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Clients' knowledge, attitude and practices on hydration, presenting hydration status and pharmacist's intervention while requesting prescribed drugs

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ABSTRACT

This study examined the relationship between hydration status and prescription drug requests among clients attending a Pharmaceutical Care Clinic in Ikot Ekpene, Nigeria. A cross-sectional design involving 443 consenting adults utilized a three-part methodology: a structured questionnaire assessing knowledge, attitudes, and practices (KAP) related to hydration; oral interviews to collect medical and prescription histories; and laboratory analysis of hydration indicators. The questionnaire, based on modified validated tools, tested knowledge (maximum score = 27), attitude (Likert scale), and lifestyle practices, with categorization into poor, fair, or good knowledge and positive or negative attitudes. Daily fluid intake and 24-hour urine output were recorded over three days, alongside measurements of urine volume, weight, specific gravity, and osmolality. Blood osmolality was also assessed. Out of 443 approached, 380 respondents (56.1% female, mean age 49.5 ± 6.2 years) completed the study. Knowledge scores were fair overall, with significantly higher mean scores among males and those with higher educational attainment ($p<0.05$). Positive attitudes toward hydration correlated with younger age and tertiary education. Lifestyle practices revealed that males consumed more water post-meal and during the day ($p<0.05$), while older adults showed reduced water intake. Laboratory findings indicated a consistent gap between mean daily fluid intake (approx. 3.5 L) and urine output (approx. 2 L), with males exhibiting higher values. These gender- and education-linked differences in hydration behavior may have pharmacokinetic implications, particularly for renally-excreted drugs. Findings suggest a need for hydration-focused patient counseling in pharmacy settings to optimize therapeutic outcomes and minimize adverse drug events.

Keywords: Hydration status, dehydration, biopharmaceutics, drug disposition, lifestyle practices

Introduction

Water is essential to life as it plays a vital role in every biological system [1]. A scenario of inadequate water levels in humans may affect the biochemical and physiological activities at the cellular level manifesting with or without dysfunctions [2, 3]. Many diseases are characterized by water imbalances in the biological system. As diseases are approached with treatment options, the disposition of selected drugs is similarly affected by the hydration status of the individual and consequently the efficacy and safety [4]. There are limited reports on the assessment of the hydration statuses of clients or patients at the point-of-care prior to prescribing and dispensing of medications cum dosing formalities.

The effect of hydration status on individuals who are on medications has biopharmaceutics consideration as the solubility of drugs at different phases of transit is a key factor [5]. At the gastrointestinal luminal side, drugs are required to be in solution for absorption through the epithelium [6]. The available water in the gastrointestinal tract alongside the hydration status of the epithelial cells influences drug permeability across the cells into the portal [7]. Similarly, the movement of drugs in blood across the extracellular space reaching for the different tissues and into the intracellular compartment are function of water activity [8] receptors is via the solubilized-water based phase. Intestinal absorption occurs through passive permeation (paracellular or transcellular) or active uptake via intestinal transporters. All of these are dependent on the physicochemical properties of the drugs and the absorptive environment. Similarly, passage of drugs via blood to the extracellular and intracellular system is a dynamic function that correlates with the water activity and presence in the system [9].

Patients take drugs most commonly via the oral route but without sufficient recourse to their personal water consumption as a therapeutic factor. Some patients have illnesses that predispose them to dehydration or a hypohydrated status [10]. Several forms of dehydration have been reported in different cases. Isotonic water loss occurs when water and sodium ions are lost together in an individual whereas hypertonoic dehydration results when water loss exceeds sodium ions. Hypotonic dehydration results when the loss of sodium ions exceeds water loss as observed in cases with prolonged diuretic use [11]. Lifestyle practices influenced by socio-cultural beliefs may be responsible for a skewed drug disposition and clinic-toxicological effects with some medications. Other causes of dehydration include illnesses especially those related to symptoms such as diarrhea, vomiting, fever, increased sweating and urination. An infant can become severely dehydrated only after few hours of illness. This has been reported as the major cause of death in children globally [12].

Dehydration affects drug disposition in some predictable manner [13]. Water soluble drugs presents with higher plasma concentration and consequent toxicity. Similarly, the plasma concentration of fat soluble drugs increase due to higher total body fat. This study seeks to evaluate the KAP in patients about dehydration and evaluation of presenting hydration status of clients requesting for drug supplies in a community pharmacy.

Methods

Study protocols

This was a three-part study involving a pre-coded and self-administered questionnaire followed by an oral interview and laboratory determination of fluid intake and urine output hydration levels of respondents. The cross-sectional study focuses on knowledge, attitude and practice assessments of hydration/dehydration. The questionnaire was designed from modification of previous surveys [14] to test knowledge scores (9 enquiries) on definition, symptoms, causes and prevention of dehydration while the oral interview was to establish attitudinal association (6 enquiries) and lifestyle practices (6 enquiries) on fluid consumption in relation to clients' past/current medical concerns. The knowledge levels was categorized as poor, fair and good rated by scores of (<9.0), (9.0 - 18.0) and (>18.0), respectively, out of a maximum score of 27 points. The questions required a "Yes" or "No" answer and 3 point for each correct response. Attitude scores were similarly computed from responses to questions with scores based on respondents' agreement on a scale of numeric values 1 to 5 (using Likert scale with 5 for Strongly agree, 4 for Agree, 3 for Indifference, 2 for Disagree and 1 for Strongly disagree). Adjudging a negative or positive attitude on fluid intake was evaluated as <50% or >50%, respectively. The outcome of response in terms of knowledge scores and attitude scores were matched with the clerked/oral interview for past medical history cum presenting complaints.

