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Water Insecurity Experiences and Coping Strategies Adopted among Individuals in Enugu, Nigeria: A Gender Perspective

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Abstract

In many parts of the world, many people struggle with water shortages. Persistent challenges concerning water availability and quality, and the physical and economic barriers to water access exacerbate the concerns surrounding water security. Nonetheless, the experiences of water security vary among individuals and households, both within specific regions and across different regions. This study seeks to evaluate the status of individual water security among males and females and identify the coping strategies utilized by respondents in addressing their experiences of water insecurity. The study, which was conducted in Enugu, collected data from 100 respondents using semi-structured questionnaires. The study findings indicated that both males and females had water insecurity issues (Mean Score [MS]=20.81), with the females (MS=22.08) having more frequent experiences of water insecurity than males (MS=19.54). Although women had a higher prevalence of water insecurity than men, there was no statistically significant difference between the experiences of men and women in the study area. This study thus contradicts the dominant assumption that women are disproportionately affected by water insecurity and suggests that water insecurity experiences extend beyond gender experiences. Based on these findings, the study recommends improving water affordability, especially for low-income individuals, and advancing water infrastructure to ensure a consistent and reliable water supply.

Keywords: IWISE, coping strategies, gender experiences of water insecurity, physical water scarcity, economic water scarcity

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Expériences d'insécurité hydrique et stratégies d'adaptation adoptées parmi les individus à Enugu, Nigéria : une perspective de genre

Résumé

Dans de nombreuses régions du monde, de nombreuses personnes sont confrontées à des pénuries d'eau. Les difficultés persistantes liées à la disponibilité et à la qualité de l'eau, ainsi que les obstacles physiques et économiques à l'accès à l'eau, exacerbent les inquiétudes concernant la sécurité hydrique. Néanmoins, les expériences en matière de sécurité hydrique varient selon les individus et les ménages, tant au sein d'une même région qu'entre différentes régions. Cette étude vise à évaluer l'état de la sécurité hydrique individuelle des hommes et des femmes et à identifier les stratégies d'adaptation utilisées par les répondants pour faire face à leur expérience de l'insécurité hydrique. L'étude, menée à Enugu, a recueilli des données auprès de 100 répondants au moyen de questionnaires semi-structurés. Les résultats de l'étude ont indiqué que les hommes et les femmes souffraient tous de problèmes d'insécurité hydrique (MS = 20,81), les femmes (22,08) étant plus fréquemment confrontées à cette situation que les hommes (MS = 19,54). Bien que la prévalence de l'insécurité hydrique soit plus élevée chez les femmes que chez les hommes, aucune différence statistiquement significative n'a été observée entre les expériences des hommes et des femmes dans la zone d'étude. Cette étude contredit ainsi l'hypothèse dominante selon laquelle les femmes seraient touchées de manière disproportionnée par l'insécurité hydrique et suggère que les expériences d'insécurité hydrique vont au-delà des différences de genre. Sur la base de ces résultats, l'étude recommande d'améliorer l'accessibilité financière de l'eau, en particulier pour les personnes à faibles revenus, et de développer les infrastructures hydrauliques afin de garantir un approvisionnement en eau constant et fiable.

Mots clés: IWISE, stratégies d'adaptation, expériences de genre en matière d'insécurité hydrique, pénurie physique d'eau, pénurie économique d'eau

1.0 Introduction

Water is essential for the survival and well-being of individuals and the sustainable development of nations globally (WHO & UNICEF, 2019; Guppy & Anderson, 2017). However, water scarcity has remained a global concern as most countries worldwide experience various dimensions of physical and economic water shortages (UN-Water, n.d.). Globally, about 844 million people lack access to basic water services, 2.1 billion people lack access to clean drinking water and more than 2.2 billion individuals face water scarcity (WHO & UNICEF, 2019). This situation is projected to worsen in the upcoming decades as a result of economic and population growth, industrialization, climate change, and rapid urbanization (Karimidastenaei et al., 2022; Nounkeu et al., 2021) that would, in turn, increase domestic, industrial, and irrigation water demand. Several countries, such as Spain, Italy, India, China, Sri Lanka, Greece, Serbia, Niger, Namibia, and Mauritania have declared a drought emergency resulting from insufficient quantities of water to meet increasing demand (UNCCD, 2023). To address this water crisis, initiatives such as the Global Water Initiative and the Global Framework for Water Scarcity in Agriculture (WASAG) were launched. Additionally, the observance of World Water Day annually on 22 March, the creation of the Sustainable Development Goal

(SDG6), the Earth Summit in 1992 and United Nations Water Conferences in 1977 and 2023 underscored the critical role of water resources in environmental, economic, and human development and shines a light on the global water crises. These efforts resulted in progress, as the UN noted a rise in the percentage of people who have access to safely managed water, from 69% to 73%. Although progress has been documented, water issues appear to be escalating faster than society can address them (Salehi, 2022), with water scarcity continuing to intensify. This challenge is particularly severe in developing countries in Sub-Saharan Africa, such as Nigeria, where people experience both physical and economic shortages of water (Iduseri et al., 2021). These circumstances have significant repercussions on individual water insecurity.

