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Water sources and management practices among the household residents of Barangay Labuyo, Tangub City, Misamis Occidental, Philippines

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Abstract

The purpose of this study is to determine the water sources and management practices among the household residents of Barangay Labuyo, Tangub City, Misamis Occidental. A total of 204 household respondents were randomly interviewed using a survey questionnaire. Data on water management practices were measured using a 5-point Likert scale. One-way ANOVA and Pearson correlation were further used to determine the differences and relationships between demographic profiles and management practices. Results show that pipe water supply from the main source (68%) was the primary water source used among household residents. In terms of sex, females often practice water management on the water sources with a weighted mean of 3.42. While respondents with age 68 years and older exhibit a higher degree (weighted mean=3.63) of involvement in water conservation measures. And respondents with college degree have applied their in-depth comprehension and knowledge on water conservation with a weighted mean of 3.48. The study also revealed a significant difference in the management practices between two sexes, among all ages and levels of educational attainment with p values <0.05. The association between demographic profiles with management practices further presents a significant relationship. Generally, the demographic profile (sex, age, and educational attainment) has a weak positive relationship towards management practices with values, r = 0.26, p = 0.00021; r = 0.34, p = <0.05; and r = 0.26, p = 0.00014, respectively. Thus, results suggest the need for enhancing community awareness on sustainable water source management and putting it into practice consequently reducing inadequacy of water supply in the area.

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Introduction

Water is one of the most vital resources on earth (Makki *et al.*, 2011). Only 97% of the water on Earth is salty, leaving 3% as fresh water, of which slightly over two-thirds (68.9%) are frozen in glaciers and polar ice caps (Cassardo and Jones, 2011). Of all global freshwater resources, 29.9% are groundwater and 0.26% is concentrated in lakes, reservoirs, and river systems (Li and Qian, 2018). Globally, groundwater is used by about 25% of humans for local activities, while 50% is used for portable water purposes (McClain and Paye, 2017). The overall quality of life for humans, animals, and plants is linked to the quality and quantity of water resources (Boylu and Gunay, 2017). However, population growth, a rise in water per capita use, urbanization, and economic development are considered the main factors that lead to water scarcity all over the world (Wang *et al.*, 2012).

The Philippines is endowed with vast water resources consisting of marine, inland, and groundwater reservoirs, which have an estimated storage capacity of 251,100 million m^3 and a dependable supply of 126,000 million m^3 per year (Rola *et al.*, 2018). The country has 59 lakes and 421 river basins with drainage areas ranging from 40 to 25,649 km^2 and many reservoirs with an aggregate area of 50,000 square kilometers (Lapong and Fujihara, 2008; Raymundo, 2015). There are three levels of water systems in the Philippines: Level I (point source) is a protected well or a developed spring with an outlet but without a distribution system; Level II (communal faucet system or stand post) is a piped system with communal or public faucets usually serving 4-6 households within a 25-meter distance; and Level III (waterworks system) is a fully reticulated system with individual house connections based on a daily water demand of more than 100 liters per person (Sicat *et al.*, 2020). According to estimates from the 2015 Family Income and Expenditure Survey (PSA 2016), 43.6% of the population access water through level III systems, 11.2% get their water from level II systems, and a large proportion of 45.2% have access to water through level I systems (Velasco *et al.*, 2021).

There is a growing trend of water supply shortages in major urban centers in the Philippines (Cruz, 2020). In the previous decades, the country has been distinguished by a fast-paced population increase and urbanization. Its current population of 95 million is expected to reach 126 million by 2030 (Mason, 2014). Per capita water availability has been declining over the years, brought about by increased water demand arising from economic growth and population increases in the country (Rola *et al.*, 2015). Population growth will limit the amount of water available per person, because an increase in per capita water consumption driven by development will intensify water demand, straining the local water supply (Okello, 2015).

Another factor that affects the water sources in the Philippines is the household's management practices of the water. An Asian Development Bank (ADB) report stated that if some Asian countries face a water crisis in the future, it will not be because of physical scarcity of water but because of inadequate or inappropriate water governance, including management practices, institutional arrangements, and socio-political conditions (Rola *et al.*, 2015). Water consumption within households is dependent on numerous factors, which include: the number of people in the house, the age of residents, the education levels of residents, the lot size of properties, the resident's income, the efficiency of water-consuming devices, and the attitudes, beliefs, and behaviors of consumers (Willis *et al.*, 2011).

In Barangay Labuyo, Tangub City, in the province of Misamis Occidental, many household residents experience a limited supply of water sources because the barangay population expands as a result of the increasing number of students studying at the Northwestern Mindanao State College of Science and Technology (NMSCST) located in the barangay. Moreover, there have been no studies conducted on the state of the water sources, including the management practices in the barangay. Thus, the objective of this study is to determine the water sources and management practices among household

residents in Barangay Labuyo, Tangub City, Misamis Occidental. Results of the study will aid the City and Barangay Local Government Units to formulate policy with regard to the conservation of residential water sources. Similarly, this will enhance resident's awareness and practices on efficiently safeguarding their water resources.

