambiente, comportamiento, contaminación, preocupación, saneamiento.

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1 Introduction

Concern for environmental problems began to be more openly discussed in the 1970s (Vargas et al., 2019). In the 1980s, humans manifested that concern for the environment (Álvarez and Vega, 2009) and in the early 1990s, it was referred to in the global context at the Rio de Janeiro Earth Summit (Agenda 21, 1992).

From the perspective of the Social Sciences, research on this concern has been expressed in theoretical formulations, methodological proposals and empirical treatments that allow the understanding of human beings to interpret the problem (Amérigo et al., 2012), expressed in environmental concerns and their correlation in pro-environmental behaviors.

There is a vast and important scientific production on the subject made from different perspectives. In fact, on the one hand, there are studies with one-dimensional pro/anti-environmentalism approaches in the relationship between self and nature, with emphasis on safety, health and environment (Vargas et al., 2019) or environmental education by gender (Pérez-Franco et al., 2018). On the other hand, studies with two-dimensional structures with strong emphasis on cognitive processes, such as anthropocentrism-ecocentrism (Thompson and Barton, 1994), new ecological paradigm (Dunlap et al., 2000) and use-preservation (Milfont and Duckitt, 2010) or approaches with a strong emphasis on affective and emotional processes, such as: emotional affinity (Kals et al., 1999), identity (Clayton, 2003) and articulation with nature (Vining et al., 2008) whose methodological frameworks were taken for empirical studies (Suárez et al., 2007). As well as studies with tripartite factorial structures: selfishness, socio-altruism and biospherism (Amérigo et al., 2005); Anthropocentrism, Progress and Naturalism (Hernández et al., 2001) but also studies under theoretically integrated four-dimension structures: apathy, anthropocentrism, connectivity and emotional affinity (Amérigo et al., 2012).

However, studies on environmental behavior are scarce or little diffused, moreover, there are almost nonexistent related to the relationship between attitudes with measures of environmental behavior, being pioneers, in this line, the conceptual proposals about education in the subject made by Álvarez and Vega (2009) and exploratory studies of Amérigo et al. (2012); Amérigo and García (2014); Amérigo et al. (2017); Favara and Moreno (2020); Rivera-Jacinto and Rodríguez-Ulloa (2009); Hernández et al. (2001); Palavecinos et al. (2016). Most of these empirical studies have taken as units of analysis mainly university students from Spain, Mexico, Brazil, Chile, Argentina, Peru, and complementarily older people in Costa Rica and Spain.

In developing countries such as Peru, most diseases affecting people living in extreme and vulnerable poverty are largely attributable to basic needs related to environmental sanitation (World Health Organization, 2019), solid waste management given the huge volume that occurs in urban areas and with the difficulties to eliminate them, exacerbated by inadequate environmental practices, which ultimately denote a picture that arouses concern in different sectors of society that try to alert and sensitize the population and authorities. The solutions and responses to the problem are very diverse at the global, regional and national levels, depending on economic, geographical, political, educational and cultural characteristics (Velásquez Patiño, 2008).

In Puno, the situation becomes even more critical, since the wastewater is discharged into the bay of Titicaca Lake without proper treatment, coupled with the poor management of urban solid waste, the collapse of the system of oxidation ponds, the dismantling caused by the urban construction system, the fragility and separation of technological, institutional and social factors, which severely affect the environment and human health (Tumi Quispe, 2014).

Faced with this complex and multideterminative problem, the study aims to respond to the following concern: what are the expressions and relationship of pro-environmental attitudes and practices of the population of the city of Puno on sanitation, pollution and environmental management? The purpose of the research is to contribute to the design of a public policy of environmental education that serves as a guiding framework for citizen behavior and institutional management related to the environment.

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2 Materials and Methods

2.1 Area of study

The study context is the city of Puno, which is comprised from the west bank of Titicaca Lake, in the inner bay formerly called Paucarcolla, on a slightly undulating surface, surrounded by hills. Titicaca Lake, located in the high plateau area between Peru and Bolivia, at an altitude of 3 810 m above sea level, with a total area of 8.167 km^2, a maximum amplitude of 125 km and an extension of 400 km, is considered the highest navigable lake in the world, its importance is supported by the richness of its biodiversity, aquatic fauna and tourist potential (Aranibar Ramos and Patiño Huayhua, 2022; Tumi Quispe, 2016); but paradoxically, its inner bay has been subject to an increasing pollution process (Luca and Ticona, 2006) and severe eutrophication (Jimenez et al., 2016; Fontúrbel-Rada, 2003) product of anthropic action (Valderrama and Canales, 2007), with negative effects on human health (Miranda Aliaga, 2004; Valderrama and Canales, 2007) and the atmosphere.

2.2 Research design

The research design is non-experimental (since the study does not establish the manipulation of independent variables, but assumes unrestricted respect for the natural and social environment) and transversal (the process of collecting information and measuring variables was performed by establishing a single temporal cut). The focus of the research is quantitative; it is socio-environmental because its dimension of analysis; the level of analysis is micro because it is descriptive and correlational.

2.3 Population, sampling type and sample

The universe consisted of the population over 18 years old living in the urban area of Puno, comprising 97 264 inhabitants (Instituto Nacional de Estadística e Informática, 2018); the operational population is 382 people, randomly determined without replacement and considering the 95% confidence degree and a margin of error of 0.05.