Finally, laboratory assessment of daily fluid intake versus daily urine output volumes for 3 consecutive days was performed. Urine collection was total and collected into a 4L container from a particular hour of the day to same time the next day (i.e., 24 h). Respondents were asked if they missed any samples and responses noted. Missed urine samples were not factored into the computation as actual urine presented were measured and computed. The volume (L) of urine was measured with a 1L measuring cylinder while the weight (g) was measured with a weighing scale (Camry Mechanical co, USA). The urine density and urine specific gravity (USG) were computed as weight/volume (g/L). Furthermore, osmolality of the

urine samples was determined using freezing – point osmometer (OsmoPRO®MAX, Advanced Instrument Inc. Norwood, MA). Blood samples (2 mL) was taken from the median cubital veins of respondents into a plain sample bottle and subsequently analyzed. Blood osmolality was similarly performed using blood samples with the freezing – point osmometer. Physical observation of the clients were made during the discussions and noted accordingly. The drugs on the prescriptions were also noted and recorded. The duration of study was a period of 6 months (July to December, 2022).

Study area

This was a single-centered study conducted in a Pharmaceutical Care Clinic (PhCC) in Ikot-Ekpene, an urban area located in Akwa-Ibom State, Southern Nigeria. The historic city is the political and cultural capital of the Annang ethnic group in Nigeria. It lies in the coastal highway between Calabar and Aba. Ikot Ekpene covers an area of 45 square miles (116 km^2 with a projected population of 415,000.

Study population

The study population comprises of clients patronizing community pharmacies in the area.

Inclusion criteria

Every client above 18 years who were willing to participate was recruited into the study.

Exclusion criteria

Non-fluency in English language or Ibibio, the major spoken languages in the study area was basis of excluding possible respondents in this study.

Sampling method and sample size

Clients were approached as they called to fill their prescriptions. They were informed about the study and their consent sought in writing. Convenience sample method was adopted as everyone who met the criteria calling at the PhCC was eligible to participate in the study. Sample size was calculated using the formula

$$n = {Nz^2\delta^2}/{(N-1)e^2+z\,\delta^2} \quad \text{....(Equation 1).}$$

$$n = {415000\ x\ 1.96x\ 1.96\ x\ 10x10}/{(415000-1)1x0.1+1.9}$$

$$n = {398566}/{4150.48}$$

$$n = 384$$

15% calculated for attrition bring sample size to 443 clients

Where n=required sample size; z = z value at reliability or significant level 95% = 1.96; δ=standard deviation of the sample, 10; e = acceptable margin of error, 0.1.

Study protocols

The recruitment of respondents was spread over 6 months excluding Sundays. Recruitment and participation time each day were mornings (9:00 am to 12:00 pm) and evenings (2:00 pm to 6:00 pm). The questionnaires were collected immediately after completion and the oral interview commenced. A sample of blood was thereafter taken and labeled with the code on the questionnaire. The respondents were subsequently advised to take definite measurements and records of fluid intake and urine output for the following 3 days post recruitment. The respondents were requested to report for further instructions/counseling based on the outcome of hydration test.

Ethical approval

Ethical approval was received from University of Uyo Institutional Health Research Review Board

Data collection/analyses

Data collection and entry/collation were done by the principal researcher and 3 research assistants. This was entered into Microsoft excel spreadsheet, Windows 10.

Statistical analysis

Characteristics of respondents were summarized as frequencies and percentages while the continuous variables were presented as mean and standard deviation or standard error (as applicable). Data for the variables were tested for normal distribution using Kolmogorov-Smirnov test, and for plausibility and consistency. Data with normal distribution were proceeded with parametric test (T-test or analysis of variance (ANOVA) while non-parametric test employed Mann-Whitney – U test or Kruskal –Wallis test) as considered appropriate for differences within the variable group. Statistical significance was taken at the levels of 0.001 or 0.01 or 0.05 and indicated appropriately in parenthesis. The coefficient of variation was determined as SD/mean of values.

Results

A total of 443 (265 female, 178 male) clients were approached; (10.4%) did not agree to participate. The reasons for non-participation among the decline group were time factor (43.5%), blood sampling/bleeding inconveniences (41.3%) and personal (15.2%). A response rate of 65.8% 380/443 comprising of 380 respondents, female 213 (56.1%) and male 167 (43.9%), pulled through the study with an average monthly participation of 65. The mean age of the respondents was in 49.5±6.2 years. Table 1 presents the socio-demographics of the respondents.