Materials and methods

Locale of the study

The study was conducted in Barangay Labuyo, Tangub City, in the province of Misamis Occidental (Fig. 1). It is situated at approximately 8.0676° North and 123.7252° East. The elevation at these coordinates is estimated at 17.9 meters (58.7 feet) above mean sea level. Its population, as determined by the 2020 Census, is 1,621. This represented 2.37% of the total population of 68,389 in Tangub City (Philatlas, 2015). As of 2022, the barangay recorded a total population of 1,732 with 416 households. The water sources found in Barangay Labuyo that are used by household residents are pipes supplied by the city water district and barangay, pipes supplied by electricity, bore wells or hand pumps, deep wells, and others such as springs with an outlet. Based on the study of Omarova *et al.*, 2019, rural people have to use multiple sources due to the lack of a stable water supply system in the villages. Moreover, the area experiences water shortages due to population growth, as one of the developing college institutions, the Northwestern Mindanao State College of Science and Technology (NMSCST) is located in the barangay. The growing number of students has prompted the establishment of numerous businesses, such as boarding houses, which are expected to increase demand for water sources while limiting supply in the households of Barangay Labuyo residents.

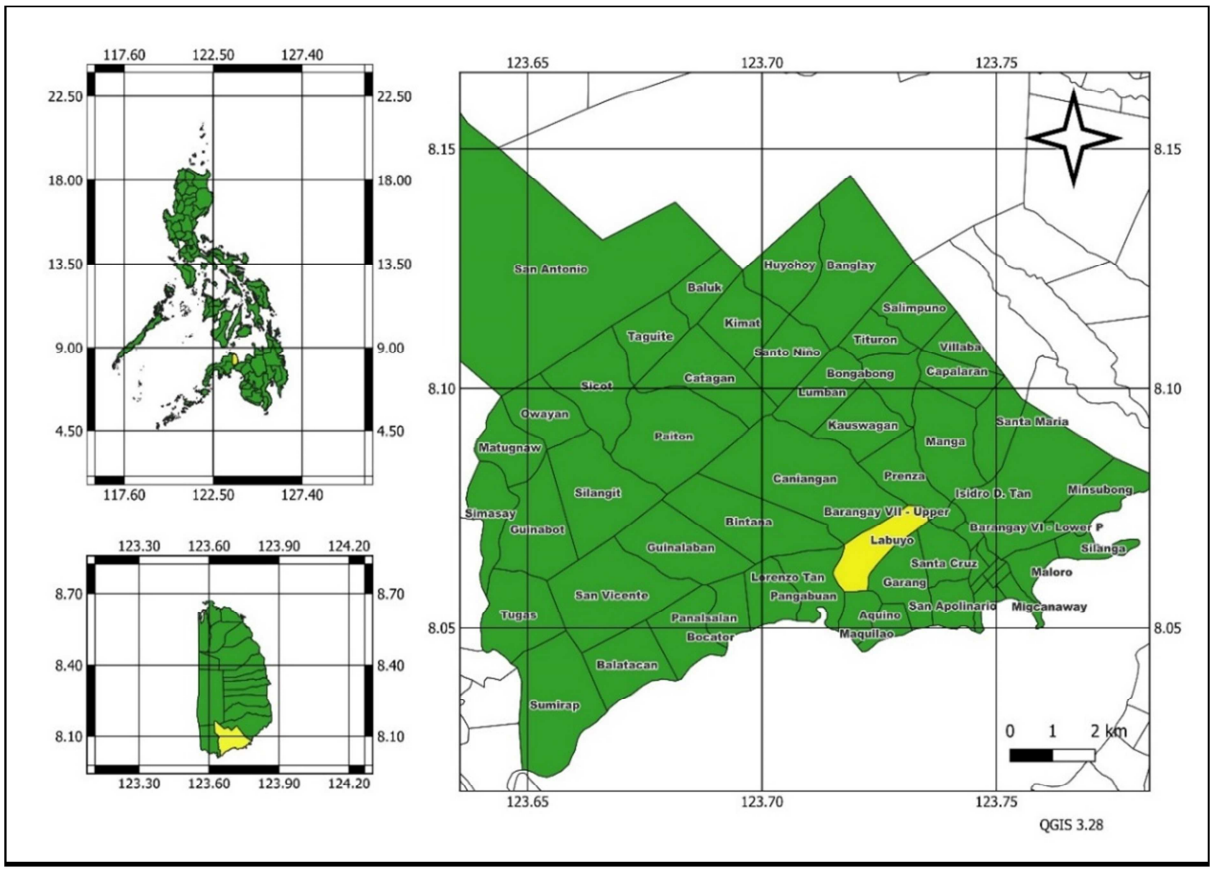

Fig. 1. Location Map of the Study Area. The two inset maps at the left are the map of the Philippines (upper) and the province of Misamis Occidental (lower). The right side map is the City of Tangub highlighting the sampling area in yellow, Barangay Labuyo..

Sample Size

Slovin's formula was employed to calculate the appropriate sample size for a population. The calculated sample size was 204 out from the 416 households present in the Barangay. This was obtained using the Slovin's formula (Adhikari, 2021).

Slovin's formula

$$n = \frac{N}{1 + Ne^2}$$

Wherein;

n = sample size

N = population size

e = margin of error of 0.05

Respondents of the Study

A total of 204 household residents of Barangay Labuyo, Tangub City, Misamis Occidental, participated in the study. The respondents were randomly selected, regardless of their background profiles.

Research Instrument

A survey questionnaire is the principal instrument used in the study. A semi-structured questionnaire for water sources and management practices was used by the researchers. The questionnaire had three sections. The first section consisted of the demographic information of the respondents, which included their age, sex, marital status, highest level of educational attainment, monthly income, type of family, and residency. The second section included questions relating to water sources used by household residents.

Table 1. Five-point Likert rating scale with verbal interpretation, score point and range of values.

