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Women and Water Security: Managing Conservation and Consumption During Supply Disruptions in Motlhabeng Village, Mahikeng

Palesa Mgwadhleka, Tendayi C. Garutsa and Temitope J. Owolabi *

Department of Sociology, North-West University, Mahikeng 2745, South Africa; 35846690@mynwu.ac.za (P.M.); tendayi.garutsa@nwu.ac.za (T.C.G.)
* Correspondence: 56183135@mynwu.ac.za

Abstract

This study examines the role of women in water conservation and consumption at the household level during periods of water supply interruption in Motlhabeng Village, located within the Mahikeng local municipality in South Africa. Water scarcity remains a global challenge, disproportionately affecting women, particularly in low-income and rural communities where they serve as primary managers of household water resources. Drawing on ecofeminist theory, the study explores the intersection between gender, environmental sustainability, and social inequality, highlighting how women's lived experiences shape water management practices. A qualitative phenomenological research design was employed to capture the lived experiences of women aged 18 to 60 who have resided in the community for over ten years. Data were collected through face-to-face interviews with purposively selected participants and analyzed using thematic analysis. Findings reveal that women bear the primary responsibility for water collection, storage, allocation, and conservation, often traveling long distances due to limited access to water sources. Strategies such as rainwater harvesting, greywater reuse, and traditional purification methods were widely adopted to cope with water shortages. Despite their central role, women remain largely excluded from decision-making processes related to water governance. The study identifies a disconnect between policy frameworks and the realities faced by women, emphasizing the need for inclusive, gender-sensitive approaches to water management. It concludes that recognizing and integrating women's knowledge and experiences into policy and practice is essential for sustainable water resource management and improved household well-being.

Keywords: ecofeminism; household water management; water conservation; water supply interruption; women's roles

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1. Introduction

Water has always been a crucial source of both life and development. Yet, it is facing increasing threats from the impact of climate variability, population growth, and poor infrastructure. Therefore, water conservation and water consumption at the household level have become major subjects of interest, particularly in areas with consistent water supply failures [1,2]. Water conservation includes the efficient and prudent use of water to reduce wastefulness and maintain the long-term viability of available water supplies [3]. Water consumption represents the total amount of fresh water used for household, agricultural, and economic purposes [4].

Understanding how families and individuals manage these two related concepts will be essential to addressing global issues regarding water scarcity, environmental sustainability, and human welfare.

Household water management is gender-based. There is a growing literature indicating that women play a very significant role in the conservation and consumption of water [5–7]. In addition, when communities rely on an unreliable system of water delivery, women's roles in water conservation and consumption increase significantly. As reported by [8], women generally serve as the main managers of household water supplies and are responsible for all aspects of water sourcing, storage, allocation, and protection for household use. When a community experiences an extended period of no or little water, women assume even greater responsibility for conserving and using the available water to meet the needs of their families. Women and children in developing nations, including many in Sub-Saharan Africa, are responsible for collecting water in approximately 76% of homes, and travel long distances and spend multiple hours per day to collect water [9].

As reported by [10], a significant portion of the world's population experiences water shortages for at least a month of every year. Additionally, approximately 26% of the world's population do not have access to clean drinking water and 46% lack basic sanitation. These numbers emphasize the urgency of resolving water-related problems and highlight the disproportionate burden women carry in terms of managing household water supplies. Through their daily activities involving the management of household water, women develop practical knowledge and insights regarding water accessibility, quality, and sustainability [11]. It is estimated that, collectively, women spend up to 200 million hours per day on water-related tasks such as collection, storage, and utilization [12].

The gendered aspect of water management is further supported by socio-cultural norms that attribute household duties to women. In many low-income environments, women not only collect the water for the home but also allocate it among competing household needs, such as food preparation, cleaning, sanitation, and caregiving. The responsibility to allocate water among competing needs may require women to prioritize the needs of other family members over their own, thus placing women at risk of health complications such as dehydration and water-borne illnesses. Furthermore, the physical demands associated with water collection, such as long walks and carrying large quantities of water, can negatively impact women's health and well-being. Women's time commitments for water-related tasks may also limit their opportunities for education, income-generating activities, and social interactions [13,14].

In Sub-Saharan Africa, water insecurity is inextricably linked to gender inequality. Ref. [15] suggest that water security in the region is gendered and that women and girls are primarily responsible for providing household water. Research has shown that women tend to consume and manage more water than men due to their household obligations [16,17]. The disproportionate role women play in managing water underscores the necessity to examine women's roles in water conservation and consumption in depth, and particularly in regions where water supply systems are unreliable.

South Africa presents a suitable environment for such an examination. Although South African policymakers have made considerable efforts to ensure equitable access to water, inequities in water services remain, particularly in rural and impoverished communities [18]. South Africa's legal framework, including the National Water Act of 1998 and subsequent amendments, emphasizes the sustainable use of water and equitable distribution. Nevertheless, the implementation of these policies has frequently failed to achieve the intended objectives, with continuing disparities in access to water. Disparities in access to water are clear in the Mahikeng local municipality. Residents of villages in Mahikeng, including Motlhabeng, have endured prolonged water supply disruptions since 2019 [19]. During these disruptions, households have employed various alternative coping mechanisms, such as rainwater harvesting and purchasing

water at considerable expense. For households unable to afford these alternatives, water scarcity becomes a daily reality, with far-reaching implications for their health, hygiene, and quality of life. In addition to disrupting daily routines, water scarcity also exacerbates pre-existing socioeconomic inequalities and adds further stress to already vulnerable populations [20].

Under these circumstances, women play a pivotal role in managing household water scarcity. They are responsible for navigating the challenges of supply interruptions, finding ways to conserve the limited water available, and meeting the household needs of their families despite the constraint of limited water availability. Notwithstanding their significant role in managing household water scarcity, there appears to be a notable absence of empirical research examining women's experiences and contributions to water conservation and consumption during water supply interruptions, particularly within the northwest province of South Africa. Although previous research has studied the water supply challenges more broadly [21], they have predominantly neglected the gendered nature of household water management.

The absence of research is further exacerbated by the disconnection between policy commitments and the on-the-ground realities. International frameworks, including the Sustainable Development Goals, emphasize the achievement of universal access to water (SDG 6) and the promotion of gender equity (SDG 5). Global and national policy discourse also advocates for the integration of women in water management processes. However, as reported by [22], these initiatives frequently fail to address the structural inequalities and socio-cultural impediments that influence women's experiences. As a result, women continue to bear the disproportionate burden of water insecurity and receive little acknowledgement or support from formal institutions.