Table 1: Socio-demographic characteristics of respondents and their perception of illness

Characteristics	Categories	N(%)
Gender	Male	167 (43.9)
	Female	213 (56.1)
Body weight (Kg)	Male	
	40 – 60	36 (9.5)
	61-80	56(14.7)
	81 and above	65(17.1)
	Female	
	40 – 60	89 (23.4)
	61-80	52(13.7)
	81 and above	72(18.9)
Age Group	18-30	142 (37.4)
	31-60	165 (43.4)
	61-above	73 (19.2)
Educational attainment	No formal	97 (25.5)
	Primary	115 (30.3)
	Secondary	137 (36.1)
	Post secondary	30 (7.9)
Marital status	Single	199 (52.4)
	Married	174 (45.8)
	Separated	7 (1.8)

Table 2 Knowledge scores for respondents

S/n	Mean knowledge score																	
	Gender			Age						Body weight				Educational level				
K	A	B	p-value	C	D	E	F	G	p-value	H	I	J	p-value	K	L	M	N	P-value
K1	2.52	2.25	0.078	2.63	2.42	1.89	2.57	2.47	0.068	2.28	2.29	2.52	9.079	2.01	1.83	2.19	2.43	0.043
K2	1.80	1.06	0.086	1.39	1.40	1.23	1.72	1.32	0.057	1.57	1.17	1.77	0.789	1.42	1.89	1.84	2.50	0.032
K3	1.98	1.30	0.081	2.51	1.60	1.52	1.37	0.90	0.078	1.61	2.36	1.59	0.579	0.84	2.24	2.45	2.30	0.052
K4	2.70	2.39	0.080	2.44	1.40	1.61	1.07	2.26	0.066	2.40	2.52	2.65	0.074	1.86	2.40	2.21	2.74	0.027
K5	1.08	1.04	0.079	1.56	1.69	2.29	1.07	0.82	0.690	1.66	1.30	1.31	0.068	1.33	2.56	2.65	2.90	0.023
K6	1.06	1.45	0.062	1.56	1.21	1.47	1.69	1.41	0.678	1.77	1.91	1.46	0.071	2.20	2.66	2.26	2.26	0.023
K7	1.45	1.55	0.012	1.53	1.77	1.32	1.60	1.41	0.678	1.67	1.51	1.44	0.068	2.44	2.61	2.43	2.60	0.034
K8	1.52	144	0.087	1.30	1.87	1.38	1.51	1.47	0.078	1.36	1.56	1.44	0.089	2.01	2.37	2.17	2.04	0.046
K9	2.66	2.63	0.067	1.59	1.50	1.86	2.31	2.30	0.064	1.24	2.85	1.16	0.076	1.86	2.35	2.06	2.52	0.029

- **Average scores per group have been computed**

QUESTIONS K1-K9 ; K1-Hydration status relates to the fluid in the body; K2-Fluid in the body affect the efficacy of drugs/; K3- Some symptoms are due to dehydration; K4-Some physical activities can cause dehydration; K5-Some drugs can cause severe dehydration; K6-Dehydration can cause drug toxicity; K7-Dehydration can cause hospitalization; K8-Dehydration can cause death; K9- Dehydration can be reversed

Gender (A is male; B is female); Age (C is <12-28; D is 29-38, E is 39-48, F is 49-58 and G is 59 years and above); Body weight (H is 40-60kg, I is 61-80kg, and J is 81 kg and above); Educational status (K is primary, L is secondary, M is tertiary and N is post-tertiary educational attainments)

Table 3 Attitude scores for respondents

S/N	MEAN KNOWLEDGE SCORE																	
	Gender			Age						Body weight				Educational level				
K	A	B	p-value	C	D	E	F	G	p-value	H	I	J	p value	K	L	M	N	P-value
K10	3.50	2.14	0.045	2.16	2.11	1.13	1.45	2.14	0.030	2.32	1.9	1.41	0.670	1.48	1.25	1.19	2.10	0.031
K11	2.11	1.94	0.078	2.31	2.49	2.07	1.48	2.34	0.022	1.73	1.4	2.62	0.510	2.98	2.59	2.49	2.25	0.025
K12	4.14	2.46	0.032	2.21	2.98	1.98	2.03	1.87	0.051	2.44	1.9	2.12	0.781	1.40	2.75	2.12	2.87	0.078
K13	2.16	3.16	0.025	2.49	3.10	1.84	2.45	1.35	0.050	2.41	2.1	1.85	0.678	2.25	1.90	2.47	2.12	0.068
K14	2.74	3.17	0.011	2.32	2.69	1.49	1.32	1.63	0.057	1.73	1.6	1.52	0.499	2.17	1.11	2.67	2.10	0.097
K15	2.13	3.41	0.140	2.12	2.95	1.42	1.69	1.49	0.075	1.31	2.4	2.63	0.673	1.10	2.32	2.19	2.35	0.019

- **Average scores per group have been computed**

K10- taking water after food is my practice; K11- taking water as I continue with my meal is my ideal practice; K12- After eating and before another meal, I drink water as a lifestyle; K13- I move along with water to drink throughout the day; K14 –I take water daily first thing in the morning; K15 –I am concerned and monitor the urine I void steadily

Gender (A is male; B is female); Age (C is <12-28; D is 29-38, E is 39-48, F is 49-58 and G is 59 years and above); Body weight (H is 40-60kg, I is 61-80kg, and J is 81 kg and above); Educational status (K is primary, L is secondary, M is tertiary and N is post-tertiary educational attainments)