Water security is a complex and multidimensional concept that involves ensuring reliable access to sufficient, safe, and affordable water for various purposes. It encompasses both the quantity and quality of water resources and extends to issues of water management, infrastructure, and resilience to water-related challenges. Initially viewed as a water scarcity issue, the concept of water security has evolved and is now looked at holistically, encompassing several dimensions (Cook & Bakker, 2012; Chapagain et al., 2022). Water insecurity is defined as insufficient access to adequate safe and clean water at all times for all members of a household to sustain a healthy and active life Young et al. (2019) and Nounkeu et al. (2021). Numerous studies have extensively explored the global landscape of household and individual water security, unveiling various dimensions and challenges. Water insecurity has been linked with food security (Young et al., 2021; Musse, 2021), sanitation and hygiene (Mukherjee et al., 2020; Iduseri et al., 2021), conflicts and violence (Gleick & Shimbuku, 2023), human health (Anthonj, 2021; Stoler et al., 2021; Mishra et al., 2021), and livelihood (Aromolaran et al., 2019; Everard & West, 2021). Water security has also been assumed to be associated with mental and behavioral well-being such as anger, shame, anxiety, and stress (Kangmennaang & Elliot, 2021; Kimutai et al., 2023; Toivettula et al., 2023).

In Sub-Saharan Africa, especially Nigeria, ongoing water insecurity issues stem from rapid population growth, climate changes, and inadequate water infrastructure, all of which place increasing pressure on existing water resources. A key characteristic of water insecurity in Urban Nsukka is the primary reliance on groundwater, which is expensive and constitutes a significant proportion of the individual budget. The Urban Nsukka region of Nigeria is primarily characterized by a lack of surface water with groundwater such as boreholes and unconventional sources such as rainwater predominantly fulfilling the potable and non-potable water requirements of individuals and households (Mama et al., 2019). However, the impervious nature of the soil poses difficulty in accessing groundwater, and where feasible, it proves to be a costly venture that most individuals are unable to afford.

As the issues related to both the physical and economic water shortages, access, water quality, and sustainable use and management persist and intensify, they directly contribute to the problem of water insecurity. However, experiences of water insecurity differ among individuals and households, both within and across regions. Women have long been recognized as primary water collectors in most households and this responsibility places a significant burden on them. Despite this significant role they play in the household, studies have shown that women have lower access to water than their male counterparts (Bisung & Elliot, 2018; WHO & UNICEF, 2019). Thus, they may likely experience higher water insecurity than males in households. The traditional role of water collectors assigned to women laid a foundation for assumptions that the associated burden

of water insecurity is largely on women. However, contemporary studies on water insecurity show that men carry a significant burden of water insecurity. Thus, recent research has emphasized the paramount importance of recognizing gender inequities in water access. Nevertheless, some comparative studies that examined the gendered differences in water insecurity showed that although both men and women had poor water access and were water insecure, women had lesser water security than men. For instance, Stevenson et al. (2012) and Wutich and Ragsdale (2008) found that women had higher experience of Water, Sanitation and Hygiene (WaSH) related negative mental health outcomes than men in Ethiopia and Bolivia. A similar situation was found in Pakistan by Khalid et al. (2024), who reported that over 50 percent of men and women were water insecure, but the prevalence of water insecurity was more profound among women. Qualitative studies by Nordstrom and Widman (2022) revealed that Ghanaian women do not receive any help from men in the households in collecting water. Thus, solely bear the financial, emotional, health, and physical burden associated with water provision for household use. In most African countries, including Nigeria, women have reported cases of violence as a result of lack of water in the home. United Nations (2007) also reported that women had a lower attendance at school than boys as a result of their WaSH experiences. Bisung and Elliot (2018) similarly showed gender-differential access to water resources resulted in female-headed households being less water secure than male-headed households in Kenya. Contrarily, Nebie et al. (2024) reported that men engaged in livestock production had a higher perception of water insecurity than women. Similarly, men in Ethiopia and Ghana were reported to be more water insecure than women (Young et al., 2022). These findings raise important questions about how gender shapes experiences of water insecurity, given the underestimation of men's role in water provisioning in the household.

Based on the existing findings from the literature, the study adopted an experiential metric (Independent Water Insecurity Experience Scale [IWISE]) to compare the water insecurity experiences between men and women. The IWISE scale is an experiential scale developed by Young et al. (2019). This tool has been validated in 31 low and middle-income counties (LMICs) around the world (Bethancourt et al., 2022; Young et al., 2019, 2022), which makes it a valid tool for this study. The study went further to test if there was a statistical significance in the mean experience of males and females. The study also identified the coping strategies adopted by respondents and the extent of adoption of these coping strategies to these experiences of water insecurity. This study is useful as it will help to identify intra-household variations in water insecurity experiences among household members. Conventional water indicators typically concentrate on metrics of water quantity and quality; however, contemporary research underscores the importance of evaluating individuals' direct experiences with water availability, accessibility, and utilization. Such an approach is essential for a comprehensive understanding of how individual water insecurity influences health and well-being. Utilizing the experiential (IWISE) scale to assess individual water insecurity will help policymakers grasp the extent and impact of water stress on individuals based on their different characteristics, including its effects on health, economic conditions, and psychological well-being. The study employed a disaggregated method based on individual-level characteristics of gender. This will provide evidence on whether the water insecurity experiences of women are significantly different from men, especially considering the gender roles of women as water collectors in households. This will provide evidence to policymakers that will guide the development of water-related projects and interventions tailored to suit the specific attributes of these groups of individuals (Quandt et al., 2022).