The continued water supply interruptions in the Mahikeng local municipality, combined with the limited consideration afforded to women's roles in household water management, illustrate the need for targeted and contextualized research. Understanding how women navigate water scarcity, the tasks they complete, and the methods they employ to manage water scarcity will help inform more inclusive and effective water management policies. These findings will assist in bridging the gap between policy and practice and ensure that interventions are based on the lived experiences of those impacted by water insecurity.

With this background, this study investigates women and water security in the Mahikeng local municipality, with a focus on the roles they play in managing water conservation and consumption during water supply disruptions. More specifically, the study aims to identify the tasks that women complete in relation to water conservation and consumption at the household level during water supply disruptions. The study aims to give prominence to women's experiences and contributions to ongoing debates regarding gender, water security, and sustainable development, while providing empirical evidence to support gender responsive approaches to water governance.

2. Literature Review

Water collection is the process by which women and girls are largely in charge of obtaining water for domestic use, especially in areas without consistent access to clean water. During times of water shortages, when sources of clean water may be few or far away, this duty becomes even more important [23]. Women are mostly affected, bearing the brunt of water collection and having to travel long distances to collect water. A popular notion that is advanced in the literature is that collecting water is predominantly the responsibility of women and girls, especially in rural and low-income areas; the literature consistently highlights the unfairly heavy labor burden on women due to water supply interruption. Similarly, the role of women as water collectors is influenced by the household chores, they are responsible for, such as cooking, cleaning, laundry, childcare, and small-scale farming, all of which rely heavily on water and are primarily carried out by women.

2.1. Water Rationing/Distribution at Household Level

Women play a central role in water distribution, as water for domestic usage is essential to everyday routines, hygiene, and public health. Women carry out most water-related household duties, distribute water within the home, and live in rural and low-income areas.

For necessities like drinking, cooking, and personal hygiene, women frequently give priority to water. Before using the water for other purposes, such as washing clothes or watering plants, they make sure there is enough for these essentials. Similarly, women must consider the demands of various family members. They may, for instance, set aside more water for children's personal hygiene and less for adults to meet everyone's fundamental needs.

Water for domestic usage is essential to everyday routines, hygiene, and public health. However, water distribution is constantly inadequate in rural parts of less developed nations due to the need for excellent water quality and the normally expensive equipment costs. Women in rural Nepal are in charge of fetching water from far-off sources, a laborious and physically taxing task. To ensure that it is used effectively for drinking, cooking, and other necessary tasks, they carefully ration this water for household chores. Much of the literature focuses on rural communities, but there is limited exploration of urban water scarcity contexts. Studies like those of [24] touch on this indirectly, but more focused studies are needed to understand urban women's water-related issues, such as experiences of rationing water during water supply interruptions at the household level. This study aims to fill this gap by providing an examination of the tasks undertaken by women during water supply interruptions at the household level.

2.2. Container and Storage Management

A common thread across the studies is that women play a central role in managing water for household consumption and hygiene. In [25], women are reported to use a variety of storage containers, including buckets and plastic cans, with a noticeable effort to store drinking water separately from water used for domestic activities. This finding is consistent with other studies [26], which also emphasize that women tend to use covered containers to protect water from contamination, demonstrating an understanding of hygiene and safety.

While [27] highlight that women store water in covered containers to prevent contamination, ref. [28] argue that the type of storage container used, particularly plastic, can negatively impact water quality. Despite the widespread usage of plastic containers, many women are unaware of the possible health hazards connected to specific plastic containers. Clean and pure water is also subject to contamination if not stored or handled properly. By safe storage, it is meant that once the water has been purified, it is stored in such a way as to prevent re-contamination.

2.3. Water Purification Techniques

In many rural areas, women are responsible for household water purification, often using point-of-use (PoU) treatments like boiling, filtration, and solar disinfection to improve water quality. These methods are consistently reported as practical and widely employed, especially during times of water scarcity, as noted by [29]. However, the research also highlights the socioeconomic barriers these women face, which can limit access to more advanced water purification technologies.

While women in rural areas are resourceful, creating improvised filtration systems from locally available materials like sand, charcoal, and cloth, this does not address the underlying issue of inadequate access to cleaner, safer water sources. Ref. [30] conducted a study on water conservation methods in rural South Africa and discovered that during the period of water shortages, water from streams and rivers had to be boiled before drinking, according to participants, because it was tainted by animals and humans who dumped

waste like dirty diapers into them. Since some individuals do their laundry at the dams and natural springs, those who depend on them for water also worried about soap and detergents contaminating their water. Many villagers had to make extensive trips to obtain water because community taps and tanks were reportedly located far from homes. The plastic household tanks were also prone to contamination, according to some responders, causing dust and mold to contaminate the water.

This contradiction illustrates a gap between the recognition of the need for improved water purification and the inability of many communities to access or afford suitable technologies. Financial constraints limit rural people's access to innovative purification technology. This discrepancy emphasizes how important it is to take socioeconomic issues into account when assessing the viability of PoU treatments. Additionally, research indicates a knowledge gap about the ways in which cultural values and customs impact women's adoption of contemporary water purification methods in response to water supply interruption. Examining how socioeconomic status, education, and cultural norms interact to influence women's water purification methods should be the focus of future study using an intersectional perspective.

2.4. Rainwater Harvesting

Rainwater harvesting is a simple and affordable technique that has been used for ages, and this technique gathers rainwater from catchment areas or roofs and stores it in various storage systems. Rainwater harvesting has the potential to provide a valuable source of water for rural communities, especially in areas with limited access to traditional water supplies. RWH is recognized as a viable water management strategy for small-scale agricultural use, particularly in rural, low-income areas, and this is supported by multiple studies [31]. However, the studies also identify the significant challenges related to water quality and the physical limitations of the system. Microbiological and physicochemical contamination of harvested rainwater, particularly when collected from rooftops, poses health risks, as identified by various studies. These findings highlight the dual nature of RWH—while it can be a beneficial source of water, it also carries substantial health risks if not managed appropriately.