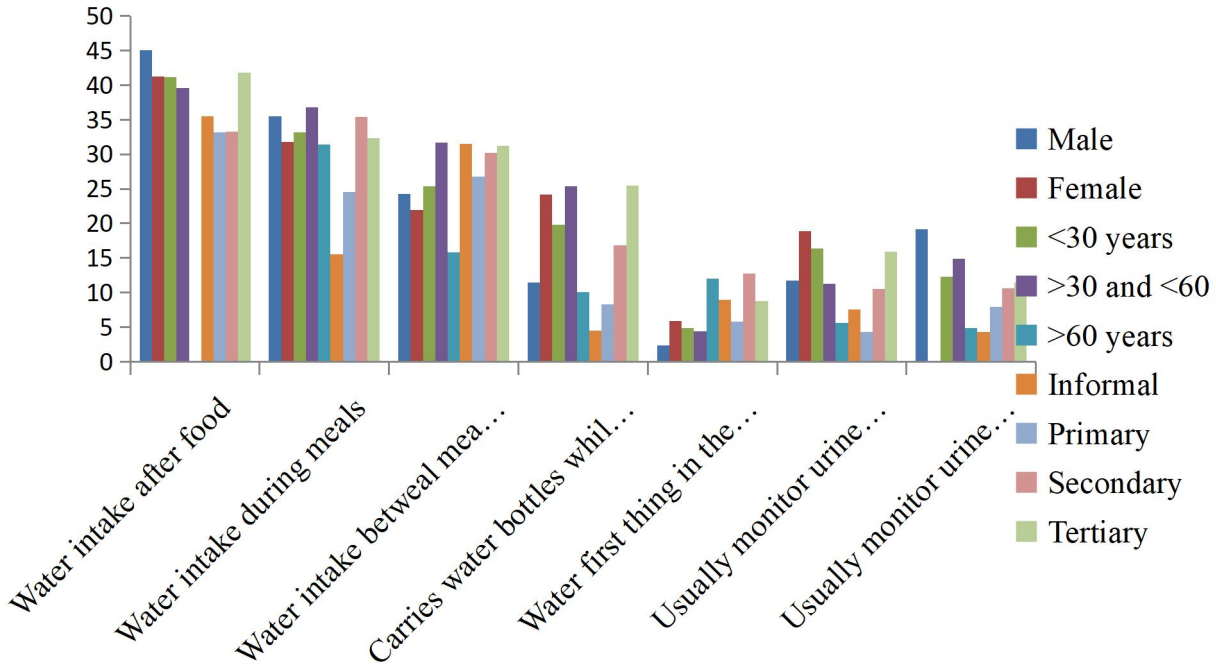


Figure 1: Lifestyle practices of respondents to water intake

The lifestyle practices as revealed in Figure 1 varied widely among the genders, age groups and educational levels. Significantly higher proportion of males take water after food than females as well as during meals alongside between meal times ($P<0.05$).The proportion of older population revealed lower water intake practices after food than the younger respondents ($P<0.05$). Similarly, respondents with tertiary level of education drink water after meals more than the lower levels of educational exposure.

The mean daily volume of fluid intake (water and other fluids)for all respondents was higher than the mean daily urine output ($P<0.05$). Similarly, the values of mean daily fluid intake and urine output for the respective genders showed significant higher values gender wise.

The figure 2 presents the mean daily fluid intake and urine output across three days among all participants, with gender-based comparisons. Overall, fluid intake averaged above 3.5 L/day for all participants, while urine output remained consistently lower, averaging just above 2 L/day. Male participants had higher mean fluid intake (approximately 4.2 L/day) and urine output (about 2.3 L/day) compared to females, who averaged around 3.2 L/day in intake and 1.6 L/day in output. This discrepancy suggests possible gender-related differences in hydration behavior, metabolism, or fluid retention. From a pharmacological standpoint, these variations can influence drug pharmacokinetics—especially for medications eliminated via the kidneys or those sensitive to hydration levels (e.g., NSAIDs, diuretics).