2.4 Data collection technique and instrument

The data collection technique was the survey, through a structured questionnaire applied to heads of families between October and December 2018. Environmental attitudes were measured with 12 items grouped into three dimensions: factors of contamination in the house (water quality, garbage collection, unpaved streets, domestic animals in the house and sewer obstruction), sources of pollution of the Titicaca Lake Bay (wastewater, solid waste, collapse of the oxidation lagoon), effects of factors and sources of pollution on human health (neuropsychological, digestive, dermatological, and ocular symptoms). The measurement of environmental behaviors was carried out through 14 items grouped into three types of behaviors: environmental practices in the home (type of container for storing solid waste (SW), place of storage of SW in the house, frequency of disposal and final disposal), conditions of access to water services in the house (sources of water supply in the house, access and home distribution of water, installed and operational hygienic services) and sanitary and hygiene practices in the home (frequency of hand washing after handling SW, place of disposal of feces, cleaning frequency of the bathroom). The assessment of the dimensions of environmental attitudes and practices was performed under the vigesimal system (0 to 20 points), considering in each item different categories in accordance with the current regulations on environmental sanitation.

In addition, the study used secondary sources, referring to information on the population and housing census (Instituto Nacional de Estadística e Informática, 2018), as well as diagnoses and evaluation studies on pollution and eutrophication of the Titicaca Lake basin carried out by the regional environmental institutions.

2.5 Processing and statistical analysis

Data processing was performed with SPSS statistical software, as well as descriptive, inferential and hypothesis testing analysis. The statistical test performed was non-parametric through the probability distribution of the chi-square to establish the correlation degree between environmental attitudes (dimensional optics) and environmental behavior

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(three-dimensional optics) that possesses the population of Puno, denoting that more than half of the population possesses positive attitudes (62%), on the contrary, environmental practices are inadequate in most of the population (55.2%).

Chi square (Ritchey, 2002; Flores et al., 2017) was used because it responds to the fact that the central variables of the study, given their nominal or ordinal nature, did not make possible to perform statistical tests with a higher level of precision and depth.

3 Results

The urban population of Puno presents the following basic features. Regarding the main occupation, half of the population (50,79%) is made up of independent workers and one out of four is employed; in four out of five heads of families their income is less than 2000 thousand soles; while in 1 out of 10 their income is less than the minimum living income (US $ 232), which means that these families are within the belt of poverty or extreme poverty. In relation to the level of education of the heads of households, most completed higher education (64.92%) and to a lesser extent secondary education (29.84%). The majority (69.90%) own the houses, and a smaller proportion rent it (28.80%), which could imply a greater neighborhood identity and sense of belonging to the area they inhabit, which could condition their attitudes and environmental practices regarding the pollution of Titicaca Lake.

In this context, the assessment of environmental attitudes and practices of the population of Puno focuses on the reality, conditioned both by the economic, social and cultural context, as well as by the level and degree of effectiveness of the regional environmental institutionality to promote an environmental education program that contributes to the construction of an environmental and ecological awareness of social actors in a sustainable perspective (Figure 1).

At the structural level, the proposed conceptual model establishes as fundamental components environmental conceptual knowledge (ECK) and environmental ecological awareness (EEA). At the functional level, the model considers a process of articulation (relationship, entanglement, coexistence and dependence), which can be of concordance and/or discordance, of environmental conceptual knowledge that will have its correlation and expression in environmental attitudes (EA) and environmental and ecological awareness that is expressed in the environmental practices (EP) of social and institutional actors.

In this context, the characterization of attitudes (positive or negative) and environmental practices (adequate or inadequate) of the urban population of Puno, is carried out considering the following axes and dimensions of analysis. In the assessment of environmental attitudes, the expressions about pollution factors in the house, sources of pollution of Titicaca Lake and effects of pollution of Titicaca Lake on human health are considered. The assessment of environmental practices is related to environmental management in the home, access to water services in the home, and the health and hygiene conditions of the family in the home. The assessment of the relationships of pro-environmental attitudes and practices is established through the nonparametric chi-square statistical test.

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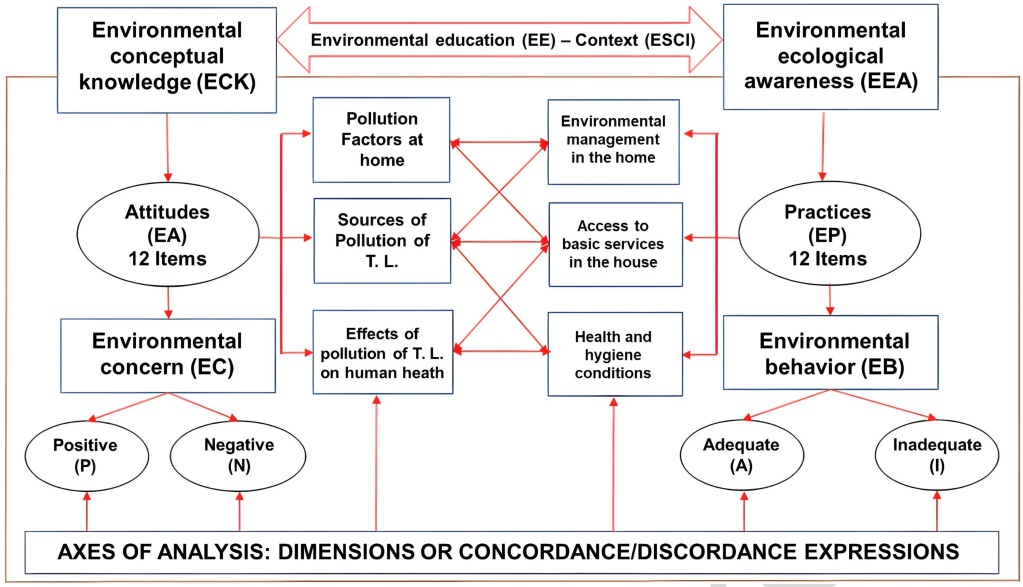