On one hand, the method is seen as advantageous in rural, low-economic regions, particularly during dry seasons when other water sources are scarce. On the other hand, RWH is not universally accessible or feasible, as it is highly dependent on factors such as roof size, available storage space, and regional rainfall patterns. For example, many households, particularly in urban and rural areas with little rainfall, struggle to implement effective RWH systems, as they are not technically feasible or do not significantly supplement their water needs. Furthermore, the methods of collection can introduce contaminants, such as dirt and animal waste, especially when water is collected through informal means like buckets and dishes.

2.5. Education and Behavior Changing

A popular notion advanced in the literature is that, by educating family members about the importance of water conservation, women help create a culture of sustainability within the household. This education can lead to long-term behavioral changes as family members become more aware of their water usage. Since women are frequently the main users, administrators, and collectors of water in homes and agriculture, particularly in developing nations, it is crucial that they teach families and communities water-saving techniques and practices. They have unique insights into the quality, dependability, and effective use of water resources because of their everyday interactions with them. Teaching families

and the community increases their understanding to encourage sustainable behaviors in communities and families.

Women in Gakuto Village, Botswana, have come up with ways of coping with the lack of water. They reuse water at the household level, alter their water habits, and use rainwater collection. Members of the community use these tactics to cope with the scarcity of water [32]. Another strategy used by the villagers to save water is to modify and alter their everyday routines. Such actions have played a major role in reducing water usage in regions afflicted by drought, such as the municipalities of Mbhashe and Mnquma. To cut down on the frequency of laundry, some participants stated that they keep special occasion clothing separate from everyday clothing. Others, on the other hand, only cook once every two days and steer clear of water.

2.6. Decision-Making and Planning

Water and women are inextricably linked. Many developing nations consider water to be "women's responsibility." Household water is collected, carried, stored, and managed by women and girls. They have extensive knowledge of daily household water needs, water sources, and water quality. Women must therefore participate in all decisions pertaining to water concerns because they have a significant stake in them. Furthermore, increased efficiency and better water security have resulted from women's leadership. Two case studies from Sri Lankan water Community-Based Organizations (CBOs) show the benefits of women's leadership in community water supply and sanitation initiatives as well as the challenges of defying ingrained social stereotypes regarding women's leadership abilities [33].

Women's leadership and participation in water governance are crucial for developing sustainable and equitable water management systems. According to a study of 121 water governance projects in 49 low- and middle-income nations, women's meaningful participation increased sustainability and effectiveness, while project failure was associated with their exclusion. Expanding women-led water stewardship across sectors and building on current efforts in the commercial sector, global organizations, public policy and water diplomacy, and community-led projects are all possible. Evidence that women's participation in water projects increases sustainability and success can be used to raise money and support for future gender-sensitive projects, allowing for further investment in gender priorities and WASH [34].

On the other hand, WASH initiatives continue to receive insufficient funding, and those that are carried out frequently lack gender-sensitive design or monitoring to increase their efficacy. The benefits of better water and sanitation services are obvious, yet funding for WASH programs is declining. Between 2017 and 2020, official development assistance (ODA) for water and sanitation decreased by 5.6%, and in 2022, 75% of nations said their national WASH strategies and goals lacked adequate funding [35]. Furthermore, [36] argues that the opinions of women can improve the formulation and application of water policy, improving results for all users. The 1992 Dublin Statement highlights the importance of women's participation in water resources projects at all levels. Women are important stakeholders in water management decisions given that they are frequently in charge of collecting and overseeing water for household usage. Giving women the authority to decide on sanitation improves results in households and society. More sustainable and efficient water systems are associated with women's involvement in water committees. This study intends to emphasize the vital role that women play in managing water resources, especially in developing countries where women are typically thought to be responsible for collecting, storing, and managing water.

2.7. Women as Caregivers

Women are overwhelmingly responsible for water collection, storage, and often water purification, a task that directly intersects with their caregiving responsibilities. This respon-

sibility extends to coping with water scarcity by reusing water and seeking out alternative sources, even when these sources are contaminated, which increases their exposure to health risks and places additional strain on their caregiving duties. The studies consistently point to a gendered division of labor, where water-related tasks are primarily the responsibility of women, reinforcing their role as caregivers and compounding their vulnerability to health issues and environmental hazards.

While studies like [37] emphasize the importance of women's knowledge and management of household water, ref. [38] brings attention to the risks associated with women's overburdened role in water management, particularly through wastewater reuse. The contradiction here lies in the fact that while women are essential for managing water resources and ensuring sanitation, their increased responsibilities and reliance on unsafe water sources exacerbate their vulnerability. This creates a paradox where women's involvement in water management, despite being necessary, contributes to their health risks and reinforces gender inequality.

This research uses an ecofeminist lens; where there exists a direct correlation between the degradation of the environment and social injustices. The most marginalized groups, including women, face economic marginalization; therefore, this research will use the theory to analyze how the marginalization of women in relation to access to clean drinking water relates to social injustice.

While many researchers have defined ecofeminism generally as people interacting with their environment, the goal of this research is to apply ecofeminism as a tool for analyzing qualitative data on water disruptions in Mahikeng. To achieve the above-stated purpose, this research follows [39]. It analyzes how social inequalities influence human–environment interaction using four different lenses. First, the lens illustrates how the failures of man-made water infrastructure force women to complete unpaid labor so that they can provide drinking water to their households. Second, the lens reviews the gendered obligations assigned to manage and care for household water. Third, the lens examines the extent to which women reside in poverty in a community experiencing perennial water shortages. Fourth, the lens reviews how women lack representation in decision-making at the community level regarding water management. Therefore, even though women utilize their knowledge, adaptive measures, and coping mechanisms to maintain water security in their households, they do not participate in local government decisions about water management.

Therefore, this research has significance using an ecofeminist lens since it seeks to understand where ecology, gender, and social justice intersect. Rather than simply documenting how women conserve and consume water while under supply disruption conditions, the framework contextualizes these activities within larger systems of inequity and ecological stress, thus providing explanations for why the burden continues to fall upon them and who bears it. In addition to locating women's household water work within broader systems of failure, poverty, and exclusion from governance, this research will contribute to developing more inclusive and context-specific forms of water governance in environments similar to that of Mahikeng, South Africa.