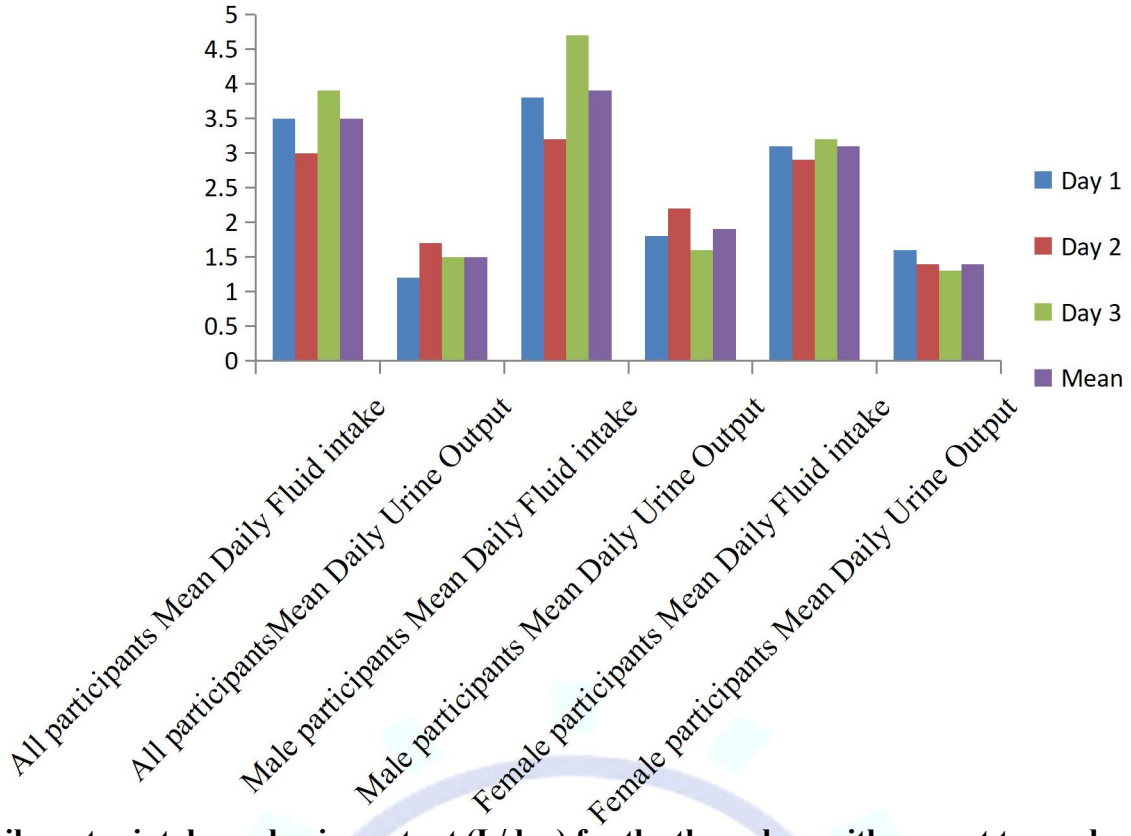


Figure 2: Daily water intake and urine output (L/day) for the three days with respect to gender

The figure 3 illustrates gender-based differences in symptoms reported by clients related to hydration status, with potential implications for drug use and pharmacokinetics. Overall, female clients reported a higher frequency of hydration-related symptoms such as dizziness/light-headedness (95%), dark/concentrated urine (75%), and dry mouth/lips/tongue (40%) compared to males. Males, however, reported more excessive urination (60%) and thirst (40%), which may suggest differences in fluid loss or compensatory intake.

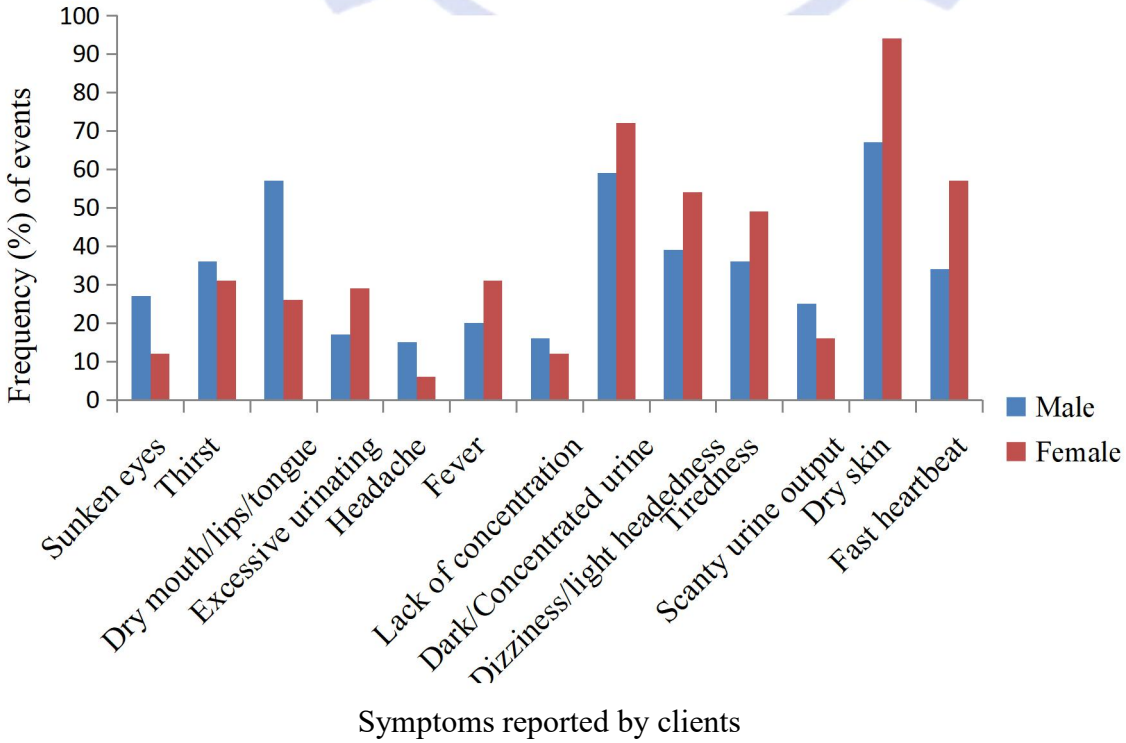
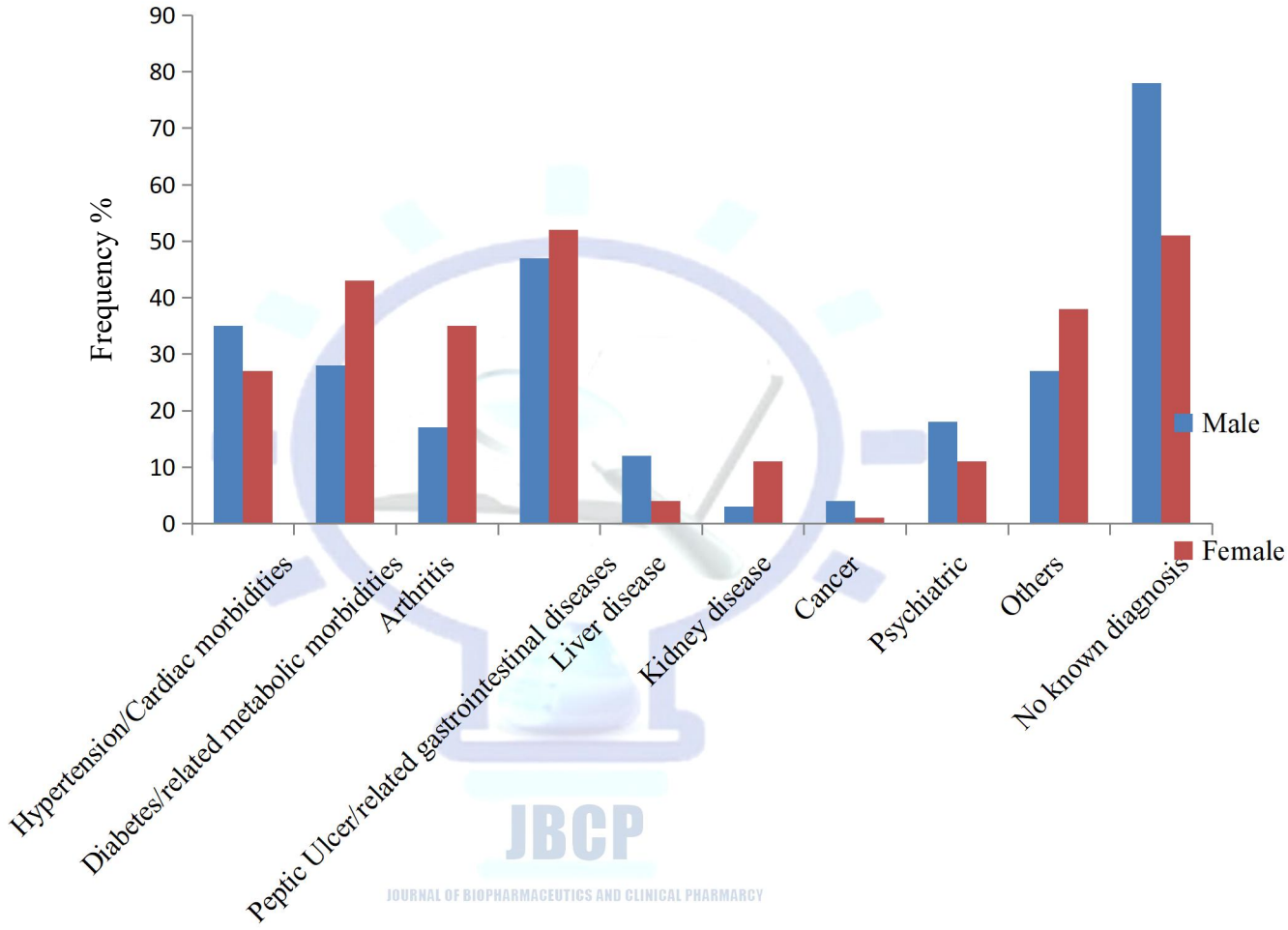