Verbal Interpretation	Score Point	Range of Values (mean)
Never	1	1.00-1.80
Rarely	2	1.81-2.60
Sometimes	3	2.61-3:40
Often	4	3.41-4.20
Always	5	4.21-5.00

In section three, questions relating to household water management practices were based on the study of Fan *et al.* (2014). Moreover, the respondents were asked to give their response based on a 5-point Likert scale (Preedy and Watson, 2010).

The researchers used 1 as the lowest scale, denoting "never," to 5 as the highest, representing "always" (Table 1). The 5-point Likert scale was used to give the respondents flexibility when answering the questions (Afroz *et al.*, 2015).

Data Collection

Researchers made a courtesy visit with the Barangay Chairperson of Labuyo, Tangub City, and obtained permission to conduct the study which was done on November 2022. The researchers randomly selected respondents and sought their consent to participate in the study before conducting a face-to-face interview.

Data was acquired via a semi-structured survey questionnaire and utilized native dialect to facilitate effective communication with the respondents and determine the water sources and management practices among the household residents of Barangay Labuyo, Tangub City, Misamis Occidental.

Data Analysis

Descriptive statistics were used to analyze the data of the socio-demographic profile limited to sex, age, and educational attainment of the respondents (Gupta *et al.,* 2019). On a 5-point Likert scale, a frequency was used to measure the household residents' responses regarding their management practices for water sources (Table 1).

The one-way ANOVA was applied to determine the differences in the mean of the water management practices by sex, age, and educational attainment of the respondents. A Tukey's test was also utilized to determine which pair of means differed significantly from one another. Statistical significance was set at $p<0.05$. In addition, Pearson correlation is used to measure the relationship between variables (Akoglu, 2018). The study measured the relationship between demographic profile and management practices for water sources.

Pearson correlation coefficient formula

$$r = \frac{\sum(Xi - \bar{x})\sum(yi - \bar{y})}{\sqrt{\sum(Xi - \bar{x})^2 \sum(yi - \bar{y})^2}}$$

Results and discussion

Socio-Demographic Profile of the Respondents

Table 2 shows that female respondents (66%) outnumber male respondents (34%). This implies that the high percentage of female respondents in the survey can be attributed to the socioeconomic factors and intrinsic gender roles that determine the division of labor in most societies, where males are expected to work and earn enough money to meet the family's basic needs while women are in charge of managing the home and caring for the children (Wood and Eagly, 2010).

Table 2. Socio-Demographic characteristics of household residents (N=204) in Barangay Labuyo, Tangub City, Misamis Occidental.

Demographic Parameters	Characteristics	N	Percent (%)
Sex	Male	69	34
	Female	135	66
Age	18-27 years	37	18
	28-37 years	47	23
	38-47 years	40	20
	48-57 years	33	16
	58-67 years	26	13
	68 years and above	21	10
	Married	122	60
Marital Status	Single	52	25
	Widowed	24	12
	Separated	6	3
	Elementary Level	29	14
Educational Attainment	Junior High-School Level	61	30
	Senior High-School Level	3	2
	College Level	111	54
Monthly Income	Php 40,001 and above	66	32
	Php 10,001- 40,000	97	48
	Php 10,000 and below	41	20
Type of Family Residency	Nuclear	135	66
	Joint/Extended	69	34
	5 years below	32	15
	6-10 years	26	13
	11-15 years	16	8
	16-20 years	30	15
	21 years and above	100	49

Water Sources in Barangay Labuyo, Tangub City, Misamis Occidental

The age of the respondents ranged from 18 to 68 years and above. The majority of respondents are between the ages of 28 and 37 (23%), followed by the ages 38–47 with 20%. Moreover, the majorities of the respondents are married (60%) and are followed by 25% of lone persons. For educational attainment, the majority of the respondents attended college (54%); after that, 30% finished high school, while the elementary level had 14%. Furthermore, the results of the survey revealed that most of the households interviewed have an average monthly income of Php 10, 000–40, 000 (48%), followed by Php 40, 001 and above (32%). In addition, 66% of respondents' households are made up of nuclear families, while 34% are made up of extended families. The nuclear family system is now the most common residential form due to increasing economic rationality, which has resulted in the disintegration of the extended family system and an increase in the percentage of nuclear families (Khalid *et al.*, 2021). In addition, nearly all of the respondents had lived in the area for 21 years or more (49%).

In Table 3, there are 204 households that participated in the interviews conducted in the sampling area. The primary water supply acquired by household residents are pipes from the main source supplied by the water service providers—the Water District (WD) and Barangay (68%). According to the study conducted by Velasco *et al.* (2020), in terms of population served by the water service providers, water districts serve the largest proportion of the population in all regions of the Philippines. The top three regions with the largest proportion of population served by WDs are Region VII (Central Visayas), Region 10 (Northern Mindanao), and Region III (Central Luzon). Moreover, the study of Walag *et al.* (2018) shows that the total population served by different water service providers in Region 10 (Northern Mindanao) as of 2007 was 388,511, where 190,435 of the total population came from water districts, 159,930 from LGUs, and 40,146 from Rural Water Supply Associations (RWSA) and Barangay Water Supply Associations (BWSA). Most household residents used the pipes from the main source supplied by the water service providers because it is the easiest and most affordable water supply in the area. In terms of cost, public water sources are 4-10 times cheaper compared to private sources (Jideonwo, 2014). Moreover, the respondents are strained by the present status of their water supply, which comes from the barangay and appears to be intermittent. Similarly, the supply of water deteriorates as face-to-face classes are conducted and an increasing number of students reside in boarding

houses situated in the barangay. This is corroborated by the studies of Boretti & Rosa (2019) and Tsegaye *et al. (2011),* which show that population and economic growth can increase water demand and reduce water resources, which may result in more frequent intermittent water supplies.