2.0 Methodology

2.1 Study Area

The study was conducted in Nsukka, a town and local government area in Enugu state. It is the administrative center of Nsukka Local Government and is made up of small towns like Alor-Uno, Nru(Ikpa), Agu-Echara (Barracks), Onuiyi, Edem, Ihe U.N.N and Umakashi (Ugwuishiwu et al., 2016; Ozoko & Amadi, 2022). It is located between latitudes 6º49'0"N to 6º53'0"N and longitudes 7º19'0"E to 7º26'0"E with an estimated population of about 444,100 people (City Population, 2022). Nsukka has an average annual rainfall of about 1,500mm and an average temperature of 27^0C (Yakubu et al., 2022). The town follows a tropical climate pattern with distinct wet and dry seasons. The rainy season in Nsukka begins in April and ends in October, while the dry season, popularly referred to as *harmattan*, lasts from November to March, with the heaviest rainfall occurring between July and September. The area lacks physical access to surface water and largely depends on groundwater like boreholes, which are seasonally supplemented by rainwater in the rainy season and water tankers/vendors in the dry season. The region has limited physical access to surface water and primarily relies on groundwater sources, such as boreholes. During the rainy season, this supply is occasionally boosted by rainwater, while in the dry season, water is supplemented by tankers or vendors. These water tankers, also known as mobile water vendors, are large vehicles (over 10,000 litres) that transport water to various locations. The water supplied is from various sources such as boreholes, streams, reservoirs, and water treatment plants.

2.2 Sampling Technique

Stratified random sampling was employed in the selection of 100 respondents (50 males and 50 females) who were household heads in Nsukka Urban. This sample size was chosen as a result of time and resource constraints. However, the size provided an adequate representation of the population. To reduce potential sampling bias, a random sampling technique was employed in the final selection of respondents to capture a wider range of respondents. This resulted in the random selection of 50 males and 50 females for the study. Additionally, to reduce response bias, participants were encouraged to provide honest responses by providing assurances of confidentiality and anonymity. The questions asked were presented in very clear language for easy comprehension by respondents. Data collection was facilitated through focus group discussions and the use of a pretested and validated semi-structured questionnaire (which comprises both open and close-ended questions). Content validation of the questionnaire was done by three researchers who had expertise in this field of research. This was done to ensure that the questionnaire covered all important areas of the IWISE and that the questionnaire was effective for the purpose it was developed. Prior to the data collection, a focus group discussion (FGD) was conducted with ten participants in the study area. FGD participants were recruited by adopting a purposive selection and snowballing. Selected participants were well informed on the water challenges in the story and had lived there for a minimum of two years. Informed consent was obtained from all participants. Questionnaires were administered to the respondents by well-trained enumerators after obtaining verbal consent from the respondents. Personal details such as names and addresses, which could reveal the identity of the respondents, were anonymized. The questionnaire included questions on the socioeconomic characteristics (age, household size, marital status, and monthly income), respondent's WaSH responsibilities in the household, ownership/control of water storage devices, and access to water on-premise.

2.3 Data Analysis

To achieve the study's major objectives of assessing individual water insecurity experiences among males and females, the IWISE scale, which was developed by Young et al. (2019), was used. The scale comprises 12 distinct components that address various facets of water insecurity, such as concerns about water availability, interruptions to daily routines and food preparation, challenges in maintaining hygiene, disruptions in water supply, and emotional distress (Young et al., 2019). These 12 distinct IWISE components are: worry+ interrupt +clothes+ plans +food +hands +body +drink +angry +sleep +none +shame= total IWISE scale score. Each component is evaluated using a four-point scale, yielding a total score that ranges from 0 to 36. Never is scored as 0; rarely (1–2 months) is scored as 1; sometimes (in some months) is scored as 2; often and always (in almost every month) are both scored as 3. Individuals with an IWISE Scale score ≥ 12 are classified as water insecure, while those scoring from 0 to 11 are considered water secure at this cutoff point. Following this Likert scale classification, the mean score was given by 0+1+2+3/4= 1.5. This mean score was utilized to determine which experiences most significantly influenced the IWISE scores. Consequently, IWISE variables with a mean score below 1.5 (MS < 1.5) were not considered prevalent or frequent experiences encountered by individuals, whereas those with a mean score of 1.5 or higher (MS ≥ 1.5) were recognized as prevalent or frequent experiences encountered by individuals.

A 3-point Likert-type scale rating with responses of “often or always used (2)”, “rarely used (1)” and “never used (0)” was used to evaluate the coping strategies employed by individuals to deal with water insecurity experiences. The mean of the responses was given by 2+1+0/3 = 1.0. An interval scale of 0.05 was adopted with the upper limit as 1+0.05=1.05 and the lower limit as 1-0.05=0.95. Based on this, any coping strategy below the mean score of 0.95 ((MS<0.95) was not regarded as a coping strategy while mean a score of 1.05 and above (MS≥1.05) was regarded as a coping strategy employed by individuals.

