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Prevalence and Associated Risk Factors of Dehydration among Pregnant Women in Southern Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Despite available evidences that pregnant women are specific vulnerable target population for dehydration and the importance of adequate hydration to both the mother and the developing fetus, studies assessing the prevalence and associated risk factors of dehydration among pregnant women are limited.
Aim: The aim of the present study was to determine the prevalence and associated risk factors of dehydration among pregnant women in Uyo metropolis, Southern Nigeria.
Methods: A total of 316 pregnant women from selected obstetric centers in Uyo Metropolis met the inclusion criteria and were evaluated for socio-demographics, lifestyle-related behaviors and urinary specific gravity using standard instruments. Mean values were calculated and used for the determination of the hydration status of the participants. Univariate analysis was used to assess the relationship between socio-demographic variables and lifestyle related behaviours and prevalence of dehydration. Multiple logistic regression analysis was used to determine odds ratios (ORs) and 95% confidence interval for factors associated with dehydration in pregnancy.

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Results: About 14.6% of the pregnant women were dehydrated, and factors associated with high prevalence of dehydration were age between 26 and 35 years, being married, urban residence, acquiring a tertiary education and income between 20,000 and 50,000 naira. Others were, null-parity, third trimester of pregnancy, physically active, poor dietary habits, alcohol consumption, inadequate water intake and short sleep duration. Inadequate water intake (1-2 cups of water) (OR=6.10,C.I=2.029-18.360) or 5-7cups of water (OR=4.04,C.I=1.385-11.785), consumption of mostly high carbohydrate diets (OR=3.55,C.I=1.003-12577), consumption of mostly high protein diets (OR=3.25,C.I=1.893-11.844) and craving for strange foods(OR=3.71, C.I=1.563-8.81) significantly increased the odds for dehydration among the participants.
Conclusion: Demographic, obstetric and lifestyle-related factors drive the high prevalence of dehydration among pregnant women and should be considered in designing intervention programs to prevent dehydration among pregnant women in our communities.

Keywords: Dehydration; pregnant women; risk factors; lifestyle; demographics.

1. INTRODUCTION

Water plays a significant role in virtually all aspects of human life including pregnancy and pregnancy outcomes. When the body's demand for water is more than supply, a state of fluid deficit (dehydration) ensues, and leading to derangement in several physiological processes [1]. Fluid balance studies in pregnancy indicate that extra fluid is required to meet the increasing demand by the mother (due to several physiological changes) and the fetus (for fetal growth and development) [2]. Apart from the water contained in the placenta and amniotic fluid, there is a considerable retention of water in the maternal tissues, both in the extracellular and intracellular fluid compartments. Interestingly, this extensive water retention occurs in the face of increased water loss due to several physiological and metabolic activities associated with pregnancy. For instance, ventilation increased by 40%/min, tidal volume increased by 39%/min, water loss through expiration and sweating increased by 500 ml/day greater than the pre-pregnant level due to increase activities of thyroid and adrenal glands [3], while vomiting and salivation may be excessive during the first and second trimesters [4]. It is reported that the total body water increased by 6-8 liters and plasma osmolality decreased by 10 mosm/kg below the non-pregnant level. There is decreased thirst threshold and vasopressin release during first trimester [5,6]. Hemodynamic adjustments during the first and second trimester may remain normal around the new set point, however, during the third trimester, the regulation may be more vulnerable and may lead to poor fluid balance and derange endocrine activities. Also, excretion of fluid is decreased [7] and the response of anti-diuretic hormone (ADH) to increase osmolality is also decreased [8]. Increase renal perfusion and glomerular filtration become necessary to enhance excretion of extra waste products. The increased metabolic activities led to increase cutaneous circulation and respiratory rate. The resultant increase in evaporation of water if not adequately replaced could result in severe dehydration. There are also increased nutrients and energy requirements and a concomitant increase water requirement. There are also several changes in endocrine system during pregnancy that increased the vulnerability of pregnant women to fluid and electrolyte deficit including increased release of prolactin and aldosterone [3] and decreased vasopressin release. Indeed, pregnancy is a period of increase fluid demand in the face of increased fluid and electrolyte loss which creates a state of negative fluid balance which if not met leads to dehydration and associated maternal and fetal complications. Even so, studies examining the fluid intake of pregnant women in several other countries including United States of America, New-Zealand and Indonesia [9,10,11] found that a significant proportion of pregnant women don't drink enough water and are exposed to several other risk factors of dehydration as in the general population. Identifying these risk factors is of utmost importance in designing intervention to improve the hydration status of pregnant women in our communities because current risk factor eventually manifests as disease and public heath burden. Knowledge of risk factors can then be applied to shift their population distribution. Therefore, the aim of the present study was to assess the prevalence and associated risk factors of dehydration among pregnant women in Uyo Metropolis, Southern Nigeria which has not been documented.