Figure 1. Model of relationships between attitudes and pro-environmental practices
Source: Own elaboration (2020)

3.1 Environmental Attitudes of the Urban Population of Puno

In general terms, the environmental attitudes of the population indicates that most of the heads of households have positive attitudes according to dimensions (factors of pollution in the house, sources of pollution of the Titicaca Lake and effects on human health) and categories of analysis (Figure 2):

- The positive attitudes of the population towards the factors of pollution in the house, indicates the prioritization of water quality (93.2%) and garbage collection (88.5%), being lower in the other categories of analysis.
- Attitudes towards sources of pollution in the bay are differentiated, emphasizing the negative effect of the collapse of oxidation ponds (84.3%) and wastewater (77.5%), which allows questioning the management of the municipal government; while the effect of poor solid waste management is smaller (56.8%), expressing the co-responsibility that families and the municipal government have in the final disposal of solid waste.
- Attitudes regarding the effects of pollution on human health emphasize the negative effect on the incidence of neuro-psychic (69.9%) and digestive (66.4%) symptoms, with less or no incidence in dermatological and ocular symptoms.

On the other hand, the environmental attitudes of the population of Puno, considering the variables degree of education and gender of the heads of families, present several trends (Table 1):

- Pollution factors in housing, considering the level of education, denotes positive attitudes of the primary level that prioritizes the quality of water (100%) and garbage collection (95%), being lower in the population of the secondary and higher level. Gender shows a similar trend in the prioritization of pollution factors, but with a higher positive attitude in women (94.7%) compared to men (91%).

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- Regarding sources of pollution of Titicaca Lake, the highest proportion of positive attitudes is present in the population of primary level that emphasize the negative effect of the collapse of the oxidation pond (100%) and to a lesser extent wastewater (85%); on these same factors, in the gender situation, men (86.5% and 82.4%) to a greater extent emphasize the negative effect.

- On the negative effects on human health of the factors and sources of pollution of the bay, the perception of the population is emphasized in the neuro-psychic and digestive symptoms, where the positive attitude is higher in the level of higher education (4 of 5 people) and of the males regarding the females.

Consequently, the study shows that the attitudes of most of the population (62%) are positive, but differentiated, given that in factors of contamination in the house predominates the quality of the water (93.2%) and garbage collection (88.5%); in sources of contamination of the bay of Titicaca Lake stand out the negative effect of the collapse of the oxidation ponds (84.3%) and wastewater (77.5%) and the effects on human health especially in the neuro-psychic (69.9%) and digestive symptoms (66.4%). Therefore, improvement of the population's pro-environmental concern is conditioned by the preventive action of the local and regional government not only to reduce the factors and sources of pollution with clean technologies, but also to implement mechanisms of participation, strengthening the sense of co-responsibility in civil society organizations.

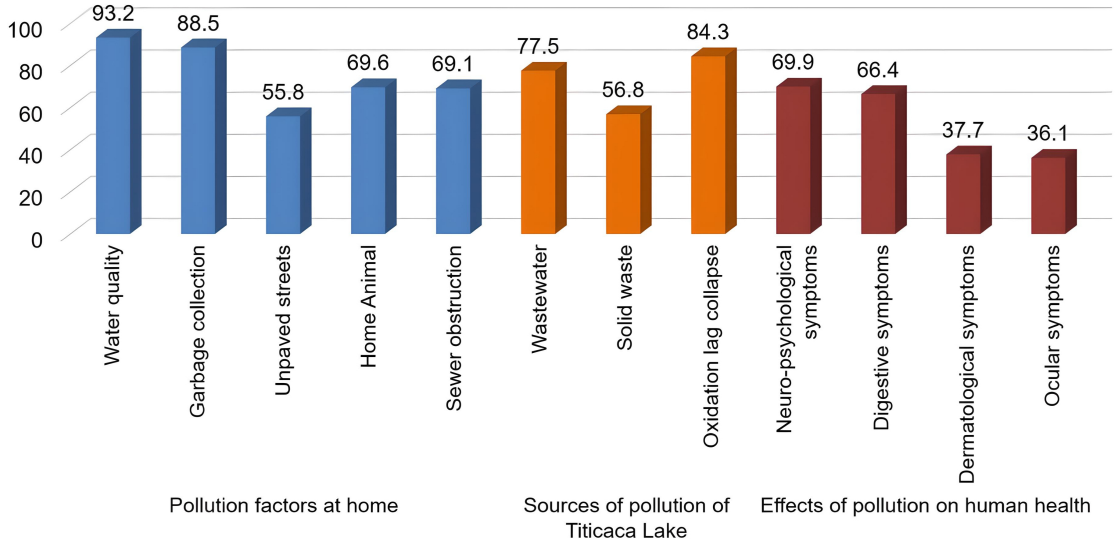

Figure 2. Positive environmental attitude of the urban population of Puno by dimensions and categories of analysis

3.2 Environmental practices of the urban population of Puno

The characterization of the environmental behavior of the population is carried out considering the dimensions of environmental management of the family in the house, the access to water in the house and conditions of health and hygiene.

3.2.1 Family environmental management at home

In general, the environmental practices of the family at home are related to the type of container for storing solid waste (SW), place in the house where SW are deposited, frequency of disposal of SW, final disposition of SW and frequency of hand washing after handling SW, all presenting different features (Figure 3):

- The containers for storing SW used by most families in the house indicates the predomi-

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nance of the use of polyethylene bags (66.5%) and to a lesser extent waterproof containers with lid (26.4%).