A t-test was used to test the null hypothesis “There is no significant difference between the mean IWISE scores of men and women in the study area.”

3.0 Results and Discussion

3.1 Socioeconomic Characteristics of Respondents

Table 1 highlights the socioeconomic disparities influencing water insecurity experience. The result indicates that the majority of respondents (62%) were married with an average household size of approximately five persons. Results also indicate that 63% of individuals lived in rented houses, and this could influence access to various types of water services and their water insecurity experiences. Similar deductions were made by Joshi et al. (2023) who suggested that ownership of a house has been linked to differential access to various types of water services, as the tenure status of houses can hinder the ability to access diverse water services and achieve water security. The average monthly income of respondents is ₦72, 380 ($48.03), about ₦2412.67 per day ($1.60). This suggests that these individuals exist below the poverty line of $2.15 per day. Evidence indicates that individuals with lower incomes generally experience reduced water security, as income levels have been linked to better access to water and the capacity to procure resources for water treatment (Ngarava et al., 2019).

Table 1: *Socioeconomic Characteristics of Respondents (n=100)*

Individual socioeconomic characteristics	**Percentage (n=100)**	**Mean**
Sex		
Male	50.0	
Female	50.0	
Household size		4.78
Marital status		
Single	24	
Married	62	
Divorced	3	
Widowed	11	
Monthly income		72,380
Ownership of house		
Owned	37.0	
Rented	63.0	
Contact with agricultural extension agent in the past year	19	
Yes	81	
No		
Access to water on-premises		
Yes	43	
No	57	
Access to a free water source		
Yes	09	
No	91	
Control/ownership of water storage tanks		
Yes	94	
No	6	
WaSH responsibility in the household		
None	0	
Fetching/collecting water	40	
Paying for WASH expenditures	70	
Domestic chores like cooking/cleaning	57	
Child care (child between 0-5year)	50	

The results also suggest poor contact between the individuals and the extension agents in the study area, which could impede the dissemination of technologies and information on water conservation practices. This lack of communication may hinder the ability to manage water resources more effectively and mitigate water security issues, as highlighted by Huang and Lamm (2017). Similarly, Sinyolo et al. (2014) observed that households had limited access to extension services.

The results reveal that 43% of participants had water available on their premises, and 94% had control over facilities for water storage. Nonetheless,

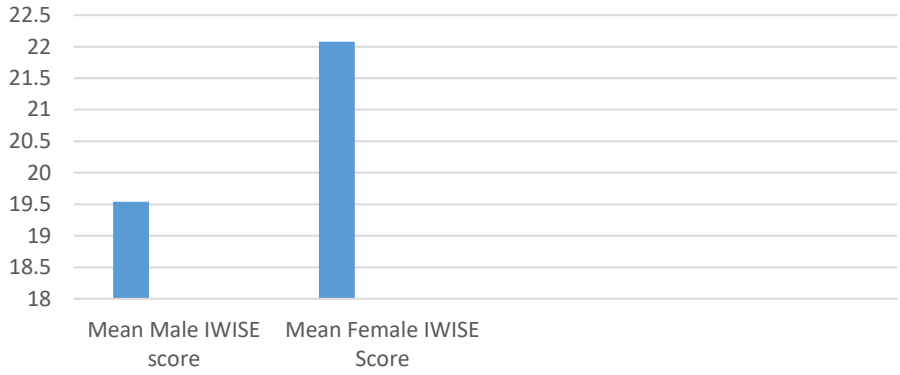
a mere 9% of respondents had access to a free water source, suggesting that the provision of water for domestic use generally entails some financial expenditure. Chitonge (2020) and Dolan et al. (2021) reached a comparable conclusion, noting that despite the presence of freshwater resources, a significant portion of the population remains unable to access adequate water due to economic limitations. The interviews with respondents indicated that their primary sources of free water are private boreholes and rainwater. In contrast, they generally incur costs for other water sources, such as commercial boreholes, water vendors, and sachet or bottled water, which are the predominant sources of potable and non-potable water.

3.2 Gender Differences Between Individual Water Insecurity Experiences

Table 2 presents the descriptive statistics showing the mean of water insecurity experiences for male and female respondents. The respondents were asked about the frequency of experience of water insecurity based on the 12 listed items. Following the responses of respondents to questions on the IWISE scale, the result shows that none of the respondents were water secure as they all had IWISE scores ranging from 12 to 36. However, females had higher levels of water insecurity, with HWISE scores of 19.18 and 22.04 for males and females, respectively, as shown in Figure 1. The higher scores of women are intricately linked to the traditional roles of women as water collectors, distributors, and managers of water and water-related activities in the household. They are thus more likely to experience higher water insecurity in their search and use of water. Despite their water responsibilities in the household, the social dynamics within and outside the household lead to lower bargaining power for water access, management, and use (De Guzman et al., 2022). Similarly, findings by Khalid et al. (2024) showed that women are more likely to be water insecure than men. Based on this result, it is thus important to consider the peculiarities of various users based on individual-level characteristics, such as gender, when designing or implementing water-related projects. The overall average IWISE score is 20.61, which is an indication of the relatively high level of water insecurity experience in the study area (the total possible IWISE score is 36). Similar conclusions were reached by Workman and Ureksoy (2017) and Nkemdirim et al. (2017), suggesting that, despite the presence of water sources, various limiting factors can result in frequent adverse experiences that exacerbate water insecurity for households.