Moreover, 20% of the participants acquired water from pipes run by electricity to meet their water demand without dealing with public water supply issues. According to the study by Devoto *et al. (2012),* households' willingness to pay for a private connection is high in order to increase the time available for leisure and reduce inter- and intra-household conflicts on water matters, leading to sustained improvements in well-being. Furthermore, a sufficient quantity of free water from nature is available to some of the household residents in Barangay Labuyo, Tangub City, on a daily basis, with these sources consisting of bore wells or hand pumps (5%), deep wells (3%), and others (4%) such as springs with an outlet.

Table 3. Water sources used by the household residents (N=204) in Barangay Labuyo, Tangub City, Misamis Occidental.

Statements	Choices	N	Percent (%)
Water sources that are mainly used in your household.	Bore Well/Hand Pump	10	5
	Pipe water supply through the main source	139	68
	Deep Well	6	3
	Pipe water supply through electricity	40	20
	Others	9	4
Going to the neighborhood when water supply runs out.	Yes	73	36
	No	131	64
Water sources that are available in your neighborhood.	Bore Well/Hand Pump	15	20
	Pipe water supply through the main source	18	25
	Deep Well	7	10
	Pipe water supply through electricity	15	20
	Others	18	25

In the study of Ayanshola *et al. (2013)*, wells and boreholes were used as secondary water sources by the participants. A majority of the interviewees, accounting for 64%, expressed a preference for anticipating the restoration of their water supply instead of seeking assistance from their neighbors when there is a temporary water disruption. Participants claimed that fetching water from a neighbor can be a time-consuming and physically demanding task. Therefore, it is more practical to store water and wait until it is accessible again rather than expend the effort to retrieve it from a nearby source. It is supported by the previous study of Agesa and Agesa (2019) that fetching water is laborious and time-consuming and may reduce time available for other activities such as schooling, leisure, etc. 36% of the participants have expressed their intent to approach their neighbors for urgent water needs if they experience a water supply interruption. The water sources that are available in the neighborhood include the main source provided by the water district (25%), a bore well or hand pump (20%), electricity (20%), a deep well (10%), and others (25%); this includes a spring with an outlet.

Management Practices on Water Sources by Sex

Household water demand management has become a priority for preserving precious water resources (Singha and Eljamal, 2021). Hence, water management practices among household residents play an important role in conserving water and minimizing significant water shortages in the barangay. Table 4 depicts the management practices on water sources based on the sex of the household residents of barangay Labuyo.

Supported by the computed mean scores in terms of the management practices on the water sources, the female respondents are higher compared to the male ones. Females have a weighted mean of 3.42, indicating that they often practice water management on the water sources, such as paying attention when the tap is dripping at home (M = 4.14), turning off the faucet and using a glass when brushing teeth (M = 4.28), rinsing fruits or vegetables (M = 4.05), and washing dishes (M = 4.38), taking a bath or shower less than 30 minutes (M = 4.23), collecting rain water

at home (M = 2.54), using rain water for watering the plants (M = 2.53) and cleaning the house (M = 1.93),

Table 4. Management practices on the water sources based on the sex of the household residents in Barangay Labuyo, Tangub City, Misamis Occidental.

	Mean Likert Score	Verbal Interpretation
Paying attention when the tap is dripping at home.		
Male	3.46	Often
Female	4.14	Often
Turning off the faucet and used a glass when brushing teeth.		
Male	3.94	Often
Female	4.28	Always
Turning off the faucet and used a container when rinsing fruits or vegetables.		
Male	3.63	Often
Female	4.05	Often
Turning off the faucet and used a container when washing dishes.		
Male	3.97	Often
Female	4.38	Always
Taking a bath or shower for 30 minutes below.		
Male	4.12	Often
Female	4.23	Always
Collecting rain water at home.		
Male	2.19	Rarely
Female	2.54	Rarely
Using rain water for watering the plants.		
Male	2.03	Rarely
Female	2.53	Rarely
Using rain water for cleaning the house.		
Male	1.54	Never
Female	1.93	Rarely
Using laundry buckets and basins when washing clothes.		
Male	4.42	Often
Female	4.63	Always
Wearing clothes more than once.		
Male	1.46	Never
Female	1.50	Never
Not allowing the faucet run continuously when washing clothes.		
Male	3.29	Sometimes
Female	3.51	Often
Washing clothes in large quantity.		
Male	2.62	Sometimes
Female	2.73	Sometimes
Checking the pipes, hoses or faucets for leaks.		
Male	3.42	Often
Female	4.01	Often
Weighted Mean		
Male	3.08	Sometimes
Female	3.42	Often

Using laundry buckets and basins when washing clothes (M =4.63), wearing clothes more than once (M = 1.50), not allowing the faucet run continuously when washing clothes (M =3.51), washing clothes in large quantities (M =2.73), and checking the pipes, hoses or faucets for leaks (M=4.01). While the male has a weighted mean of 3.08 in which they sometimes do management practices on the water sources. The reason that women hold management practices for water sources is that they expressed concern about the cost of water used in the household, as they pay a monthly price for water supply. Since there is an inadequate water supply, they also practice storing water to be used for household chores in a frugal manner. This finding was supported by the study of Diakite *et al.* (2020), which found that women consumers engage in practices of conservation principally because they hope for positive outcomes (reduction of water bills, reduction of water scarcity). This is similar to the study by Tong *et al.* (2017), which found that in China, women adopted more water conservation practices than men because of past experiences and memories of hard times of water shortage and the inconvenience of collecting water. While in Turkey, women practiced 31 water-saving behaviors, such as turning off the water when brushing teeth and washing hands, not operating the dishwasher and washing machine until it is full, and to name a few (Hablemitoglu and Ozmete, 2010).