2. SUBJECTS AND METHODS

Of the initial 436 pregnant women recruited from selected obstetric centers in Uyo Metropolis, Akwa Ibom State, Southern Nigeria, 316 met the inclusion criteria and participated in the survey which took place between November, 2019 and February 2020. Exclusion criteria were decline participation, inappropriate completion of questionnaire, mental impairment, inappropriate age (<18 years or >45 years), co-existing chronic ailment such as diabetes mellitus, heart failure diabetic insipidus, diuretic therapy and other drugs known to affect the hemodynamic status of participants.

Participation was voluntary and withdrawal from the study was allowed at any stage of the survey. Written informed consent was obtained from all participants and study protocols were approved by the Institutional Research and Ethics Committee.

This study was conducted according to the guidelines laid down in the declaration of Helsinki of 1975, as revised in 2000 for the conduct of human experiment.

2.1 Assessment of Measures

A three-section, semi-structured self-administered questionnaire was used to obtain information from the participants. The questionnaire was adapted from previous studies that assessed the hydration status of pregnant women and associated risk factors [12,3,4,11]. However, few modifications were made to suite the hypothesis of the present study.

For the purpose of this study, dehydration was defined as urinary specific gravity (USG) > 1.020 while euhydration was defined as USG < 1.020 based on the diagnostic criteria as recommended by the Australian Pathology Association.

The first part of the questionnaire asked questions about participants' socio-demographic profile such as age (yrs), marital status, ethnicity, area of residence, educational status, employment status, number of children, family size and household income/month.

The second part of the questionnaire assessed the past and present obstetric history (family size, parity, gravidarity and age of the present pregnancy in weeks. Lifestyle characteristics of the participants were also assessed including smoking habit, physical activity status (type of exercise and duration of exercise per day), sleeping habit, dietary habit (frequency of food consumption, eating at fast foods, frequency fruits and vegetable consumption, urge to eat strange foods, coffee consumption, energy drink, alcohol intake, soft drink consumption and water intake (no. of cups and frequency/day).

The age of the participants was stratified into 18-25, 26-35, 36-45 and >45 years.

Marital status was sub-divided into single and married. Dietary habit was assessed by a 24hr dietary recall and classified into good and poor dietary habits. High frequency of macronutrients consumption, fast food, low fruits and vegetable intake, restaurant patronage was defined as poor dietary habits while a balance diet consumed 2-3 times/day including large intake of fruits and vegetable was regarded as good dietary habit.

Cigarette smoking habit was assessed by asking the participants whether they do smoke or not. Those that replied affirmatively were further asked how often they smoke? hence they were stratified into smokers and non-smokers. Alcohol drinking habit of the participants was assessed by asking whether they do drink alcohol or not. Based on their responses, they were grouped into drinkers and non-drinkers.

Physically activity was assessed based on the US healthy people 2010 physical activity standards which recommended 150 minutes of moderate to high intensity aerobic activity per week in bouts of 10 minutes or more for adults aged 18 to 64 years using this scale. Respondents were classified into physical active and physically inactive. Consumption of energy drinks and coffee were stratified into user and non-users.

Participants were asked to state their daily water and other fluid intake in terms of quantity and frequency of consumption. They were also asked to state the number of cups of water they drink each day. Based on the number of cups and frequency, The consumption of less than 12 cups of water per day or less than 3 times/24h was defined as inadequate water intake, while consumption of >12 cups/24h or equal to or >4 times was defined as adequate water intake.

2.2 Assessment of Hydration Status

Early morning urine samples were collected from the participants for measurement of the urine specific gravity (USG) using combi 10 diagnostic test strips. This was done on two consecutive days and the mean value was calculated and used to determine the hydration status of the participants. USG is a valid, reliable, convenience widely accepted indicator of hydration status in most cases and strongly correlates with changes in other physiochemical properties of the urine. Contamination of urine sample was avoided by the use of one urine strip per urine sample.

Euhydration was defined as USG < 1.020 while dehydration was defined as UGS > 1.020.

2.3 Statistical Analysis

The socio-demographic variables and lifestyle habits of participants were analyzed using frequencies and simple percentages. Relationship between categorical variables was tested using Chi-square test. Multiple logistic regression analysis was used to test for any association between lifestyle habits and risk of dehydration. Based on this model, odds ratio (OR) and 95% confidence interval (CI) were computed. Statistical computations were performed using Statistical Package for Social Sciences (SPSS) version 22.0.