The results show that the most prevalent individual water insecurity experiences that contributed to individual water insecurity experience for males and females were frequent feelings of anger about water situations (MS males=2.36 and females=2.46), repeated water supply interruptions (MS males=2.20 and females=2.52), and worry about insufficient water (MS males=2.06 and females=2.48). It can be deduced from Table 2 that the frequency of water insecurity experiences differed between men and women. The experiences of women were relatively more frequent than that of men as they recorded higher mean scores in most attribute, excluding washing hands after dirty activities (MS=0.72), bathing (MS=1.98), sleeping thirsty (MS=0.84), and insufficient drinking water (MS=1.82).

Figure 1: Mean water insecurity experience for male and female respondents.



The interviews with participants indicated that the frequent interruptions in water supply are due to dependence on water sources that are outside the control of the individuals. For instance, primary water sources for individuals were commercial boreholes and private tankers with seasonal supplementation by rainwater in the rainy season. However, the commercial boreholes are not always operational, which can result in interruptions to a consistent water supply for the individuals. Moreover, water tankers are frequently unreliable, as respondents reported numerous instances where water suppliers did not fulfill their commitments or tanker associations went on strike, leading to disruptions in water supply. Individuals also reported frequent feelings of anger as a result of the water situation. Water is needed for the survival and overall well-being of individuals and its unavailability in sufficient quantities has been associated with adverse mental health impacts such as anger. The findings reveal a lack of free water supply for individuals. Consequently, an increase in water consumption necessitates a higher financial outlay for individuals, which may result in feelings of anger and frustration. Additionally, the long distance to collect water and frequent interruptions in the water supply could also lead to frequent experiences of anger over the water situation. The result aligns with the findings by Lemaitre et al. (2023), who identified water supply interruptions, water worry, and anger about the water situation as the prevalent water insecurity experiences in Colombia.

Other factors that contributed to the individual water insecurity include frequent worrying about insufficient water for household needs (MS=2.35), inability to wash clothes (MS=2.33), disruption in plans (MS=2.13), inability to bathe (MS=2.03), insufficient potable water (MS=1.91), change in food (MS=1.81), feelings of shame or stigmatization (MS=1.58). Experiences such as going to sleep thirsty (MS=0.84 and 0.8), and having insufficient water to wash hands (MS=0.72 and 0.62) were less frequently experienced by both males and females. This can be attributed to the fact that hand-washing typically requires only small quantities of water whether from improved or unimproved sources, which individuals can readily access. As a result, the inability to wash hands occurs less frequently and thus has minimal impact on overall individual water insecurity. The results align with the findings of Fielmua et al. (2023), who stated that 80% of respondents in peri-urban areas of Ghana frequently washed their hands in all five critical hand-washing moments. However, Stoler et al. (2021) made contrary findings suggesting that hand washing was limited in low and middle-income countries due to insufficient quantities of water. Furthermore, the interviews with respondents indicated that rare instances of going to bed thirsty were due to intentional measures taken by individuals to guarantee the availability of drinking water, particularly at night, to address unexpected

situations. Individuals made a concerted effort to secure water from alternative sources to fulfill their needs.

Generally, the high level of water insecurity can have implications for individual well-being, nutrition, health, and overall quality of life. Water insecurity leads to physical health challenges such as higher probabilities of individuals being dehydrated and contracting water-borne diseases. Aside from the physical health implications of water insecurity, the chances of having emotional and mental health challenges are higher with increasing water insecurity. Constant stress and feelings of anxiety and depression over water challenges can translate to individuals developing anxiety disorder and high blood pressure as a result of water insecurity. Similarly, Wutich et al. (2020), Kayser et al. (2019), Ahmed et al. (2021) and Geere et al. (2010) reported higher cases of mental health conditions, physical injuries, and even death as a result of water insecurity. Concerning nutrition, high water insecurity experiences have adverse implications for food security and nutritional well-being. Water is an essential nutrient and plays a critical role in human well-being. High IWISE scores imply insufficiency in water supply, manifested in lower dietary diversity, poor food handling and hygiene, higher beverage intake, higher out-of-home food consumption, and higher food insecurity. Similarly, Gazan et al. (2016) and Slotnick and Leung (2023) reported that households with lower water insecurity had higher water intake and healthier food consumption patterns. Additionally, Thompson et al. (2020) posited that water insecurity ultimately led to the dual burden of malnutrition. Water insecurity inversely influences the quality of life of individuals and households. Thus, higher IWISE results in lower quality of life and satisfaction with life. For instance, for individuals who rely on agricultural activities that are water dependent (like crop processing) as their primary livelihood source, frequent interruptions in water supply would limit the activities they can carry out significantly impacting household economic well-being. Aihara et al. (2016) provided corroborating evidence that suggested that respondents felt a decline in their life's quality as a result of water insecurity.