3. Methodology

3.1. Research Design

The researcher used a phenomenological research method that is descriptive. In this study, the focus is on understanding the phenomenon of household water management, especially among women, as it relates to collecting, accessing, storing, using, and managing water in their daily lives. As such, the researcher sought to gain an understanding of how household water management occurs for the participants. According to [40], when researchers adopt a descriptive phenomenological research design, the researcher collects qualitative data during interactions with participants. The data collected through

participants' own experiences of household water management provide a rich source of information about the participants' experiences, struggles, and ways of coping, as well as their interpretations of how they manage household water. When analyzing the data, the researchers attend to the participants' descriptions of their experiences, identify the common themes or meanings of the participants' experiences, and identify the most important characteristics of the experience. Therefore, in addition to identifying the types of strategies households use to manage their water resources, the goal of this study was to provide insight into how household members experience and interpret their actions related to managing their household water resources.

3.2. Study Setting

The study was conducted within the Mahikeng local municipality in Motlhabeng Village. Motlhabeng Village is located in the northwest province of South Africa. In South Africa, Mahikeng's development is unique. Western developments have been grafted onto this native African settlement, which now forms its center, with traditional areas surrounding it (Figure 1). The most significant South African city that depends so heavily on groundwater is Mahikeng; because the groundwater level is now too deep for many boreholes to reach, well fields are delivering less water currently than they did in the past. Uncertainty around the local economy's water supply is also decreasing expectations, raising expenses, and weakening social cohesiveness. The value of an existing business is diminished, and additional investment is less likely in the absence of assurance of a consistent and dependable water supply. Richer locals self-insure using their own boreholes, on-site storage, or home reverse osmosis systems, further exacerbating inequality. They consequently lose interest in the city's municipal issues. Therefore, the rationale for studying this setting is to investigate the role of women in water conservation and consumption at the household level during water supply interruptions in Motlhabeng Village, Mahikeng.

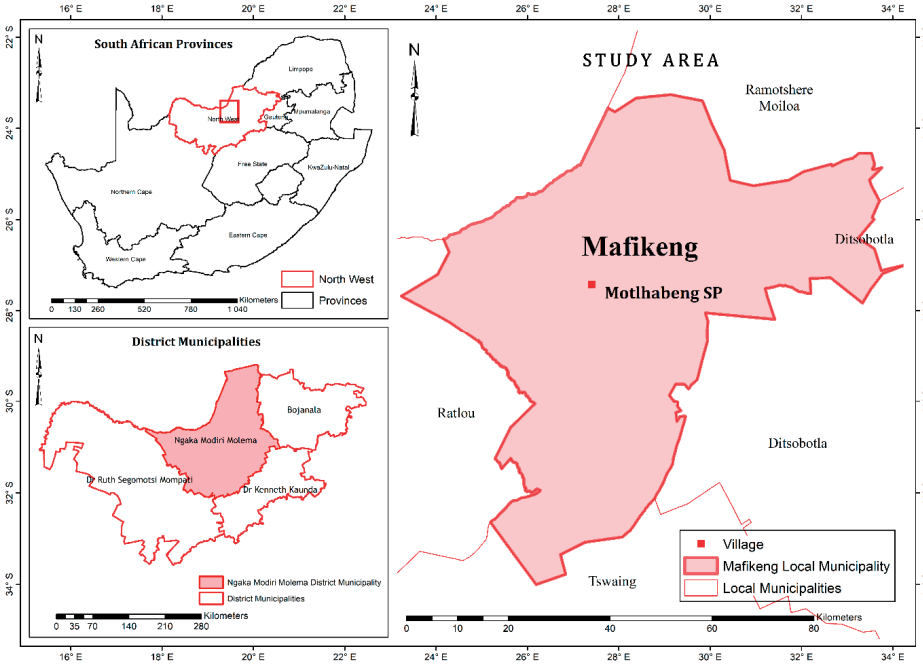


Figure 1. Map of Motlhabeng Village, Mahikeng Local Municipality, northwest province, South Africa. Source: Researchers 2025.

3.3. Sampling Technique

The research study used a non-probability sampling technique. The sampling technique chosen is purposive sampling, selecting 15 participants in Motlhabeng who understand the research question regarding the role of women in water conservation and consumption during water supply interruptions at the household level.

3.4. Population and Inclusion Criterion

The target population is women who reside in the Mahikeng Local Municipality, or until a point of data saturation is reached, specifically in Motlhabeng Village. It includes women who reside in Motlhabeng Village, Mahikeng Local Municipality; women who have stayed more than 10 years in Motlhabeng Village; women between the ages of 18 and 60 years; and single and married women.

3.5. Data Collection

Interviews were held face-to-face to provide a stronger level of validity and to better understand how women conserve and consume household water and their role in doing so during periods of supply interruption. A total of 15 women participated in this study by means of purposive sampling in Motlhabeng Village. Each participant completed one 45 min interview that was conducted in English. Informed consent was obtained prior to each interview and the interviews were recorded with a digital recorder. Following transcription, the interviews were compared to the recordings for verification purposes. Through interviewing participants, it was possible to gather descriptive accounts of the experiences, perceptions, and challenges faced by women, as well as establish rapport. Thematic analysis of the data provided information about the participants' views and actions related to their conservation and consumption of household water. Two researchers who were familiarized with the transcripts developed preliminary codes from the transcripts; then they organized these preliminary codes into themes, which were then reviewed and refined. No additional coding could be identified after the 13th interview; thus, data saturation had been achieved. The results of the thematic analysis yielded consistent views and disagreements regarding the conservation and consumption practices of women during periods of interruptions.

3.6. Data Analysis

The study uses a thematic analysis; according to [41], thematic analysis is an approach to data analysis that concentrates on identifying themes and providing descriptions, explanations, evidence, and connections for them. To achieve this, as per the methodology employed six phases of data analysis were used.

Step 1: Familiarize with data: The researchers were familiarized with the data through data that were gathered through face-to-face interviews and reading notes of the data set. The researchers transcribed the recordings of the interviews to address the research questions of the study.

Step 2: Generating initial themes: At this point, meaningful segments of data were identified and used to answer the objectives of the study. The researchers examined data obtained from the interviews and updated preliminary codes. The data collected through interviews was relevant to the study.

Step 3: Search for themes: The codes that were relevant to the study were then compiled and organized into fundamental themes; the researchers organized the codes into themes and subthemes. The researchers found patterns in the interview answers answering the research question on the role of women in water conservation and consumption at the household level during water supply interruption. Themes were found by patterns that

were recurring. This process provided the researchers with the help of grouping codes into meaningful codes.