3. RESULTS

Of the 436 pregnant women initially recruited to participate in this study, 316 met the inclusion criteria to participate giving a response rate of 72.5%. The socio-demographic variables of the 316 participants revealed that 3.4% were between the ages of 18 and 25 years while 69.0%, 7.6% were between the ages of 26-35 and 36-45 respectively. Two point eight percent were singles while 97.2% were married. Sixty one point four percent were of Ibibio ethnicity, 13.0% were Annang and 19.6% were Igbos. Two point eight percent (2.8%), 34.5% and 62.7% had primary, secondary and tertiary level of education respectively. Employment status of participants showed that 27.5% were unemployed while 22.2% were employed and 50.3% were self employed. Distributions of income level among participants were as follows; 15.2% had income level of 1000-20,000, 50.6% had income level of 20,000-50,000 and 34.2% of the participants had income level of >50,000. Twenty nine point seven percent (29.7%), 36.1%, 32.3% and 1.9% had family size 1, 2, 3 and 4 respectively (Table 1).

Table 2 shows the distribution of hydration status based on past and present obstetric history. The prevalence of dehydration was higher among the primi-gravidae, those who had no miscarriage and were in their third trimester of pregnancy. However, significant relationship was found only in the duration of current pregnancy (P<0.05).

Life style habits that showed significant relationship with dehydration were; duration of exercise (P<0.000), frequency of eating (P<0.002), urge to eat strange foods (P<0.007), frequency of energy/soft drink consumption (P<0.048) and quantity of water (number of cups of water) consumed per day (P<0.008) (Table 3).

Table 4 shows the distribution of the symptoms associated with dehydration among dehydrated pregnant women including urinary frequency of 4-6 times per day, sweat occasionally (65.2%), defecate 3-4 times per day (43.5%) and those who had recurrent diarrhea (13.0%). Others include positive past history of urinary tract infection (14.9%) and dry mouth (19.6%).Recurrent vomiting in 23.9% of the participants while majority of the participants (43.5%) described their environment as usually very hot.

The physiochemical properties of participants' urine showed a significant difference (0.0000) in urinary pH with dehydrated participants having a significantly lower pH than the hydrated participants (5.80±0.59 versus 6.18+0.66). However, the USG of the participants' urine showed no significant difference between the dehydrated and the hydrated participants (Table 5).

Result of multiple logistic regression shows that physical activity (OR=2.03, C.I=1.179-22.953), consumption of mostly high carbohydrate containing foods (yam, rice, fufu,) (OR=3.55, C.I=1.003-12.577) and consumption of high protein containing foods (meat, beans and milk) (OR =3.25, C.I=1.893-11.844) were associated with higher odds for dehydration. Results also revealed that eating of strange foods (OR =3.71, C.I =1.563-8.81) and drinking of 2-4 cups of water (OR=6.10, C.I=2.029-18.360) or 5-7 cups of water (OR=4.04, C.I=1.385-11.785) significantly increased the odds for dehydration among participants (Table 6).

Table 1. Socio-demographic variables of the participants

Socio demographic variables	Dehydrate (n=46) 14.6%	Non-dehydrated (n=270) 84.4%	Total (n=316) 100%
Age(years)			
18-25	8(17.4)	66(24.4)	74(23.4)
26-35	33(71.7)	185(68.5)	218(69.0)
36-45	5(10.9)	19(7.0)	24(7.6)
Marital Status			
Single	8(3.0)	1(2.2)	9(2.8)
Married	26(97.0)	45(97.8)	307(97.2)
Ethnicity			
Ibibio	27(58.7)	167(61.9)	194(61.4)
Anang	8(17.4)	33(12.2)	41(13.0)
Ibo	8(17.4)	54(20.0)	(62(19.6))
Area of Residence			
Urban area	31(67.4)	202(74.8)	233(73.7)
Rural area	15(32.6)	68(25.2)	83(26.3)
Educational Status			
Primary school	1(2.2)	8(3.0)	9(2.8)
Secondary	9(19.6)	100(37.0)	109(34.5)
Tertiary	36(78.3)	162(60.0)	198(62.7)
Employment Status			
Unemployed	9(19.6)	78(28.9)	87(27.5)
Employed	20(43.5)	50(18.5)	70(22.2)
Self employed	17(37.0)	142(52.6)	159(50.3)
Income Level(Naira)			
10,000-20,000/month	5(10.9)	43(15.9)	48(15.2)
21,000-50,000	26(56.5)	134(49.6)	160(50.6)
>50,000	15(32.6)	93(34.4)	108(34.2)
Family Size			
1	15(32.6)	79(28.3)	94(29.7)
2	17(37.0)	97(35.9)	114(36.1)
3	14(30.4)	88(32.6)	102(32.3)
4	0(0.0)	6(2.2)	6(1.9)

Table 2. Association between obstetric history and prevalence of dehydration among participants