Table 2: *Descriptive Statistics of Water Insecurity Experiences for Male and Female Respondents (n=100)*

IWISE item	**Male mean (n=50)**	**Std. dev.**	**Female mean (n=50)**	**Std. dev.**	**Pooled mean (n=100)**
Average IWISE score	**19.54**	**9.715**	**22.08**	**9.593**	**20.81**
In the last year:					
How frequently did you worry you would not have enough water for all of your needs?	2.06	0.81	2.48	0.64	2.27
How frequently has your main water source been interrupted or limited?	2.20	0.60	2.52	0.728	2.36
How frequently have problems with water meant that clothes could not be washed?	1.90	0.781	2.12	0.68	2.01

Table 2 continued

How frequently have you had to change schedules or plans due to problems with your water situation?	1.62	0.915	2.32	0.83	1.97
How frequently have you had to change what was being eaten because there were problems with water?	1.46	0.899	1.96	0.87	1.71
How frequently have you had to go without washing your hands after dirty activities because of problems with water?	0.72	0.749	0.62	0.797	0.67
How frequently have you had to go without washing your body because of problems with water?	1.98	0.734	1.86	0.84	1.92
How frequently has there not been as much water to drink as you would like?	1.82	1.144	1.80	1.02	1.81
How frequently did you feel angry about your water situation?	2.36	0.625	2.46	0.607	2.41
How frequently have you slept thirsty because there wasn't any water to drink?	0.84	0.703	0.8	0.775	0.82
How frequently has there been no useable or drinkable water whatsoever?	1.18	0.906	1.22	0.856	1.20
How frequently have problems with water caused you to feel ashamed/excluded/stigmatized?	1.40	0.849	1.92	0.95	1.66

3.3 Coping Strategies with Water Insecurity Experiences

The respondents were asked about the frequency of usage of the listed coping strategies. Information on the various coping strategies adopted was obtained from both literature and FGD. Descriptive statistics of the coping strategies of the male and female respondents can be seen in Table 3. Water scarcity occurs in most areas of Nigeria, both rural and urban areas. Individuals are thus compelled to adopt coping strategies to deal with these water challenges. The result indicates that the highly adopted strategies by both men and women were water harvesting (MS=1.86 for men, MS=2.0 for women), water use management (MS= 1.7 for men, MS=2.0 for women), water recycling and reuse (MS = 1.52 for men, MS=2.0 for women), and reducing appropriate hygiene behaviors (MS = 1.72 for men, MS=1.60 for women). Although these coping strategies were highly adopted by both men and women, the extent of usage of these strategies was higher in men than women. Additionally, buying water on

credit (MS= 0.84 for men, MS= 1.48 for women) and water treatment (MS =0.7 for men, MS=1.14 for women) was identified as a frequently used coping strategy by women only. Some strategies men highly adopted than women include reducing appropriate hygiene behaviors (MS=1.72), purchasing or increasing storage facilities (MS=1.22), and diversifying or changing water sources (MS=1.58).

Multiple responses were recorded by respondents indicating that individuals employed a combination of coping strategies. Similar findings have been recorded by several related studies. For instance, Ahile et al. (2015) identified fetching water from distant sources, rainwater harvesting, minimizing water use, and water storage as the coping strategies of households in Makurdi. Similarly, Venkataramanan et al. (2020) identified several coping strategies to address various domains of water scarcity, such as access, use, quality, and reliability.

Rainwater harvesting is an improved water source that has been recognized as a key coping strategy frequently employed in regions with constrained water supply. In the study area, a preliminary survey indicated that most households lacked access to the conventional piped water supply. Boreholes were the most conventional sources, but they are highly unreliable and subject to fluctuations in supply. This is aggravated by the impervious nature of the soil in the study, which makes it difficult and expensive to drill boreholes. The few who can drill boreholes commercialize the boreholes by selling the water to others. To cope with water scarcity, individuals and households adopt rainwater harvesting. While the availability of rainwater is often limited by the seasonal nature of rainfall, during periods when it is accessible, such as the rainy season, it substantially alleviates economic water shortages and improves physical water availability and access. Due to rainwater use, this coping strategy can lower the financial costs associated with water provision and enhance physical access to water. This is consistent with the findings of Oloukoi et al. (2013) and Achore et al. (2013), who identified rainwater harvesting as a key coping strategy for addressing water insecurity. Individuals have increasingly turned to purchasing water from private vendors, such as water tankers, as a necessary measure to cope with water insecurity resulting from the absence of accessible, reliable, and free water sources (Hossain & Ahmed, 2015). However, this strategy can adversely affect individual welfare, as the high cost of water often imposes a significant financial burden that individuals may struggle to manage. Similar observations were reported by Nchor and Ukam (2024), who highlighted the financial strain associated with buying water from private vendors, particularly in areas lacking piped water infrastructure.

The implementation of water management strategies, such as limiting quantities of water for domestic usage (average MS=1.85) and practices of recycling or reusing water (average MS=1.76), has also been adopted by individuals. Interviews with respondents indicated that they frequently resort to reducing the amount of water used for bathing or repurposing bathwater for toilet flushing during periods of limited water supply and also to reduce the cost of purchasing water for these domestic activities.