Step 4: Review of themes: In this step, the researchers examined and formulated data that were relevant to the themes and subthemes. Examining and formulating data-relevant themes. In addition to answering the research questions, the researchers ensured that they made sense with the content. The researchers examined the themes and subthemes that are connected to the data in this step and then excluded themes that are not connected.

Step 5: Defining and naming themes: Data were analyzed thoroughly so that the themes and subthemes were defined and refined by the researchers to ensure that the connection between each theme is clear.

Step 6: Producing the report: In the final phase the researchers compiled data and findings into a report with themes that have been carefully and thoroughly verified.

3.7. Ethical Considerations

Anonymity and confidentiality of study participants were ensured by withholding their names and identities during the data collection, analysis, and reporting phases. No participants was obliged to participate in the study and they could withdraw from participating in the study if there was any feeling of being uncomfortable. Also, the participants were informed that there were no benefits they were involved for participating in the study. The ward councilor of Motlhabeng Village in Mahikeng served as the gatekeeper to ensure that the researchers approached the participants in an ethical manner.

Ethical clearance (NWU-01082-24-A7) was obtained to conduct the research and gain trust from the community. The ward councilor granted permission by providing the researchers with a formal letter of approval. To ensure trustworthiness in this study, the researcher used multiple data sources by conducting face-to-face interviews with 15 women to confirm findings. The validity of the results is strengthened by triangulation. Although a number of other data resources were used for the larger study, the qualitative analysis presented in this paper uses the results of only 15 in-depth interviews with women residing in Motlhabeng Village. Bias is one inherent flaw of qualitative research; as such, there are a few ways that the researchers attempted to increase the trustworthiness of the findings. Reflexivity, consistent with [42], the process of examining their own perspective, assumptions, and position (during both data collection and interpretation), was utilized. The researchers also employed member checking (returning a summary of the researchers' interpretations to participants to confirm or correct) and peer debriefing (colleagues who were not participants reviewed the codes, themes, and interpretations and challenged emerging conclusions).

4. Findings and Discussion

4.1. Demographic Information of Respondents

The study included participants who were selected using the inclusion criteria, with a total of 15 participants. The age range of the women was from 18 to 60 years. Findings revealed that the majority of women in Motlhabeng, Mahikeng had a high level of education. The age groups of 30–40 years and 40–60 years have a background of Secondary-level education. Findings also show that only 20% of women have formal jobs, another 20% are unemployed, and 60% represent the women who have informal jobs. One may argue that the women in informal jobs may have embraced the idea of self-reliance and entrepreneurship as a means of mitigating the effects of poverty. The high percentage of women in informal work reflects economic vulnerability and limited access to a stable income; however, their working hours are flexible, which may allow women to travel to water sources to collect water. The 20% of unemployed women means that they have

no income at all, exacerbating poverty and the privatization of women, as they only rely on unreliable unsafe water sources and cannot afford purchased water. While formal employment may offer a stable income and access to purchased water, it limits time for household water management.

4.2. Tasks Undertaken by Women in Water Conservation and Consumption at Household Level During Water Supply Interruption in Motlhabeng Village

4.2.1. Water Collection

Globally, women and girls perform water collection for approximately 80% of households that lack a water source located on their property. While access to clean drinking water globally is measured using "global access" indicators, these measures do not allow for a breakdown of how men and women benefit and bear costs related to the availability of clean drinking water. Therefore, women's experiences with water-related constraints, although significant, remain largely hidden due to the lack of disaggregation of global access measures by sex.

The women interviewed describe the work they do to obtain water during a water supply outage:

> "I use municipal water. Most of the time, the community tap isn't working or there is insufficient water available. I am responsible for obtaining water for our home. . .when the community tap doesn't function properly or there is no water available at the community tap, I must go to Sediba. I reside with my father who is elderly and always ill. His prescription requires that there always be sufficient water available in the home. . ."
>
> (Participant D)

> "We could go without water for up to 2 weeks before we would receive it again. After receiving water again, we need to quickly gather it and store it, because once again, we have the potential that we will run out of water. . .my husband, son, and myself take turns gathering water. We obtained the water from the community tap located next to the road. . .the last time there wasn't enough water in the community tap, I asked my neighbors if they had any extra water available. They always seem to have water in their own tap."
>
> (Participant E)

Several of the female interviewees stated that they obtained water from the community taps in Motlhabeng, but many reported that those taps were either dry or broken. Additionally, irregular and extended periods of interruption in service made it even more difficult for the women to obtain water and required them to travel greater distances to alternative locations such as Sediba, creating additional physical demands upon them.

Participant E indicated that she occasionally receives assistance from her husband and son with obtaining water. These observations regarding male assistance with obtaining water are provided here as an observation only. Because these observations do not reflect changes in gender roles or shifts in masculine/feminine perceptions/ideologies, no interpretations will be made. Additionally, Participant E also identified herself as the person who ensured that water was collected regardless of whether she did so personally or requested assistance from her neighbors when the tap was dry.

The analysis of participants mentioning being assisted by males to collect water during water supply interruptions at the household level revealed a deviation from the common narratives that women are the only water collectors at the household level. Water collection is perceived as a responsibility for women at the household level in many African countries. Many rural areas are embedded in gendered divisions of labor reflecting traditional gen-

der roles that were socially constructed; therefore, men participating in water collection at the household level revealed a shifting dynamic in traditional gender roles, and such shifts can redefine the perceptions of societies and their beliefs of masculinity and femininity and challenge the notion that women are the only people responsible for water managing at the household level. The involvement of men in water management promoted a shared responsibility for water collection at the household level. This aligns with SDG 5, which promotes gender equality. The findings align with ecofeminism theory, which emphasizes that women typically shoulder the burden of water collection in impoverished nations. It offers a critical perspective for understanding how economic factors that result in unregulated water sectors worsen gender inequality, disproportionately burdening women.