- The temporary storage of urban solid waste denotes that the tendency to store in the courtyard of the house is dominant (77.23%), having the kitchen less significance (5.49%).
- Most families take out the solid waste from their houses on an interdaily basis (58.9%) and to a lesser extent daily (12.83%), showing a problematic situation, i.e., 1/3 of the population take out their waste weekly.
- As for the final disposal of solid waste as an intermediate process or temporary storage, it indicates that most families (88.74%) do it in the container directly or the collective deposit outside the house, considered these appropriate practices. A similar trend is observed in the practice of hand washing frequency.

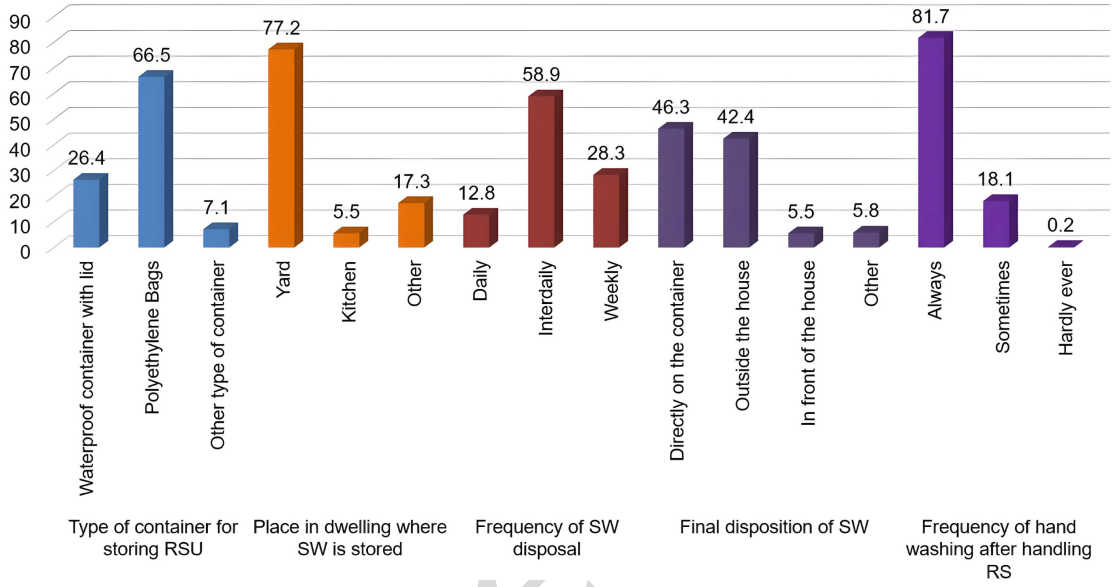

Figure 3. Population environmental practice on solid waste disposal by dimensions and categories of analysis

On the other hand, the environmental practice of the population on solid waste disposal according to the level of education and gender presents the following characteristics (Table 2):

- Regarding the use of containers for solid waste storage according to the level of education, it shows that polyethylene bags are mainly used, especially those with primary level (100%), while according to gender the proportion is 2/3 due to the predominance of the use of polyethylene bags between men and women, a practice considered as adequate.
- Relative homogeneity in the population by educational level and gender is presented, with respect to the courtyard of the house where they store solid waste, thus avoiding the proliferation of animals and odor in the house.
- The periodicity of solid waste disposal in about half of the families of the different levels of education and gender is every other day, which is conditioned by the recurrence of the collecting units of the municipal government.
- The final disposal of solid waste that families carry out mainly in the collective deposit outside the house and complementarily in the container directly, are good practices both in families of the various levels of education and gender.

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- Handwashing after handling solid waste is adequate, since more than 80% of heads of household always perform it, both those of secondary and higher education, being similar in gender.

3.2.2 Access to safe water services in the home

The conditions of access to safe water services are noted in the source of water supply in the house, level of access and home distribution of water, installed and operational hygienic services (Figure 4):

- The main source of water supply in the population's housing units is through a public network (94.77 per cent), while less than 5 per cent of housing units, located mainly in urban slums, are provided by a well or a public pool.
- 98% of the population has access to and distribution of safe water at home, of which 65.97% have access per hour per day, while only 1/3 of the houses have permanent water.
- The situation of home hygiene services in general in more than 97 per cent of the population is in a condition of installed and operational.

The conditions of access to safe water services show different characteristics considering the level of education and gender (Table 3):

- The source of water supply in the population's dwellings indicates that although it is predominant (more than 90%) access through public network is relatively greater in dwellings of family heads of higher education and in women.
- The main form of household access and distribution of safe water in both educational level and gender is permanently or in hours per day, which will have a positive effect on the health and hygiene of family members.
- Hygienic services of families, predominantly (9 out of 10) are installed and operational, being relatively higher in heads of families of secondary and higher education and in women, affecting the preservation of good health of family members.

Consequently, an important aspect of access to basic family services is related to the coverage of the service provided by the Environmental Sanitation Company of Puno.