On the contrary, the study by Verdugo *et al.* (2003) shows that women consume significantly more water than men. However, this finding should not be interpreted as the irresponsibility of females in using this resource but as the result of a higher level of involvement in chores that require water consumption. In Mexico, these activities are traditionally seen as "women's duties." Since women have the main responsibility of collecting water for household use, they are first to detect water-related problems, such as the water source declining in volume, reduced water quality due to pollution, or water taps breaking down (Thai and Guevara, 2019). All in all, the three major motivations to use water efficiently at home are to save water, help the environment, and save money (Shan *et al.,* 2015).

Management Practices on Water Sources by Age

Table 5 presents the water management practices based on the age of the household residents in Barangay Labuyo, Tangub City. Data shows that respondents aged 68 years and older have the highest

mean score, with a weighted mean of 3.63. Particularly, older adults always turn off the faucet and use a glass when brushing teeth (M = 4.24) and washing dishes (M = 4.24), and use laundry buckets and basins when washing clothes (M = 4.86). At the same time, they rarely wear clothes more than once (M = 2.29).

Table 5. Management practices on the water sources based on the age of the household residents in Barangay Labuyo, Tangub City, Misamis Occidental.

	Mean Likert Score	Verbal Interpretation
Paying attention when the tap is dripping at home.		
18-27 years	3.89	Often
28-37 years	3.74	Often
38-47 years	3.95	Often
48-57 years	4.03	Often
58-67 years	3.88	Often
68 years and above	3.86	Often
Turning off the faucet and used a glass when brushing teeth.		
18-27 years	4.19	Often
28-37 years	4.13	Often
38-47 years	3.93	Often
48-57 years	4.27	Always
58-67 years	4.38	Always
68 years and above	4.24	Always
Turning off the faucet and used a container when rinsing fruits or vegetables.		
18-27 years	3.49	Often
28-37 years	4.00	Often
38-47 years	3.85	Often
48-57 years	4.12	Often
58-67 years	4.23	Always
68 years and above	4.00	Often
Turning off the faucet and used a container when washing dishes.		
18-27 years	3.81	Often
28-37 years	4.32	Always
38-47 years	4.23	Always
48-57 years	4.45	Always
58-67 years	4.46	Always
68 years and above	4.24	Always
Taking a bath or shower for 30 minutes below.		
18-27 years	4.41	Always
28-37 years	4.30	Always
38-47 years	4.10	Often
48-57 years	4.15	Often
58-67 years	4.12	Often
68 years and above	3.95	Often
Collecting rain water at home.		
18-27 years	1.22	Never
28-37 years	2.06	Rarely
38-47 years	2.55	Rarely
48-57 years	2.71	Sometimes
58-67 years	3.27	Sometimes
68 years and above	3.61	Often
Using rain water for watering the plants.		
18-27 years	1.22	Never
28-37 years	1.91	Rarely
38-47 years	2.33	Rarely
48-57 years	2.82	Sometimes
58-67 years	3.31	Sometimes
68 years and above	3.43	Often
Using rain water for cleaning the house.		
18-27 years	1.00	Never
28-37 years	1.60	Never
38-47 years	1.85	Rarely
48-57 years	1.91	Rarely
58-67 years	2.31	Rarely
68 years and above	2.76	Sometimes
Using laundry buckets and basins when washing clothes.		
18-27 years	4.57	Always
28-37 years	4.32	Always
38-47 years	4.58	Always
48-57 years	4.58	Always
58-67 years	4.69	Always
68 years and above	4.86	Always
Wearing clothes more than once.		
18-27 years	1.38	Never
28-37 years	1.19	Never
38-47 years	1.23	Never
48-57 years	1.70	Never
58-67 years	1.65	Never
68 years and above	2.29	Rarely
Not allowing the faucet run continuously when washing clothes.		
18-27 years	3.38	Sometimes
28-37 years	3.34	Sometimes
38-47 years	3.65	Often
48-57 years	3.30	Sometimes
58-67 years	3.65	Often
68 years and above	3.24	Sometimes
Washing clothes in large quantity.		
18-27 years	2.78	Sometimes
28-37 years	2.34	Rarely
38-47 years	2.95	Sometimes
48-57 years	2.39	Rarely
58-67 years	2.73	Sometimes
68 years and above	3.29	Sometimes
Checking the pipes, hoses or faucets for leaks.		
18-27 years	4.03	Often
28-37 years	3.51	Often
38-47 years	4.15	Often
48-57 years	3.82	Often
58-67 years	3.65	Often
68 years and above	3.48	Often
Weighted Mean		
18-27 years	3.03	Sometimes
28-37 years	3.13	Sometimes
38-47 years	3.33	Sometimes
48-57 years	3.40	Sometimes
58-67 years	3.57	Often
68 years and above	3.63	Often

It appears that participants in this age bracket often engage in water management practices at home. Whereas, participants with an age between 18 and 27 years old (M = 3.03) have the lowest weighted mean.