4.2.2. Water Rationing/Distribution at Household Level for Water Conservation and Consumption

Women are crucial to household water distribution and rationing during times of water supply interruption in rural and peri-urban areas. They are frequently in charge of gathering, storing, and allocating scarce water supplies to fulfill daily demands at the household level. Participants mentioned that:

> "We store the water in 20 litre buckets and ensure that they are sealed so that is does not get contaminated. We use the water in the buckets to cook, clean, bathe and do laundry. We then reuse the water for bathing for toilet purposes."
>
> (Participant C)

> "I store our household water in 20 litre buckets and a barrel. I use the water to wash dishes, bath and cook."
>
> (Participant F)

> "I always have water for cooking. I allocate 9 litres to bath water and the rest to cooking water. We also use the rainwater, but we cannot consume the rainwater, we have donkeys here at home and we usually find the donkeys drinking the rainwater stored in the small tanks outside. We usually use the rainwater for laundry only."
>
> (Participant J)

A notable observation is that the participants utilized various forms of containers in their households to ration water for consumption. This revealed that when there is a shortage of water, women must make difficult decisions about how to use the limited water they collected. Women prioritize drinking and cooking water because it is important for household survival. This reflects the caregiving role of women and adaptive knowledge to sustain the household during water shortages. The dynamic is consistent with studies by [40] who note that this hierarchy of water use aligns with broader findings in the literature, which indicate that during periods of water supply interruption, women prioritize essential needs.

A study conducted by [43] revealed that households with an average of six people used approximately nine buckets of water in Tawa Village. Water usage varied on days when women had to do laundry, with daily water consumption ranging from 37.5 to 45.83 L per person. This is not as troubling as certain areas in Africa where water usage ranges from 5 to 10 L per person. Where water is in short supply, demand must be regulated. Limitations may arise from limited resources or supply, including storage, treatment, and distribution capacity.

From an ecofeminist perspective, women's rationing practices reveal how gendered responsibilities shape sustainable household water management. Ecofeminism emphasizes how women in rural, water-scarce areas bear the burden of water rationing while balancing

home and environmental needs. Their profound ecological understanding allows them to properly manage limited water resources while prioritizing domestic and community requirements. Using an ecofeminist lens, it becomes clear that empowering women in water governance is not simply a gender issue, but also essential to achieving sustainable water management.

4.2.3. Container and Storage Management for Water Conservation

A popular finding is that during times of drought or scarcity, women guarantee a steady supply of water by utilizing various containers to conserve water that would be used for various consumption purpose. They guarantee that each member of the household has enough water for their daily requirements. Water storage is important because it ensures that there is enough water to meet the daily demands of household members while also preserving as much as possible. Although storage may also be done in the water transportation containers, distinct containers used only for water storage are identified. The participants mentioned the following:

> "We use 20 litre buckets and barrels. Our barrels are always filled with water. These barrels help us when we do not have water in our community taps. If there is water in our community taps, we take the water stored in the buckets, especially if the water has been stored for too long and use it for household chores such as cleaning, cooking, bathing and toilet."
>
> (Participant B)

> "Water interruption is a problem, and it affects us. The water in this area is on and off, I get my water from my neighbours' well. I collect the water with buckets and pour the water into the Jojo tank."
>
> (Participant J)

> "We use a small drum for water storage, and it is the only container that we use for water storage. When we must use the water in the drum, we prioritise water for drinking and cooking, the other tasks that we may have to do using water, we do them after and if there is still water remaining in the drum and use the water to bath."
>
> (Participant I)

A popular notion from the findings indicates that water supplies are unpredictable; Participants B, I, and J demonstrate intentional and planned methods of storing water in barrels, small drums, Jojo tanks, and 20 L buckets. Participant J mentioned that she collects water from her neighbors' well and pours the water into her Jojo tank, which she uses as storage for water. This reveals that not all households had large drums. As stated by Participant I, she mentioned that they only had one small drum, which they used for storage purposes.

Empirical findings indicate that women store their water in barrels and 20 L containers, and the water stored in the barrels for too long is then used for other chores such as cleaning, sanitation, and laundry. The findings align with ecofeminism theory; this theory illuminates the burden of water storage that is carried by women as a gendered role in broader structures of environmental and social inequity. In a similar vein, it was revealed that women bearing the responsibility of container and storage management reinforces their position as the family's and the environment's caregivers. The ecofeminist perspective highlights a reflection of poor water infrastructure and poor distribution systems in Motlhabeng Village. This unpaid labor sustains households, reinforcing gendered hierarchies.

4.2.4. Water Purification Techniques

Boiling, chlorinating, and filtering water at home are examples of household water treatment and safe storage (HWTS), which can address poor water quality at the point of delivery. According to systematic studies of water quality interventions, HWTS, such as filtration and chlorination, can effectively improve drinking water quality and prevent diarrhea. The participants mentioned the following:

> "When there is water in the communal taps and the water, we stored in the buckets is also still available, we use the water stored in the buckets for household chores such as cleaning and bathing because if it stays for long without being used, eventually there will be dust in the water. We then collect fresh water from the communal taps. Sometimes water from the communal tap comes out brown indicating contamination. We collect it in that state and put it aside until the colour changes. We sometimes boil water before consumption."
>
> (Participant I)

> "To ensure that the water we consume is clean, the buckets and barrels are always covered by the lids. When you do not cover the buckets filled with water, you find dirt in the water, and this leads to us using the water for other chores such as cleaning or laundry. Before we refill our buckets and barrels, we clean them with detergents such as Jik. Water from the communal tap can sometimes be contaminated and when we see indicators that the water is contaminated, we do not consume the water but use it for other household chores and buy purified water for drinking."
>
> (Participant J)

> "I clean the containers we use at home before refilling the water and I use sunlight liquid. We usually do not feel the need to purify out water, especially drinking water. When cooking, the water is boiled while cooking, so we do not boil water before cooking or drinking water. Even the water from the well, which is most likely to be contaminated, we do not purify it. We consume it like that. I only use a sifter for the water collected from a well and after that, it is ready for consumption."
>
> (Participant H)

Findings from the above indicate several water purification techniques women in Motlhabeng Village use to ensure water is safe for consumption for their family members. This includes boiling, covering the containers, and using disinfecting agents that they use for water conservation. The participants emphasize cleaning and covering the buckets to ensure that the water is always clean. Participant J mentioned that they cover the containers with lids to prevent contamination. Participant J further discussed that when their water buckets are not covered, they find the water contaminated, leaving them to either boil the water or buy water from retailers, as they need alternative clean and safe water. Furthermore, Participant I mentioned that the water they collect from the communal tap is sometimes contaminated, and they determine the quality of the water by looking at its color to ensure that it is safe for consumption. Motlhabeng Village's water quality is assessed by its appearance. If the water is clear, it is safe to drink; if it has a different color, it is considered contaminated.