Figure 3: Frequency of occurrence of symptoms associated with dehydration among clients

Table 4: Mean daily osmolality (mOsm/Kg) for respondents

Days	Urine Osmolality (Mean ±SD mOsmol/Kg)			P-Value
	All respondents	Male	Female	
1	631±12	662±17	619±11	0.030
2	622±18	655±14	599±14	0.024
3	637±22	678±17	608±16	0.017
All samples	635±16	659±16	601±19	0.014

*Mann-Whitney test was employed to derive p-value for difference between genders



Diseases for which prescribed drugs are requested

Figure 4: Perceived/reported diagnosis for which drugs were prescribed

Discussion

In clinical pharmacy, understanding the principles of biopharmaceutics is essential for optimizing drug therapy outcomes. One often overlooked yet critical factor is the patient's hydration status. Hydration plays a pivotal role in drug absorption, distribution, metabolism, and excretion—processes collectively referred to as pharmacokinetics. Despite its relevance, the integration of hydration assessment into pharmaceutical care remains underemphasized, particularly in developing clinical settings. This study bridges that gap by evaluating the influence of hydration on drug therapy, specifically highlighting the implications of poor hydration on adverse drug events, especially in populations with limited access to health education and healthcare services.

Hydration status significantly affects biopharmaceutical processes. Proper hydration supports optimal blood flow and maintains renal function, both of which are vital for the metabolism and elimination of many medications. Drugs with narrow therapeutic windows or those reliant on renal clearance are especially sensitive to hydration status. Dehydration can lead to drug accumulation and toxicity, whereas overhydration can dilute drug concentrations, reducing efficacy. Recognizing the critical balance required, this study adopts a pharmaceutical care model that incorporates hydration assessment alongside the patient's medication profile, medical history, and presenting symptoms. This holistic approach is relatively novel in the study area, marking a progressive step in personalized medicine.

A systematic protocol was employed for sampling and data collection, enabling robust statistical analysis across demographic variables such as gender, age, and educational attainment. The findings revealed striking intra-individual and inter-group differences in hydration habits and knowledge. Notably, variations were observed in daily water intake levels, with educational status being a strong predictor. Formally educated individuals exhibited better hydration practices, suggesting a link between knowledge acquisition and health-promoting behaviors. These insights underline the importance of targeted health education campaigns to raise awareness about the role of hydration in medication effectiveness and overall wellness.