Individuals often limit essential hygiene practices, such as frequent bathing, washing clothes, and regularly cleaning sanitation facilities, as a strategy to manage water insecurity. When confronted with such challenges, individuals prioritize water use for drinking and cooking over other hygiene-related activities.

Additionally, individuals use less preferred water sources (average MS=1.47). This could be a result of several factors such as distance and cost. For instance, studies have shown that individuals prefer drinking bottled water. However, the

expense associated with this option limits its accessibility (Nnaji et al., 2013). Consequently, individuals are compelled to utilize water sources that are physically and economically accessible. This reliance on less preferred sources can have significant health implications, as noted by Azupogo et al. (2023), since these sources may be more susceptible to contamination.

Individuals have also acquired or expanded their storage facilities to cope with water insecurity experiences. In areas prone to water insecurity, especially supply interruptions, these storage systems are crucial as they enable households to maintain a reserve of water for extended periods. These storage facilities majorly include drums and tanks as well as smaller containers like buckets and gallons. This result is consistent with the findings reported by Azupogo et al. (2023) and Nchor and Ukam (2024).

Water sharing and borrowing from friends and other members of social networks was identified as a social coping strategy adopted by individuals, as evidenced by the results. Similarly, Eichelberg (2018) and Mbereko et al. (2016) stated that water sharing was a common coping strategy adopted by households in Alaska and Zimbabwe.

Additionally, individuals change their food consumption patterns. Similarly, Pelto and Armar-Klemesu (2015) documented a shift toward consuming lower-quality foods that require less water for preparation. These changing food consumption patterns may have a significant impact on dietary diversity and overall food security. This is evident in the study by Miller et al. (2021), who showed that water insecurity increases the odds of a lower dietary diversity and that water insecurity is a major determinant of nutritional well-being.

Individuals have also resorted to sourcing water from more distant locations to cope with experiences of water insecurity. For instance, when primary water sources like boreholes are non-operational, individuals frequently choose to retrieve water from more distant sources. This coping strategy may also be adopted in pursuit of higher water quality or as a more cost-effective alternative. This method of coping with water insecurity is often detrimental, especially for women and girls, who are usually tasked with collecting water for their households. They are required to travel long distances while carrying heavy containers, which, according to the literature, can have adverse effects on their health, safety, and time (Achore et al., 2020; Ahile et al., 2015; Brewis et al., 2021).

Less adopted coping strategies by both groups of individuals include trading assets to buy water (MS=0.02 for men, MS=0.64 for women), and changing the location of the house (MS=0.14 for men, MS=0.16 for women). Assets traded include agricultural inputs and output, clothing, medicines (drugs), cooking fuel, jewelry, and small livestock like bush meat and poultry among others. Some studies however identified these strategies as commonly employed coping mechanisms for water insecurity (Eichelberger, 2018; Sangeda et al., 2013; Venkataramanan et al., 2020). Nonetheless, no individual resorted to illegal connections to public water networks, and only one individual (male) constructed a borehole.

Women have been identified as the primary water users and managers, and thus, they are more likely to use a wider range of coping strategies which could ultimately affect their health and well-being, For instance, women often fetch water from distant sources than men which places a physical burden on them to carry these water from the sources to their homes. To meet household domestic needs of cooking and hygiene, they are also more likely to borrow from neighbors and friends. The role in food preparation also results in changing food consumption in periods of water shortage. The caregiving roles in the household

often place them to prioritize the water use of others before themselves. As shown in the result, they often limit the quantity of water they consume to ensure water is available for others in the household, recycle water use, and use less preferred water and sanitation facilities. However, their limited access to financial resources is evident in the lower adoption of purchasing water storage facilities.

Table 3: *Coping Strategy Adopted by Men and Women to Manage Water Insecurity Experiences (n=100)*

Coping strategy	**Male mean score**	**Female mean score**	**Average mean score**
Water harvesting	1.86	2	1.93
Buying water from private vendors	1.42	1.5	1.46
Water use management such as limiting the size of water consumed	1.7	2	1.85
Water recycling or reuse	1.52	2	1.76
Reducing appropriate hygiene behaviors	1.72	1.60	1.66
Using less preferred water source	1.44	1.50	1.47
Purchasing or increasing water storage facilities	1.22	0.98	1.10
Water sharing and borrowing water from social networks	1.34	1.46	1.40
Changing food consumption	1.34	1.68	1.51
Fetching water from distant sources	1.04	1.62	1.33
Diversifying or changing water sources	1.58	1.46	1.52
Using less preferred sanitation facilities	1.48	1.64	1.56
Water treatment to improve the quality of available water	0.7	1.14	0.92
Buying water on credit	0.84	1.48	1.16
Trading assets to buy water	0.02	0.64	0.33
Changing the location of the house	0.14	0.16	0.15
Constructing alternative water sources like boreholes	0.02	0	0.01
Drinking beverages instead of water	1.3	1.48	1.39
Illegal connection to public water networks	0	0	0