Empirical findings are in line with [44], which argues that women frequently use water treatment methods to handle water that has been gathered from unimproved sources. Rural households resort to boiling and filtering water to make it safe for consumption. Women frequently lack the financial resources to invest in advanced water treatment technologies;

many are unable to purchase expensive treatment systems or commercially treated water; therefore, they turn to more economically viable, straightforward methods such as boiling and filtration, which are convenient, reasonably priced, and capable of removing certain particles, but may not be able to eradicate all pathogens. In contrast, ref. [45] revealed that chlorinating water with sodium hypochlorite is an intervention that has been widely used by women in higher castes. However, low-income groups are especially at risk, and the upfront expenses of microbiological quality filters have typically rendered them unaffordable. Numerous authors have documented the use of traditional knowledge such as boiling water and reverse osmosis to purify water in rural communities in developing nations that lack access to drinkable water.

The findings indicate that rural women are not a homogeneous group; they have intersecting identities and social roles, leading to unequal access to resources. Although ecofeminism acknowledges women's relationship to nature, it does not presume that all of them respond in the same way. Ecofeminism recognizes the close connections between race and class injustice, gender, and ecological challenges. Because of their social and economic circumstances, women of color, especially those in the Global South, typically bear the burden of environmental degradation and climate change.

4.2.5. Rainwater Harvesting

Rainwater harvesting has been used for many decades as a means of increasing the world's water supply. Some women engage in rainwater harvesting practices to acquire water for domestic use. They use rooftop rainwater harvesting as it offers clean water for household use, while poorer households rely on open containers that are easily contaminated. Participants mentioned the following:

> "To be honest, the water that we mostly rely on in this household, is rainwater. When there is rainfall, we take our buckets and barrels outside for them to be filled with rainwater then use the rainwater for laundry and sanitation. The disadvantages of the rainwater stored outside is that it is easily contaminated and we have donkeys here at home and the donkeys tend to drink from the same buckets we store our rainwater which makes the water inconsumable, and this forces us to only use the water for sanitation purposes and laundry."
>
> (Participant A)

> "We occasionally use rainwater. When there is rainfall in our area, I take our containers outside so we can store rainwater and once the containers are full, I store the rainwater in the house for approximately two days. We use this water for bathing, laundry and cleaning. It is not always that we consume rainwater, however, if there are no other available water sources, we are forced to consume rainwater."
>
> (Participant C)

> "In my household we use rainwater for our livestock and laundry. We always have a tank outside that stores rainwater and once the tank is full, we check for any dirt in the water. If there is less dirt in the water, we use our buckets to extract the water from the tank and put a small portion of salt and aloe vera in the rainwater to purify it. After purifying the rainwater, we give it to our livestock."
>
> (Participant D)

The findings above indicate a strong reliance on rainwater, which indicates the pertinent role of women in rainwater harvesting to supplement water, contributing to water conservation. Participant D stated that they use rainwater for their livestock and laundry, enabling them to enhance their subsistence agricultural yields. The dynamic is consistent with studies by, which argued that women's livelihoods are greatly improved by rainwater

harvesting because this method gives them access to water and cuts down on the time needed to collect it. The findings revealed insights into rainwater harvesting, which is a critical strategy for women during water shortages and also serves as a strategy for women's empowerment in addition to expanding their livelihood options. In contrast, ref. [45] argued that men are typically more involved in collecting rainwater. Women may be more active in day-to-day water management due to domestic activities, whereas men may be more involved in rainwater harvesting system acquisition or technical aspects.

4.2.6. Education and Behavior Changing

The participants were questioned about educating their family members, and they responded as follows:

> "In my household, I teach my family members about always ensuring that there is always enough water in our containers. I always tell them that no one goes to bed without ensuring that there is water in our containers. Our water supply is unreliable. In the morning when my children must leave for school, we sometimes find that there will not be any water coming from the tap because of the water supply interruption."
>
> (Participant I)

> "I have not really educated my family members about water saving practices. However, my children who go to school always tell me that they are educated about water saving practices at school. They always tell me that water should not be wasted but used sparingly, they do not open the taps and leave the water running, and the water they consume should always be clean. Even after we have collected the water during water supply interruption, I use it in small portions."
>
> (Participant G)

> "I always tell them about the importance of using water without wasting it. I store our water containers in a place that is not easily accessible for the toddlers because they are the ones who tend to play with water. I also educate them about how they should distribute water that they will be using. If they want to take a bath, they know not to use more than 9 L of water."
>
> (Participant J)

Findings from the above indicate that there is a strong conservation culture that has been influenced by education and families. Participant J and I acknowledged that they educate their family members about water-saving practices, especially considering that their water supply is unreliable. Participant I further mentioned that she educates her children to always ensure that they have water overnight to cushion against water supply interruptions. Participant G does not actively educate her family members about water-saving practices; however, the children bring the water-saving practices they learned at school home. It is because of their established gender roles that women have important local ecological and social knowledge. The statements from the participants highlighted that women play an important educational and social role in encouraging water conservation among families. Similarly, ref. [46] contends that women are also in charge of teaching children and guiding family members in carrying out water conservation practices. Women are often recognized as stewards of traditional knowledge related to natural resource management.

4.2.7. Decision-Making and Planning

Regardless of their important contributions, women in rural areas still encounter several obstacles that prevent them from fully engaging in decision-making processes pertaining to water. To guarantee fair and sustainable management of water resources, the

gender gaps that currently exist in water governance and management must be addressed. Views from the participants are as follows:

> "I believe that women as the people that always ensure that we always have water at home, we are not recognised or acknowledged. We are the ones who organise the water at home, from collecting water allocating it to different purposes in the house. Another thing I do not like is that, if there will be water supply interruption, we are not informed prior, and you can wake up in the morning to no water."
>
> (Participant I)
>
> "We would appreciate it if the local leaders and municipality paid attention to our concerns and did something about it. Women roles are not seen or supported. The local leaders are not as affected as we are."
>
> (Participant A)

Both Participants I and A mentioned that women are the water managers in the household, but this role is not acknowledged. Insights from Participants I and A illustrated a gender division of labor and social exclusion of women in local water governance and acknowledgement. Women's contributions and expertise in decision-making are undervalued and not recognized. This reveals a disconnect between household decision-making that is dominated by women and community-level decision-making dominated by men. Regardless of their important contributions, women in rural areas still encounter several obstacles that prevent them from fully engaging in water governance. The findings revealed broader issues of societies deeply rooted in patriarchy, exacerbating gender inequality in rural areas. The findings highlight a need for gender transformational initiatives in water governance.