The study also evaluated the types of medications commonly used by participants, focusing on those that influence water elimination and thermoregulation. Amphetamines, frequently prescribed for attention deficit hyperactivity disorder (ADHD), were among the drugs identified. These substances can elevate core body temperature, increasing the risk of dehydration. Similarly, antidepressants, antipsychotics, antihistamines, beta-blockers, and anticholinergics interfere with the body's thermoregulatory mechanisms by impairing sweating or altering blood circulation. When hydration is inadequate, the pharmacodynamics of these drugs can shift, increasing the risk of side effects and reducing therapeutic benefits.

Alarmingly, the study revealed limited awareness among participants about the relationship between hydration and drug movement within the body. There was also poor recognition of dehydration as a potential cause of their current symptoms. Many participants reported complaints such as headache, fever, and fatigue—common signs of dehydration—yet failed to associate these symptoms with poor water intake. These misconceptions were more pronounced in female participants, who also reported a higher prevalence of the aforementioned symptoms. This disparity may reflect gender-based differences in health-seeking behaviors, biological susceptibility to dehydration, or social conditioning that influences daily water consumption.

Given these gender disparities, the study recommends the development of gender-specific education and intervention strategies to address hydration-related issues. Women, in particular, may benefit from targeted messaging that links hydration to symptom relief and improved drug outcomes. Similarly, clinicians are encouraged to assess hydration status when prescribing medications, especially those that are excreted renally or have a narrow therapeutic index. Providing hydration counseling during drug dispensing sessions could substantially reduce the risk of adverse drug events, particularly in vulnerable subgroups such as the elderly, the chronically ill, and those with limited health literacy.

The physiology of hydration is complex and influenced by multiple factors. Individual water requirements are not only determined by fluid intake but also by losses through respiration, sweating, and urination. Diet plays a crucial role as well, as certain foods contribute to fluid balance through their water content and osmotic properties. The kidneys, as the primary excretory organs, are central to maintaining hydration homeostasis. Any dysfunction in renal performance can disrupt drug clearance, leading to altered plasma drug levels and associated complications. Therefore, evaluating hydration from a physiological and pharmacological perspective is crucial in pharmaceutical care.

This study further measured 24-hour urine osmolality as an objective indicator of hydration status. Osmolality reflects the concentration of solutes in urine, serving as a reliable marker for body water balance and renal concentrating ability. Findings showed that females had significantly lower mean 24-hour urine osmolality values compared to males, aligning with the work of Perrier et al. (2015). However, the mean values for both genders exceeded

the recommended ideal of 500 mOsm/kg, indicating suboptimal hydration. These results underscore the need for hydration education and behavioral interventions, particularly in populations with inadequate water intake habits.

Lifestyle factors also emerged as key determinants of hydration. The study observed poor attitudes toward water consumption across the board, with many participants failing to meet daily recommended intake levels. Males had slightly better hydration profiles, possibly due to greater engagement in physically demanding tasks that necessitate increased fluid consumption. This aligns with the findings of Duan et al. (2022), who reported a similar gender-based trend and advocated for widespread health education to improve hydration behavior. Importantly, the implications of poor hydration go beyond comfort and performance; they directly affect the pharmacokinetics and dynamics of medications.

Hypohydration—a state of underhydration—can lead to increased plasma concentration of drugs, altered distribution volumes, and impaired renal clearance. These changes can significantly affect therapeutic outcomes, especially for medications that are dose-sensitive or require consistent plasma levels. For instance, in males experiencing high fluid loss without adequate replacement, the pharmacologic behavior of drugs may differ from that in females, leading to gender-specific variability in drug response. Thus, hydration status should be a routine consideration in therapeutic planning and patient counseling.

Moreover, urine osmolality as a measure of hydration provides insight into both behavioral and neuroendocrine responses of the body. The values recorded in this study fell within the established physiological range of 500–1200 mOsm/kg, yet still pointed to a prevalent trend of inadequate fluid intake. Maintaining osmolality below 500 mOsm/kg is ideal for facilitating solute excretion and minimizing kidney strain. Consistent values above this threshold suggest chronic underhydration, which not only affects drug disposition but may also contribute to long-term renal complications.

Finally, the integration of biopharmaceutics and hydration science within clinical pharmacy practice is both necessary and urgent. This study highlights the underappreciated role of hydration in drug therapy outcomes and calls for a paradigm shift toward more holistic pharmaceutical care. By incorporating hydration status into patient assessments, clinicians can reduce the risk of adverse drug reactions, enhance therapeutic efficacy, and promote overall health. Educational initiatives tailored by gender, age, and educational level can further support this goal. Ultimately, the intersection of hydration and pharmacotherapy represents a promising frontier in patient-centered care.

Conclusion

A fair knowledge of hydration status was observed in the surveyed population of the clientele in the PhCC. Poor knowledge was more marked in females, persons with informal training. Complications of dehydrations were also more marked in the males and the lower age groups.

There is the need to promote a culture of fluid intake and assess hydration statuses of clients calling at community pharmacies especially those requesting drugs that may aggravate the condition.

Ethical Consideration

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request. All data supporting the findings of this study have been included within the article and its supplementary materials where applicable.

Conflict of interest

The authors declare no conflict of interest related to the publication of this manuscript.