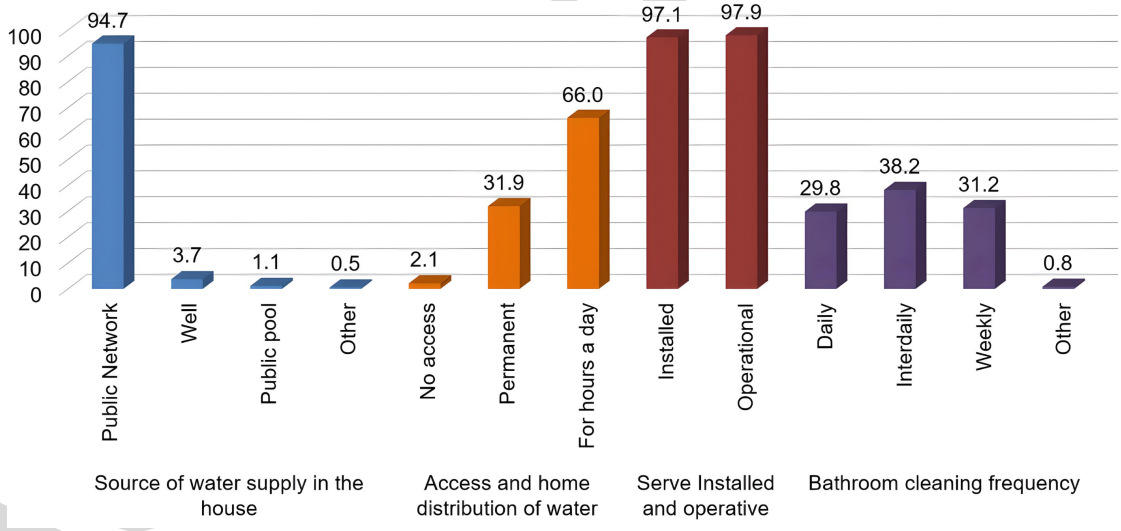

Figure 4. Conditions of access to water services in housing by size and analysis categories

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3.2.3 Sanitation and hygiene practices of the population

Sanitation and hygiene conditions of family members are related to the way of storing water at home, actions to disinfect drinking water in the home, container where drinking water is stored, place of disposal of feces and frequency of cleaning the bathroom (Figure 5):

- The form of water storage in households is varied and diversified: on the one hand, about half of families deposit water properly in polyethylene tanks (44.2%) or cement tanks (5.0%); while more than half store in inadequate containers, such as plastic buckets (18.8%), buckets (24.6%) or cylinders (7.3%).
- As for the practice of disinfecting drinking water, most families (81.7%) boil it and only less than 1/6 of families boil it, disinfect and filter it.
- The practice of most urban families (91.1%) is that the container where drinking water is stored is kept blocked, while only nine out of every hundred families do not.
- In this context, good practice is widespread, mainly in home hygiene services (96.6%).
- The frequency of cleaning the bathroom is adequate in most families (68.3%), although it is most often done every other day (38.2%) and daily (30.1%), which is considered an ideal environmental practice. The frequency of cleaning of the bathroom indicates that families make it proportionally between daily, interdaily and weekly. The latter being an inadequate practice, due to the risks to the proliferation of infectious foci within the house.

The health and hygiene practices of the urban population of Puno according to educational level and gender presents the following characteristics (Table 4):

- The form of home water storage according to the level of education indicates that most of the upper level (52%) and men (48.2%) have good practices because they use the polyethylene tank as a form of water storage.
- The sanitary practice of boiling drinking water characterizes most families at different levels of education, as well as men and women.
- More than 90 per cent of household feces are disposed of in the bathrooms of their homes, both at the level of education and gender. On the contrary, there is a small proportion who dispose their feces in the open air (1.3%) or in Titicaca Lake (1.8%), which is a practice that threatens the environment and human health.
- Regarding the frequency of cleaning of the bathroom, it is acceptable in most families of the various levels of education and gender situation, as they are performed daily or interdaily, having a positive impact on the preservation of the health and hygiene of the family.

Consequently, the study based on environmental regulations, shows that only 44.8% of the population performs adequate environmental practices in terms of disposal of urban solid waste, 64.1% in conditions of availability and access to water services and 62.2% in health and hygiene practices at home, showing the precariousness of the environmental awareness of the population, limited coverage and precariousness of environmental actions of the local and regional government. The sustained improvement of the pro-environmental behavior of the population demands the implementation of a new public policy of environmental education under the joint responsibility of the regional environmental institutions, the educational sector, and the academy.

3.3 Relationship between environmental attitudes and practices of the urban population of Puno

The relationship between environmental attitudes and practices of the urban population of Puno on environmental management of the family at home, access to water services and sanitation and hygiene conditions at home, is established to two dimensions:

- At a general level, due to a significance degree calculated from the chi-square test equal to 0.000, lower than the alpha significance level of 0.05 (5%). The study reveals the statistical evidence of the association and direction

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of a linear relationship between both analytical categories, but proportionally shows relative difference between them, since most of the population (62%) has a positive attitude, contrary, most of the population (55.2%) has inadequate environmental practices, showing a difference of 18 percentage points between them (Table 5).

- At the specific level, the following references are made by establishing the relationship between attitudes and the variables of the dimensions of the practices. In the variables of family practices at home and access to water services at home, according to statistical evidence (chi-square test), the study shows that there is no level of correlation; on the other hand, with the dimension of health and hygiene conditions of the family at home, the correlation level only presents with the variables of the form of storage of water at home and the disinfection of drinking water. The correlation level between environmental attitudes and practices also presents if the variables of spatial location of housing in the environment of Titicaca Lake, occupation and educational level are considered, but not with the variable gender situation.

Consequently, regarding the relationship between environmental attitudes and practices, the study shows that positive attitudes in most of the population do not necessarily translate into adequate environmental behaviors, a situation that questions the precariousness of the environmental consciousness of the population and the action of local and regional environmental institutions.