3.4 Difference Between Male and Female Experiences of Individual Water Insecurity

A t-test was used to test the hypothesis that "there is no significant difference in the mean scores of water insecurity experiences between males and females. The result is presented in Table 4. The t-value was calculated using the independent sample t-test by estimating if there is a significant difference between the mean IWISE score of females and males. The t-value was computed using the formula:

$$t = \frac{\bar{X_1} - \bar{X_2}}{\sqrt{\frac{s_1^2}{n} + \frac{s_1^2}{n}}}$$

Where $\bar{X_1}\ and\ \bar{X_2}$ are means of males and females, respectively. S_1 and S_2 are the standard deviation of means for males and females, n_1 and n_2 are the number of male and female respondents, respectively. Based on this, the t-value is calculated thus:

$$t = \frac{19.54 - 22.08}{\sqrt{\frac{9.715^2}{50} + \frac{9.593^2}{50}}}$$

$$\frac{19.54 - 22.08}{\sqrt{\frac{94.381}{50} + \frac{92.025}{50}}} = \frac{-2.54}{\sqrt{1.888 + 1.841}} = \frac{-2.54}{\sqrt{3.729}} = \frac{-2.54}{1.931} = -1.315$$

The t-value is -1.3155. To determine the statistical significance of the t-value, it is compared to the p-value at a 5% probability level ($p \leq 0.05$). Since both samples are independent, the degree of freedom is

$df = n_1 + n_2 - 2 = 50 + 50 - 2 = 98.$

The p-value was determined statistically on Stata using the command:

$display\ 2 * ttail(df,\ abs\ (t_{value}))$ = *display 2 * ttail(98, 1.32)*

The p-value was 0.1899. At a probability level of 5%, since the p_value>t_value (0.1899>0.05), the study fails to reject the null hypothesis, thus implying that there is no significant difference between males' and females' experiences of water insecurity in the study area. Although this result is statistically insignificant, a larger sample size could result in significant results by increasing the statistical power. Similarly, Wutich (2009) submitted that despite the significant burden of water collection and provision on women, there was no significant difference between male and female experiences in water emergencies.

Table 4: *Test for Hypothesis*

IWISE scores	**Observation**	**Mean**	**Standard deviation**	**Standard error**	**t-value**
Male	50	19.54	9.715	1.3740	-1.315
Female	50	22.08	9.593	1.3567	

4.0 Conclusion

The problem of water insecurity is evident in Nsukka as evident in the IWISE score of 20.81, with the most prevalent experiences contributing to individual water insecurity as an interruption in water supply, frequent feelings of anger over the water situation, and frequent worrying about insufficient water for individual needs. Individuals have thus devised several coping mechanisms to address these experiences, such as diversifying water sources, harvesting water, purchasing water from private vendors, and water recycling. Based on these findings, the study recommends the following:

1. Some of the coping strategies individuals use to cope with water scarcity are trading assets to buy water and buying water on credit. This implies

that reducing water insecurity experiences involves some financial implications. Thus, the study recommends improving the affordability of water, especially for low-income individuals.

2. Advancing water infrastructure to ensure a consistent and reliable water supply in various areas of town, to ensure unhindered access to potable water. This would help reduce water fetching from distant sources.
3. Promoting community participation in water management by motivating individuals and households to collaborate on self-help water supply initiatives, such as pooling resources to drill boreholes for collective use. Constructing alternative water sources like boreholes was not a widely adopted coping strategy because of its high cost. However, community participation and contribution are encouraged to raise funds for implementing such projects.
4. The mean IWISE scores of females indicate that women have higher water insecurity experiences than men. Thus, it is important to identify the peculiarities in individual-level characteristics and how they affect water insecurity experiences to better design water-related projects that suit the needs of various individuals.

Most of the coping strategies adopted by households have a long-term adverse impact on individuals. For instance, purchasing water from private vendors or on credit or trading assets to buy water is unsustainable as individuals would potentially experience higher water insecurity in the absence of finance to make purchases or assets to trade. There is thus a need to evaluate the long-term impacts of coping strategies on water insecurity experiences. Future studies could explore how the adoption of rainwater harvesting or ownership of water storage devices as coping strategies could influence experiences of water insecurity across distinct dry and wet seasons.

5.0. Policy Implications

The study contributes to the deeply entrenched gender discourse of water by revealing the gender-specific water insecurity experience faced by both men and women. Although the mean IWISE scores indicate that women have a higher water insecurity experience than men, the t-test result shows no statistical significance in their mean experiences. This indicates that experiences of water insecurity experiences transcend beyond gender and that the pre-existing household and community conditions may override gender differences. This study thus challenges the assumption of examining water insecurity from a gender perspective and advocates for policy-making interventions aimed at addressing the structural and other socioeconomic causes of water insecurity to allow for equitable outcomes.

Conflicts of Interest

The authors declare no competing interests, financial or otherwise, in conducting the research and presenting the findings.

Ethical clearance

The research was conducted after proposal, review, and approval by the Departmental Board of Agricultural Economics, University of Nigeria Nsukka. Verbal consent was obtained from survey participants before administering the questionnaire during the survey. Anonymized responses were used to secure the personal information of respondents.

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