It proves that younger individuals sometimes undertake water management practices on their water sources at home. Data revealed that individuals who are older exhibit a higher degree of involvement in water conservation measures than younger individuals. The reason behind this is that older individuals tend to have a noticeable identification with the concept of water conservation, potentially stemming from their greater life experience and exposure to water-related issues. Older participants demonstrated a stronger sense of personal responsibility for water management, a greater level of environmental consciousness, and a higher propensity to fulfill their financial obligations related to water usage. Similarly, in the study of Singha *et al. (2022),* compared to their younger adults, older adults have been found to exhibit greater engagement in water conservation practices, as indicated by their higher levels of awareness, habit, culture, and water conservation behavior. In the study of Zevi *et al.* (2022), findings revealed that younger people tend to consume more water than middle-aged and elderly individuals, potentially due to older people's identification with water and their tendency to pay their water bills. In the previous study by Jakubczak (2020), results showed that younger consumers are less likely to engage in water conservation behaviors compared to older consumers, and younger consumers tend to have lower levels of knowledge and awareness of water conservation issues as well as a lower sense of personal responsibility for water management. In China, people are more likely to practice household water conservation if they have greater environmental knowledge and concerns (Li *et al.*, 2022). It was discovered in the study of Wang *et al.* (2021) that the elderly are more environmentally conscious, and living in a nation with a higher percentage of elderly people encourages individuals to act sustainably.

On the contrary, the study of Malik *et al.* (2021) found that younger people showed a greater attitude toward water conservation, followed remarkably by a middle-aged group, while older people demonstrated less action toward water conservation.

It is supported by the study of Makki *et al.* (2011) that elderly people may be less cautious with water use because they are retired and spend most of their time at home, as compared to young people who must go to work. Another study found that younger individuals participate more in environmental events (Mondéjar-Jiménez *et al.,* 2011). Despite demonstrating positive water conservation behaviors such as using laundry buckets and basins when washing clothes and being attentive to dripping taps and potential leaks, residents in Barangay Labuyo appear to be taking limited action to preserve water resources and reduce their overall water consumption in order to minimize water costs. It has been found that effective water management practices led to improved water allocation and reduced conflicts among water users, promoting sustainable water use (Alemayehu *et al.,* 2021).

Management Practices on Water Sources by Educational Attainment

Table 6 reflects the water management practices based on the educational attainment of household residents in Barangay Labuyo. The study revealed that the college level has the highest management practices on water sources, with a weighted mean of 3.48.

The interpretation shows that college-level respondents often do water management practices like paying attention when the tap is dripping at home (M = 4.46), turning off the faucet and using a glass when brushing teeth (M = 4.46), turning off the faucet and using a container when rinsing fruits or vegetables (M = 4.13), and turning off the faucet and using a container when washing dishes M=(4.45), taking a bath or shower for 30 minutes below (M=4.27), collecting rain water at home (M=2.32), using rain water for watering the plants (M=2.17), using rain water for cleaning the house (M=1.73), using laundry buckets and basins when washing clothes (M=4.66), wearing clothes more than once (M=1.33), not allowing the faucet to run continuously when washing clothes (M=3.86), washing clothes in large quantities (M=2.96), checking the pipes, hoses, or faucets for leaks (M=4.50).

Meanwhile, the elementary level has a weighted mean of 3.25, the junior high school level has 3.01, and the senior high school level has 2.59, which means these three educational attainments sometimes follow the water management practices mentioned above.

Table 6. Management practices on the water sources based on the educational attainment of the household residents in Barangay Labuyo, Tangub City, Misamis Occidental.

	Mean Likert Score	Verbal Interpretation
Paying attention when the tap is dripping at home.		
Elementary Level	3.45	Often
Junior High-School Level	3.05	Sometimes
Senior High-School Level	3.67	Often
College Level	4.46	Always
Turning off the faucet and used a glass when brushing teeth.		
Elementary Level	4.24	Always
Junior High-School Level	3.30	Sometimes
Senior High-School Level	3.00	Sometimes
College Level	4.46	Always
Turning off the faucet and used a container when rinsing fruits or vegetables.		
Elementary Level	3.72	Often
Junior High-School Level	3.70	Often
Senior High-School Level	3.00	Sometimes
College Level	4.13	Often
Turning off the faucet and used a container when washing dishes.		
Elementary Level	4.38	Always
Junior High-School Level	3.87	Often
Senior High-School Level	3.00	Sometimes
College Level	4.45	Always
Taking a bath or shower for 30 minutes below.		
Elementary Level	3.76	Often
Junior High-School Level	4.30	Always
Senior High-School Level	4.67	Always
College Level	4.27	Always
Collecting rain water at home.		
Elementary Level	2.55	Rarely
Junior High-School Level	2.69	Sometimes
Senior High-School Level	1.00	Never
College Level	2.32	Rarely
Using rain water for watering the plants.		
Elementary Level	2.38	Rarely
Junior High-School Level	2.79	Sometimes
Senior High-School Level	1.00	Never
College Level	2.17	Rarely
Using rain water for cleaning the house.		
Elementary Level	2.00	Rarely
Junior High-School Level	1.95	Rarely
Senior High-School Level	1.00	Never
College Level	1.73	Never
Using laundry buckets and basins when washing clothes.		
Elementary Level	4.86	Always
Junior High-School Level	4.21	Always
Senior High-School Level	5.00	Always
College Level	4.66	Always
Wearing clothes more than once.		
Elementary Level	2.07	Rarely
Junior High-School Level	1.41	Never
Senior High-School Level	1.67	Never
College Level	1.33	Never
Not allowing the faucet run continuously when washing clothes.		
Elementary Level	3.03	Sometimes
Junior High-School Level	2.85	Sometimes
Senior High-School Level	3.00	Sometimes
College Level	3.86	Often
Washing clothes in large quantity.		
Elementary Level	2.68	Sometimes
Junior High-School Level	2.16	Rarely
Senior High-School Level	1.67	Never
College Level	2.96	Sometimes
Checking the pipes, hoses or faucets for leaks.		
Elementary Level	3.10	Sometimes
Junior High-School Level	2.89	Sometimes
Senior High-School Level	2.00	Rarely
College Level	4.50	Always
Weighted Mean		
Elementary Level	3.25	Sometimes
Junior High-School Level	3.01	Sometimes
Senior High-School Level	2.59	Sometimes
College Level	3.48	Often