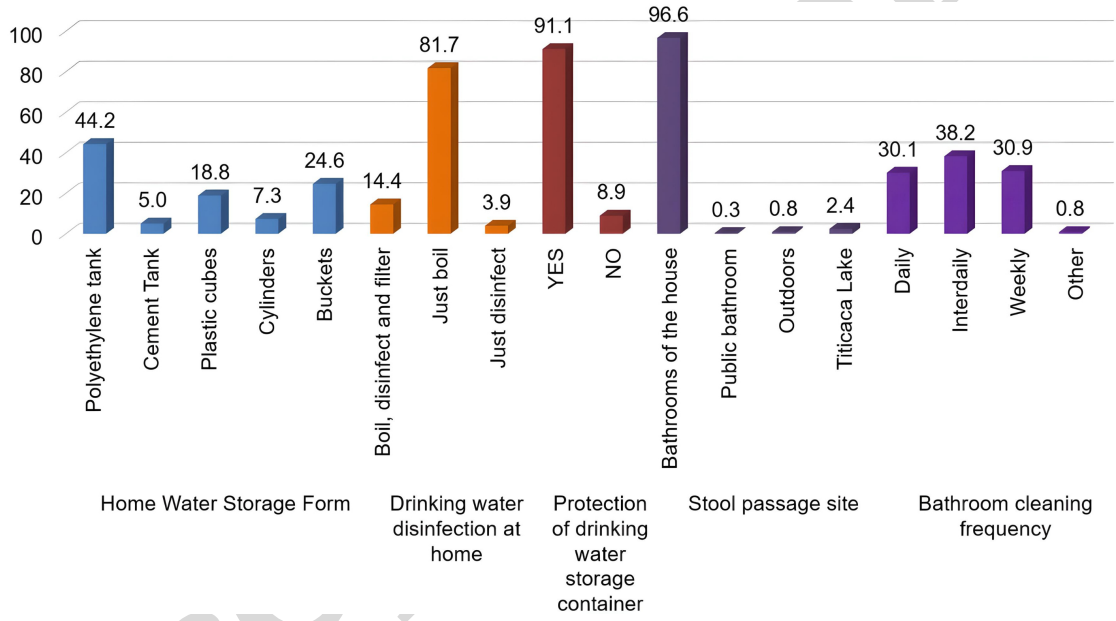

Figure 5. Sanitation and hygiene practices of the urban population of Puno by dimensions and categories of analysis

4 Discussion y Conclusions

The results of the study based on environmental regulations referred to the regulation of institutional and individual actions in the matter, valuation criteria and statistical evidence, allow concluding that the environmental attitudes of most of the population are positive, especially in terms of recognition of the factors of pollution at home, sources of pollution of the Titicaca Lake and negative effects on human health; conversely, the pro-environmental practices are inadequate, mainly in terms of environmental management at home and health and hygiene practices at home; thus indicating the existence of a relative discordance between the pro-environmental attitudes and the dimensions of the

pro-environmental practices of the urban population of Puno, which is conditioned by the level of education and gender established by the units of analysis.

4.1 Environmental Concerns

The study, based on current environmental regulations, indicates that most of the urban population (6 out of 10 inhabitants) have a positive assessment of pollution factors at home and pollution sources at the Titicaca Lake and its correlation in effects on human health, showing the sense of co-responsibility of the population and the local government.

These results are relatively consistent with the findings of Estrada et al. (2021) where higher education students from Madre de Dios-Peru show moderate environmental concern associated with sociodemographic variables (gender, age, and educational level). In Mexico, Cantú (2020) shows that despite the similarities between gender, women have more environmental awareness than men; while Pérez-Franco et al. (2018) find a moderately positive attitude towards the environment in high school students from Murcia, with gender differences; or the hope of improvement in the future as the ROSE project points out (Vázquez and Manassero, 2008).

Conversely, Vargas et al. (2019) say that the level of environmental attitudes of 69% of Mexican university students is unacceptable, being worse in areas related to safety, health and environment. Andrade Salazar and Gonzales Portillo (2019) show that the precariousness of environmental knowledge hinders the formation of attitude and robust environmental awareness; whereas Moreno et al. (2019) refer that the environmental is not a priority for university students of Buenos Aires and Paraná, but the socioeconomic emergencies. This situation shows that environmental attitudes have a complex and contradictory nature, reason for which favorable behaviors are gradually decreasing during the last two decades in the 33 European countries studied, without finding an objective reason for such reduction (Franzen and Vogl, 2013).

Likewise, it is argued that the analysis of human-nature relationships in different cultural contexts cannot be approached from a one-dimensional perspective, as has been implied by traditional measures of environmental attitudes and concern for the environment (Amérigo et al., 2012) rather, it presents evidence of the need to consider multidimensional approaches, such as Thompson and Barton (1994) which measures the environmental orientation of behavior and Schultz (2001) which establishes the assessment of the impact of the environment on different objects.

4.2 Pro-environmental behaviors

The study concludes that about half of the urban population has inadequate environmental practices regarding environmental management at home, access to water services and sanitation and hygiene practices at home, denoting not only the precariousness of the environmental awareness of the population, but also the limited coverage and ineffectiveness of environmental promotion actions implemented by the local government and regional environmental institutionalism.

On pro-environmental behavior, Sandoval et al. (2019) in Colombia show that university students have positive environmental beliefs and attitudes in most of the dimensions, while Vilca et al. (2021) say that university students from Juliaca-Peru have two emerging behavioral structures that describe the pro-environmental behavior of avoidant actions (reducing waste, saving energy and water) or beneficial (recycling, reuse and segregation). On the other hand, Hernández et al. (2001) identify inconsistencies in the actions of the staff of protected wild area of Costa Rica, since they prefer to purchase disposable and packaged products and use paper only on one side, but they express a behavior favorable to saving water and energy, as well as the separation of plastic, aluminum and paper. Faced with this situation or dual behavior, Berenguer and Corraliza (2000) argue that there is no single model for predicting environmental behavior, and that people have trouble acting on behalf of the environment despite recognizing the severity of the problems (Moreno et al., 2005).