Compliance with ethical guidelines

This study was conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval was obtained from the appropriate ethics review board, and informed consent was obtained from all individual participants involved in the study.

Authors' contributions

SOA conceptualized and designed the study, supervised data collection, and contributed to manuscript writing. MPO and JIA conducted the data analysis and interpreted the results. MIA assisted with data collection, reviewed the manuscript, and provided critical revisions. All authors read and approved the final manuscript.

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References

1. Falkenmark M. Water resilience and human life support-global outlook for the next century. International Journal of Water Resources Development, 2020; 36(2-3): 377-396.
2. Popkin BM, D'Anci KE, Rosenberg IH. Water,

hydration. and health. Nutrition Reviews, 2010;68(8):439–58.
3. Miya YY, Baba MU, El-Tahir MY, Rabiu I, Mukkaram AM. Effect of inadequate supply to the community with reference to Gidan Kwano in Niger State: a descriptive analysis. International Journal of Advanced Academic Research, 2020; 6(10): 108-119,
4. López Oliva S, Morais-Moreno C, Carretero-Krug A, Samaniego-Vaesken MdL, López-Sobaler AM, Partearroyo T, Puga AM. Drug Consumption and Hydration Status: Analysis of the Associations in an Elder Population. *Nutrients*. 2024; 16(16):2632. doi.org/10.3390/nu16162632
5. Puga AM, Lopez-Oliva S, Trives C, Partearroyo T, Varela-Moreiras G. Effects of Drugs and Excipients on Hydration Status. Nutrients. 2019;11(3):669. doi: 10.3390/nu11030669. PMID: 30897748; PMCID: PMC6470661.
6. Azman M, Sabri AH, Anjani QK, Mustaffa MF, Hamid KA. Intestinal Absorption Study: Challenges and Absorption Enhancement Strategies in Improving Oral Drug Delivery. Pharmaceuticals (Basel). 2022 Aug 8;15(8):975. doi: 10.3390/ph15080975.
7. Thiagarajah J, Verkman A. Water Transport in the Gastrointestinal Tract.2018; 6th ed. 1249-1272 Doi.org/10.1016/B978-0-12-809954-4.00055-4.
8. Stillhart C, Vuclceric K, Augustijns P, Basit AW, Batchelor H, Flanagram TR. Impact of gastrointestinal physiology on drug absorption in special population-An UNGAP review. European Journal of Pharmaceutical Sciences, 2020; 147(0. Doi.org/10.1016/j.ejps.2020-105280
9. Nichols PE, Jonnalagadda SS, Rosenbloom CA, Trinkaus M. Knowledge, attitudes, and behaviors regarding hydration and fluid replacement of collegiate athletes. International Journal of Sport Nutrition and Exercise Metabolism, 2005;15(5):515–27.
10. El-Sharkawy AM, Sahota O, Lobo DN. Acute and chronic effects of hydration status on health. Nutrition Reviews, 2015; 73(Suppl 2):97–109.
11. Ahmed SH, Badiani A, Miczek KA, Müller CP. Non-pharmacological factors that determine drug use and addiction,Neuroscience and Biobehavioral Reviews,2020; 110(1):3-27, doi.org/10.1016/j.neubiorev.2018.08.015.
12. Vega RM, Avva U. Pediatric Dehydration. [Updated 2022 Aug 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022.
13. Hooper L, Bunn D, Jimoh FO, Fairweather-Tait SJ. Water-loss dehydration and aging. Mechanisms of Ageing and Development, 2014;136-137:50-8. doi: 10.1016/j.mad.2013.11.009.
14. McDermott BP, Zhao X, Veilleux JC. Association of Knowledge and Health Habits with Physiological Hydration Status. Nutrients. 2024 May 21;16(11):1541. doi: 10.3390/nu16111541. Hydration knowledge is not related to hydration status
15. Murray B. Hydration and physical performance. Journal of American College of Nutrition, 2007;26(5 Suppl):542S–8S.
16. Bruno C, Collier A, Holyday M, Lambert K. Interventions to Improve Hydration in Older Adults: A Systematic Review and Meta-Analysis. Nutrients. 2021 Oct 18;13(10):3640. doi: 10.3390/nu13103640.
17. Armstrong LE, Johnson EC. Water Intake, Water Balance, and the Elusive Daily Water Requirement. Nutrients. 2018 Dec 5;10(12):1928. doi: 10.3390/nu10121928.
18. Perrier ET, Buendia-Jimenez I, Vecchio M, Armstrong LE, Tack I, Klein A. Twenty-four-hour urine osmolality as a physiological index of adequate water intake. Dis Markers. 2015;2015:231063. doi: 10.1155/2015/231063.
19. Duan Y, Wu R, Ji H, Chen X, Xu J, Chen Y, Sun M, Pan Y, Zhou L. Drinking water behavior and willingness to use filters by middle-aged and elderly residents in rural areas: A cross-sectional study in Tengchong, China. Front Public Health, 2022;10:961870. doi: 10.3389/fpubh.2022.961870.
20. Ibeh, CC, Emelumadu FO, Chigozie I, Umeh MJ, Onah CE, Mbanuzuru AV, Ogbuagu A, Ezenyeak C, Ajator C, Jisieike–Onuigbo N, Obi D, Okonkwo K. Comparative assessment of fluid intake of sedentary and manual workers in Anambra State, Southeast Nigeria. Journal of Public Health and Epidemiology, 2021; 13(3), 168-175.