The respondents with college degrees have incorporated their in-depth comprehension and knowledge of water conservation that they learned in school into their homes. According to Dean *et al.* (2016), knowledge and understanding of water issues in the community are considered core ingredients for solving water-related problems. Likewise, knowledge is central to models of water-related engagement, environmental citizenship, and environmental literacy (Dean *et al.*, 2016; Aslin and Lockie, 2013). It has been argued that greater knowledge allows community members to contribute to innovation and problem-solving (Davies and Simon, 2012). Moreover, the study revealed that most of the college-level respondents belong to the high- and middle-income groups with a percentage of 32 and 48, respectively. In the study of Gondo *et al.* (2020), households with high education tend to be within the high-income bracket and often have strong intentions to manage water consumption. This is also supported by the study of Zietlow and Michalscheck (2015), as a higher degree may lead to a better understanding of the scarcity problem. In turn, education may be confounded with income, as a higher education often

leads to a higher income. Nevertheless, in terms of actual water use, households with low education and income use less water than their counterparts because they have fewer water-consuming facilities and gadgets (Gondo *et al.*, 2020).

Differences of Water Management Practices by Sex, Age and Educational Attainment

Table 7 shows the differences in the mean of water management practices by sex using a one-way ANOVA. The results present a p value < 0.05 for the two sexes, which indicates a significant difference in the management practices of water sources.

Table 7. Analysis of variance for differences in the mean of water management practices sex.

	Male	Female
Mean of water management practices	3.07[a]	3.42[b]
F-value	14.84	
P-value	0.00016	

Note: Means followed by the same letter are not significantly different from each other (p<0.05).

This explained that women have higher management practices with a mean value of 3.42 than men because the majority of female respondents practice water conservation to reduce water bills and water shortages since they frequently encounter water disruptions brought on by students who reside in the barangay, which expands population and increases demand for water supply. It is indeed true that water price is the major indicator for consumers of the amount of water they consume (Yan and Liangxin, 2017) that women in the barangay of Labuyo have embraced water management practices because of the high cost, including the scarcity of water for household use.

While table 8 indicates the differences between the mean of water management practices by age. Results revealed a p value of <0.05, which indicates a significant difference between variables. There is a measurable difference in water management practices at home between the age groups of 18–27 years old (M = 3.00) and 58–67 years old (M = 3.49), as well as between 18–27 years old and 68 years old and above (M = 3.64). The research results indicate that with the passage of time and through the accumulation of experience, older adults demonstrate greater proficiency in managing their household water usage. It has been found in the Australian study that higher water knowledge is associated with older age, higher education, and living in non-urban areas (Dean *et al.*, 2016). According to the study of Gilg and Barr (2006), who examined the individual traits of various types of water savers, those with the highest ages were the most dedicated to water conservation at home. Knowledge and experience of elder community members in water management practices were crucial for the sustainability of water management systems (Wondimu *et al.*, 2019).

Table 8. Analysis of variance for differences in the mean of water management practices to age.

	18-27 years	28-37 years	38-47 years	48-57 years	58-67 years	68 years and above
Mean of water management practices	3.00[a]	3.13	3.30	3.43	3.59[b]	3.64[b]
F-value	5.26					
P-value	0.00015					

Note: Means followed with letters are the only ages among the age-groups with significant difference (p<0.05). However, means followed by the same letter are not significantly different from each other.

Furthermore, Table 9 shows the differences in the mean of water management practices in terms of educational attainment. In general, the computed p value for the levels of educational attainment is <0.05 implying a significant difference in the management practices of water sources. Among the four levels of educational attainment, only the college level with a mean of 3.49 and the senior high school level with a mean of 2.64 demonstrate a significant difference. This revealed that respondents with college degrees had better management practices than those with senior high school educations, which was expected

given that higher educational attainment is associated with a higher probability of knowing the importance of managing water sources to reduce water scarcity for household use. In the study of Karleuša *et al.* (2009), college students are educated in different aspects of water management and also promote the importance and value of water resources as the foundation of sustainable water management.

Table 9. Analysis of variance for differences in the mean of water management practices educational attainment.

	Elementary Level	Junior High-School Level	Senior High-School Level	College Level
Mean of water management practices	3.23	3.03	2.64[a]	3.49[b]
F-value	8.70			
P-value	0.000019			

Note: Means followed with letters are the only educational attainment with significant difference ($p < 0.05$). However, means followed by the same letter are not significantly different from each other.