4.3 Relationship between environmental concerns and behaviors

The results of the study show that positive environmental concerns are not correlated towards adequate environmental behaviors, denoting not

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only the precariousness of the environmental awareness of the population, but also the sense of co-responsibility of limited coverage and ineffectiveness of environmental promotion actions implemented by the local government and regional environmental institutionalism.

This situation is corroborated by Rivera-Jacinto and Rodríguez-Ulloa (2009) who show that university students in the north of the country, even though they have positive environmental attitudes, do not necessarily have adequate environmental behaviors. While Bernedo Berríos and Cazorla Galdos (2020), in a study conducted in Tacna-Peru, shows that there is a direct and significant relationship (Spearman's Rho=0.614 and p=0.000) between environmental concern and ecological behavior of students. Similarly, (Suárez et al., 2007) in Mexico point out the existence of a significant relationship between environmental attitudes and motivation to act pro-environmentally; Favara and Moreno (2020) argue that older adults with higher emotional affinity (emotional relationship with nature) and more connection (interest in nature to know and be in contact with it) are more likely to engage in pro-environmental behaviors. However, Álvarez and Vega (2009) say that environmental attitudes and behaviors have very low correlations, although attitudes have a great influence on behavior if other factors do not prevent it from materializing.

In Spain, Amérigo et al. (2012); Amérigo and García (2014) in the analysis of the relationship between environmental attitudes and behaviors, found predictors of pro-environmental behavior, as well as Murga (2008); Vázquez and Manassero (2009) who argue that the environmental attitudes of young people are positive, but with some pessimistic aspect, since the willingness to act in favor of the environment (ecological behavior) is low in relation to the concern shown. In addition, (Palavecinos et al., 2016) argue that the structure of environmental attitudes and concern among students from Chile and Spain are similar, with the same dimensions and types of behavior, as well as in the human behavior of young people who have a higher priority because attitudes are easy to modify or adapt (Pérez-Franco et al., 2018).

For the sustainable improvement of environmental attitudes and behaviors of social and institutional actors, it is necessary to design a new public policy for capacity-building in environmental and ecological education, whose implementation, under the leadership of local and regional environmental institutions, incorporates the effective participation of civil society based on a system of incentives. Hence, it is essential to consider the proposals made in the Latin American context: the edu-communication for sustainable development (Rendón et al., 2018); the photographic record (Perdomo Báez et al., 2018); the game or board games (Sanabria et al., 2017); environmental education with an integrative and interdisciplinary approach (Paula et al., 2019; Álvarez and Vega, 2009); educating with ethics and environmental values (de Castro et al., 2009). On the other hand, in the face of the increasing pollution process of Titicaca Lake due to the poor management of RSU and wastewater and the collapse of oxidation ponds and their effects on human health and the environment, it is important to consider the actions and proposals that are being carried out: the strategy of recycling before discarding (Aliaga Ortega, 2017); solid waste management actions (Olaguez et al., 2019); the participatory-action-research strategy (Rodríguez et al., 2018); co-responsibility of civil society organizations at some stages of the MRSU (De Cármen et al., 2019). In short, these proposals, strategies or methodological frameworks, subjected to a critical analysis must be validated in accordance with the Andean socio-cultural context and the Puno plateau.

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Appendix

Table 1. Positive environmental attitude of the urban population of Puno by dimensions and categories of analysis and according to level of education and gender

Dimension	Variable	Positive attitude						
		Total		Degree of education (%)			Gender (%)	
		N°	%	Prim	Sec	Sup	Male	Female
Pollution factors at home	Water quality	356	93.2	95.0	93.9	92.7	91.7	94.7
	Garbage collection	338	88.5	100.0	90.0	86.7	86.0	91.0
	Unpaved streets	213	55.8	65.0	52.6	56.5	57.0	54.5
	Home animal	266	69.6	55.0	64.9	73.0	66.3	73.0
	Sewer obstruction	264	69.1	75.0	59.6	73.0	67.9	70.4
Sources of pollution of Titicaca lake	Wastewater	296	77.5	85.0	68.4	81.0	82.4	72.5
	Solid waste	217	56.8	75.0	45.6	60.5	60.1	53.4
	Oxidation lag collapse	322	84.3	100.0	82.5	83.9	86.5	82.0
Effects of pollution on human health	Neuro-psychological symptoms	267	69.9	60.0	53.5	78.2	74.6	65.1
	Digestive symptoms	253	66.4	50.0	51.8	74.5	69.8	63.0
	Dermatological symptoms	144	37.7	5.0	17.5	49.6	43.0	32.3
	Ocular symptoms	138	36.1	10.0	19.3	46.0	40.9	31.2

Source: Socio-environmental survey, Puno, 2018.

Table 2. Population environmental practice on solid waste disposal by educational level and gender

Variable	Category	Total		Instruction Grade			Gender	
		N°	%	Prim.	Sec.	Sup.	Male	Female
Type of container for storing RSU	Waterproof container with lid	101	26.4	0.0	25.4	29.0	25.4	27.5
	Polyethylene Bags	254	66.5	100.0	69.3	62.5	66.8	66.1
	Other type of container	27	7.1	0.0	5.3	8.5	7.8	6.3
Place in dwelling where SW is stored	Yard	295	77.2	80.0	75.4	77.4	78.2	75.7
	Kitchen	21	5.5	10.0	6.1	4.8	3.1	7.9
	Other	66	17.3	10.0	18.4	17.7	18.7	16.4
Frequency of SW disposal	Daily	49	12.8	10.0	12.3	13.7	15.5	10.6
	Interdaily	225	58.9	50.0	58.8	59.3	52.8	64.6
	Weekly	108	28.3	40.0	28.9	27.0	31.6	24.9
Final disposition of SW	Directly on the container	177	46.3	35.0	40.4	49.6	45.6	46.6
	Outside the house	162	42.4	50.0	53.5	37.1	39.9	45.5
	In front of the house	21	5.5	10.0	4.4	5.6	6.7	4.2
	Other	22	5.8	5.0	1.8	7.7	7.8	3.7
Frequency of hand washing after handling RS	Always	312	81.7	60.0	82.5	83.1	80.8	82.5
	Sometimes	69	18.1	35.0	17.5	16.9	18.7	17.5
	Hardly ever	1	0.2	5.0	0.0	0.0	0.5	0.0

Source: Socio-environmental survey, Puno, 2018.