5. Discussion of Findings

The findings of the study revealed that women in Motlhabeng Village are the primary users and collectors of water. Women disproportionately bear the burden of water collection due to water supply interruptions. The findings revealed that in Motlhabeng Village, accessible water sources are scarce; therefore, participants had to travel great distances to water sources. In Sub-Saharan Africa, where approximately 45% of the population relies on collected water, Whorld Health Organisation discovered that women are four times more likely than men to do this task [46]. Participants highlighted experiencing water supply interruptions for longer periods and sometimes relying on their neighbors for water. A particular participant revealed that her son assists her in water collection. The findings revealed a contradiction in women being the only primary water collectors. A study by [47] contends that men and boys were responsible for water collection in other regions. The study revealed that both men and women collected water in urban areas.

Women, as primary water managers at the household level during water supply interruptions, oversee the allocation of water for different purposes [48]. Findings revealed that various containers were utilized to distribute water at the household level. Participants utilized the graywater method to reduce overall usage of water; this method was utilized by multiple households in Motlhabeng Village. Recycling water or graywater reuse may be a viable water-saving approach. With rising demand for fresh water and rising water scarcity indices in Sub-Saharan Africa, this technique may reduce water requirements while boosting availability for primary purposes such as household and animal life [49]. Efficient utilization of existing amounts is an option to consider, even in terms of reducing drought consequences. Graywater reuse is a significant environmental and economic initiative. During periods of water supply interruption, women play a significant role at the household level by traveling long distances to collect water and store it in different

storage containers. The findings revealed that the women in Motlhabeng Village stored their water in 20 L buckets and barrels; furthermore, the empirical findings revealed that not all households owned large containers.

Women in rural areas utilize different household water treatment and safe storage methods, such as boiling water, purifying water using detergents, and covering storage containers to prevent contamination. Findings reflect the participants' reliance on affordable, traditional purification methods, as different households may not be able to afford advanced and expensive water treatments such as chlorinating water with sodium hypochlorite.

Rainwater harvesting in rural or urban regions, where access to clean water is limited by shortages and pollution, provides benefits such as reducing expenses, considering that rainwater is a free resource. The findings indicate that women in Motlhabeng Village actively rely on rainwater harvesting for water supply during water supply interruptions. Participants described collecting rainwater using 20 L buckets, barrels, and tanks. Most households do not consume rainwater but use rainwater for laundry, cleaning, and livestock.

Education is used to share and educate family members about the need to improve water-saving practices at the household level. The findings of the study revealed that elderly women are recognized as key agents of water-saving practices at the household level and pass down this knowledge to other generations. Furthermore, participants described schools educating children about behavior changes during water supply interruptions and using water sparingly. Lastly, despite their essential role in collecting water, women in rural areas remained excluded from water governance and decision-making. The participants revealed that they are responsible for collecting water, distributing and rationing it at the household level, yet their opinions are frequently ignored by the local community leaders. Culturally related barriers are difficult to overcome since they frequently require the emergence of new social norms regarding power and influence.

6. Conclusions

This research has shown that women in Motlhabeng Village have a vital and irreplaceable function in maintaining water security for their families. It has been found that the majority of water collection, utilization, and water management falls to women, and thus they bear a disproportionate amount of the physical and mental strain caused by water shortages. The fact that many women need to travel long distances in order to find water, as well as the extended time frames of water supply interruptions, demonstrates the extreme degree of water insecurity faced in this area and how it affects women disproportionately. Although there was an indication of co-responsibility, specifically from men and boys in certain circumstances, the dominant model continues to be one in which women will take on the bulk of the responsibility for ensuring that water is available at the household level.

In addition to collecting water, women are responsible for managing and conserving water resources used within the household. Women's use of adaptive methods, including the reuse of graywater, careful distribution, and storing water in any available container, indicates their ability to be resilient and creative when faced with water scarcity. In addition to being able to meet daily household needs, these practices also contribute to environmental sustainability. Nevertheless, differences in the availability of storage and modern water treatment options reflect social and economic inequities already present in society and limit women's ability to effectively manage water.

The research demonstrates the significance of indigenous knowledge systems and intergenerational learning in supporting water conservation practices. The elderly women in particular were identified as being significant transmitters of knowledge, and schools were identified as complementary mechanisms to promote behavior change amongst younger generations. Also, the fact that households relied upon low-cost methods such as

boiling and rainwater harvesting illustrates the practical and resource-constrained nature of water conservation methods utilized by households in rural settings.

While the results of women's water collection burden are consistent with the larger body of research, this study makes an original contribution to the literature by examining water insecurity in Motlhabeng. Specifically, it demonstrates how frequent water outages and long travel times exacerbate both the physical and emotional burden associated with collecting water. Additionally, this study identified emergent co-responsibility among men and boys, which indicated that while household water management remains predominantly feminine, there is evidence of a shift occurring in household water management responsibilities.

7. Recommendations

Addressing water insecurity in Motlhabeng Village requires an integrated approach to address both infrastructural needs and gender-inclusive governance. To start with, significant investment in water supply systems that are reliable and do not have frequent and lengthy disruptions is required. The government and other stakeholders must invest in the rehabilitation of the current water infrastructure and develop alternative water supply systems (i.e., boreholes and community water schemes) to alleviate some of the burden currently experienced by women.

Secondly, water storage and treatment at the household level can be enhanced. The provision of subsidized or low-cost storage units (e.g., large-capacity tanks) and making water purification equipment available to households at reasonable costs can enhance the water quality and quantity available for consumption. Additionally, support for traditional practices such as graywater reuse and rainwater collection through training and community-based programs can promote their safe and efficient use.

Finally, strengthening community-based education programs to teach water conservation methods to all ages, and to encourage shared responsibility between men and women, can further create positive changes in behavior. Encouragement from schools and local leaders can help sustain these positive behaviors.

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