Association of Demographic Profile to Management Practices on the Water Sources

Table 10 shows the association of the socio-demographic variables with management practices. The analysis revealed that sex has a weak positive relationship with management practices ($r = 0.26$, $p = 0.00021$). This implies that the sex of the respondents significantly affects the water management practices, but in a weak manner. In this study, female respondents performed water conservation practices to save water bills and were distressed about a water supply shortage. Additionally, women control the family's water budget because they perform the majority of household duties that require water (Weng and Nitivattananon, 2007). This is consistent with the study of Tong *et al.* (2017), where female respondents declared more favor for water conservation practices than male respondents in everyday habits. Such that, women are engaged in more environmental conservation behavior than men (Jiang and Rohendi 2018; Drimili *et al.*, 2019). In addition, gender appears to be a determining factor, as many observations indicate that females generally consume considerably less than males (Davies *et al.*, 2014; Koop *et al.*, 2019). However, in contrast to the study conducted by Lee and Tansel (2013), which reported that gender and water conservation are not significantly correlated, males are practicing more water management than females. This can be partially due to the insignificant differences within the surveyed group as well as the similar environmental beliefs between males and females (Corral-Verdugo *et al.*, 2003).

Table 10. Pearson's correlation value between demographic profile (sex, age, and educational attainment) and management practices on water sources.

	Management Practices	
	r	P-value
Sex	0.26	0.00021*
Age	0.34	<0.05*
Educational Attainment	0.26	0.00014*

Significant at <0.05*

Moreover, the association between age and management practices possess a moderately positive relationship ($r = 0.34$, $p = <0.05$). This means that the age is directly proportional to management practices. Most of the respondents of the study with high water management practices was in the age of 58-67 years and 68 years above. As people age they are more likely to engage in water conservation behaviors (Olli *et al.*, 2001; Wolters, 2013). Households with greater awareness and involvement in the decision to consume less water were older (Gregory and Di Leo, 2003), this may be a result of the stage of life where families are approaching or already in the life-cycle stage of retirement. These families, with a family head aged between 60 and 65 years, often experience major lifestyle and financial changes and may have to reduce their standard of living.

Furthermore, the relationship between educational attainment and management practices has a weak positive relationship ($r = 0.26$, $p = 0.00014$).

It means that the higher the educational level, the better the water management practices. According to Bedural (2018), higher educational attainment influenced Filipinos' decisions to take environmental actions, particularly reducing water consumption; those with college education had the highest proportion of those who took this environmental action. However, this finding is in contrast to the study of Seelen *et al.* (2019), where direct and indirect water uses, as well as threats to water quality, were estimated to be higher among more educated participants. In Australia, people who received a higher education used more water because they could afford a more luxurious lifestyle, for example, swimming pools and automated sprinkler installations. This finding was also supported by previous studies by Fan *et al.* (2014), which revealed that residents with high income and educational levels underestimate their own consumption, as these groups usually have a number of appliances that consume water for operation, such as washing machines and solar water heaters, and outdoor activities, like household cleaning and garden watering. Thus, members of this group consume more water than the other groups and are not concerned with their water bills, leading to an underestimation of water consumption.

Generally, there is weak positive relationship between the demographic profile and management practices. Therefore, raising residents' awareness, comprehension, and appreciation of the environment and water is essential to guiding them toward sustainable water usage behaviors (Willis *et al.*, 2011). There are several measures proposed to achieve significant water savings and the most effective measures include the use of water-efficient appliances (low-flow showerhead and taps, water-efficient washing machines and dishwashers) and encouraging residents to adapt pro-environmental behaviour through pricing, education and awareness, restriction of water supply and rebate schemes (Shove *et al.*, 2010). Previous studies show the efficiency of education on water management to the residents in Australia where domestic water consumption was reduced by an average of 19% from 2001 to 2004 through education programs and demand management (Dolnicar *et al.*, 2012). While education and public awareness campaigns reduced water consumption by 57% in Melbourne (Bryx and Bromberg, 2009).

Conclusions

In this study of water sources and management practices among the household residents in Barangay Labuyo, Tangub City, given all the proven results, it was identified that piped water supply through the main source was the main and highest water source used among the household residents. Intermittent water supply gets worse as students reside in the barangay, which adds to the population in the area and also increases the demand for water supply.

Furthermore, it has been found that female respondents have higher management practices than male respondents because women are domestic water managers and they know how to conserve water to reduce water bills and water shortages in the household. Moreover, older individuals were more involved in water conservation than younger individuals as a result of a heightened sense of responsibility, environmental consciousness, financial compliance, as well as life experiences and exposure to water-related issues. Whereas, individuals with a college-level education exhibit superior water management practices compared to those with lower levels of education due to the fact that they understand and recognize the importance of water in everyday life and that managing water is crucial to minimize water scarcity and protect the resource for everyone. In addition, female and male shows a significant difference in managing water sources. While in age, respondents aged 58–67 years old and 68 years old or older have a significant difference from those aged 18–27 years old. This means that older respondents have more knowledge about managing their water sources due to their long experiences and changes in lifestyle when it comes to the utilization of water in the household. And, respondents with college level of education have high management practices than senior high-school level because they have recognized the importance of managing water sources to

minimize water scarcity for their household uses. Moreover, the association between demographic profile and management practices revealed a weak positive relationship. This suggests that other factors besides socio-demographic characteristics may also have an impact on how water is managed. This study raises the possibility that there are more elements at play that could be the focus of future investigation. Generally, regardless of the respondent's sex, age, or level of education, they still need basic education and public awareness on water source management in order to take individual actions to protect and conserve water sources and the environment.

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