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Table 3. Conditions of access to water services in housing by educational level and gender

Variable	Category	Total		Instruction Grade			Gender	
		N°	%	Prim.	Sec.	Sup.	Male	Female
Source of water supply in the house	Public Network	362	94.7	90.0	93.0	96.0	92.7	96.8
	Well	14	3.7	10.0	4.4	2.8	4.7	2.6
	Public pool	4	1.1	0.0	1.8	0.8	2.1	0.0
	Other	2	0.5	0.0	0.9	0.4	0.5	0.5
Access and home distribution of water	No access	8	2.1	30.0	28.9	33.9	33.2	31.2
	Permanent	122	31.9	65.0	69.3	64.1	62.7	68.8
	For hours a day	252	66.0	5.0	1.8	2.0	4.19	0.0
Serve installed and operative	Installed	371	97.1	95.0	97.4	97.2	95.9	98.4
	Operational	374	97.9	95.0	98.0	98.0	96.4	99.5

Source: Socio-environmental survey, Puno, 2018.

Table 4. Health and hygiene practices of the urban population of Puno according to educational level and gender

Variable	Category	Total		Degree of education (%)			Gender (%)	
		N°	%	Prim	Sec	Sup.	Male	Female
Home Water Storage Form	Polyethylene tank	169	44.2	10.0	33.3	52.0	48.2	40.2
	Cement Tank	19	5.0	5.0	1.8	6,5	3.6	6.3
	Plastic cubes	72	18.8	35.0	31.6	11.7	21.2	16.4
	Cylinders	28	7.3	10.0	5.3	8.1	7.3	7.4
	Buckets	94	24.6	40.0	28.1	21.8	19.7	29.6
Drinking water disinfection at home	Boil, disinfect and filter	55	14.4	0.0	8.8	18.1	18.1	10.6
	Just boil	312	81.7	95.0	90.4	76.6	76.7	86.8
	Just disinfect	15	3.9	5.0	0.9	5.2	5.2	2.6
Protection of drinking water storage container	YES	348	91.1	95.0	91.2	90.7	92.7	89.4
	NO	34	8.9	5.0	8.8	9.3	7.3	10.6
Stool passage site	Bathrooms of the house	369	96.6	90.0	98.2	99.6	98.4	98.9
	Public bathroom	1	0.3	0.0	0.0	0.4	0.5	0.0
	Outdoors	3	0.8	5.0	0.0	0.0	0.5	0.0
	Titicaca Lake	9	2.4	5.0	1.8	0.0	0.5	1.1
Bathroom cleaning frecuency	Daily	115	30.1	5.0	19.3	37.1	32.6	27.5
	Interdaily	146	38.2	50.0	55.3	29.4	36.3	40.2
	Weekly	118	30.9	40.0	25.4	32.7	29.5	32.3
	Other	3	0.8	5.0	0.0	0.8	1.6	0.0

Source: Socio-environmental survey, Puno, 2018.

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Table 5. Assessment of environmental attitudes and practices of the population (frequency distribution and correlation analysis).

Frequency distribution					
Valuation		**Frequency**	**Percentage**	**Percent valid**	**Cumulative Percent**
ATTITUDES	Positive	237	62.0	62.0	62.0
	Negative	145	38.0	38.0	100.0
PRACTICES	Adequate	171	44.8	44.8	44.8
	Inadequate	211	55.2	55.2	100.0
	Total	**382**	**100.0**	**100.0**	

Dimensions and variables of analysis of the environmental practices of the population				
Independent Variables	**Value**	**GL**	**Asymptotic Sig (2-sided)**	**Question**
Family Environmental Practices at Home [PAF]				
SW Storage Vessel Type	5.573	2	0.062	23
Place of trash storage	3.377	2	0.185	24
Periodicity of solid waste disposal	3.390	2	0.213	25
Final disposal of solid waste	1.183	3	0.757	26
Frequency washing hands after handling SW	2.351	2	0.309	28
Conditions of access to water services [ASH]				
Source of water supply at home	2.111	3	0.550	29
Degree of access and distribution of safe water	3.899	2	0.142	33
Installation of hygienic services at home	0.549	1	0.459	34
Operating Hygienic Services at home	0.583	1	0.445	35
Home Health and Hygiene Practices [PSH]				
Form of water storage at home	20.635	4	0.000	30
Disinfection actions of drinking water at home	29.257	2	0.000	31
Lid storage containers of drinking water	1.158	1	0.282	32
Stool passage site	2.274	3	0.518	27
Cleaning frequency of the bathroom	11.565	3	0.009	36
Location and socioeconomic status				
Spatial location of the dwelling	89.869	3	0.000	38
Economic Status (Occupation)	52.562	5	0.000	7
Social status (Educational level)	44.536	2	0.000	5
Gender	5.637	1	0.018	4

Source: Socioenvironmental Survey, Puno 2018.

Accepted version