	Dehydrate (n =46)	Non-dehydrated (n =270)	Total	χ^2	P-value
Parity					
None	21(45.7)	119(44.1)	140(44.3)	4.516	0.341
1	13(28.3)	84(31.1)	97(30.7)		
2	8(17.4)	54(20.0)	62(19.6)		
3	4(8.7)	8(3.0)	12(3.8)		
4	0(0.0)	5(1.9)	5(1.6)		
Number of miscarriage					
None	37(80.4)	227(84.1)	264(83.5)	0.402	0.818
1	4(8.7)	18(6.7)	22(7.0)		
2	5(10.9)	25(9.3)	30(9.5)		
Age of the current pregnancy(wks)					
1-13	10(21.7)	21(7.8)	31(9.8)	10.610	0.014*
14-26	12(26.1)	109(40.4)	121(38.3)		
27-39	24(52.2)	136(50.4)	160(50.6)		
>39	0(0.0)	4(1.5)	4(1.3)		
Gravidae					
1	21(45.7)	119(44.1)	140(44.3)	4.665	0.460
2	13(28.3)	84(31.1)	97(30.7)		
3	8(17.4)	53(19.6)	61(19.3)		
4	4(8.7)	8(3.0)	12(3.8)		
5	0(0.0)	5(1.9)	5(1.6)		
6	0(0.0)	1(0.4)	1(0.3)		

**Significant at 5% (P<0.05)*

Table 3. Prevalence of dehydration based on life style habits of participants

	Dehydrated (n=46)	Non-dehydrated (270)	Total (n=316)	χ^2	P-value
Smoking					
Yes	1(2.2)	1(0.4)	2(0.6)	2.03	0.154
No	45 (97.8)	269(99.6)	314(99.4)		
Physical Active					
Yes	42(91.3)	254(94.1)	296(93.7)	0.509	0.476
No	4(8.7)	16(5.9)	201(6.3)		

	Dehydrated (n=46)	Non-dehydrated (270)	Total (n=316)	χ^2	P-value
Type of exercise					
Walking	39(39.2)	219(86.2)	258(87.2)	2.472	0.480
Cycling	1(2.4)	6(2.4)	7(2.4)		
Jogging	0(0.0)	13(5.1)	13(4.4)		
Prenatal Yoga	2(4.8)	0(0.0)	18(6.1)		
Duration of each episode of exercise					
5-10 mins	17(40.5)	99(39.0)	116(39.2)	16.574	0.000**
11-15 mins	8(19.0)	61(24.0)	69(23.3)		
16-20 mins	3(7.1)	53(20.9)	56(18.9)		
21-30 mins	4(9.5)	25(9.8)	29(9.8)		
>30 mins	10(23.8)	16(6.3)	26(8.8)		
Frequency of Eating					
1-2 times	6(13.0)	89(33.0)	95(30.1)	12.80	0.002**
3-4 time	25(54.3)	142(52.6)	167(52.8)		
>4 times	15(32.6)	39(14.4)	54(17.1)		
Most consumed food					
Yam, Rice Fufu, Eba	23(50.0)	136(50.4)	159(50.3)	0.495	0.781
Meat, Beans, Milk	16(34.8)	83(30.7)	99(31.3)		
Fruits and vegetables	7(15.2)	51(18.9)	58(18.4)		
Fast food/Restaurant patronage					
Daily	21(45.7)	146(54.1)	167(52.8)	1.137	0.566
Weekly	9(19.6)	43(15.9)	52(16.5)		
Monthly	16(34.8)	81(30.0)	97(30.7)		
Frequency of fruits and vegetables consumption					
Daily	24(52.2)	179(63.3)	203(64.2)		
Weekly	19(41.3)	83(30.7)	102(32.3)	4.00	0.135
Monthly	3(6.5)	8(3.0)	11(3.5)		
Craving for strange foods					
Yes	20(43.5)	66(24.2)	86(27.2)	7.188	0.007**
No	26(56.5)	204(75.6)	230(72.8)		
Coffee Consumption					
Yes	2(4.3)	10(3.7)	12(3.8)	0.045	0.833
No	44(95.7)	260(96.3)	304(962)		
Frequency of coffee consumption					
Daily	0(0.0)	5(50.0)	5(41.7)	1.800	0.407
Weekly	1(50.0)	3(30.0)	4(33.3)		
Monthly	1(50.0)	2(20.0)	3(25.0)		

	Dehydrated (n=46)	Non-dehydrated (270)	Total (n=316)	χ^2	P-value
Last time Coffee was taken					
24hrs ago	1(50.0)	8(80.0)	9(75.0)	2.301	0.5612
2-1 days ago	1(50.0)	2(20.0)	3(25.0)		
Energy/ Soft drink consumption					
Yes	35(76.1)	20(74.4)	236(74.7)	0.056	0.813
No	11(23.9)	69(25.6)	80(25.3)		
Frequency of energy/soft drink consumption					
Daily	20(43.5)	78(28.9)	98(31.0)	3.91	0.048*
Weekly	26(56.5)	192(71.1)	218(69.0)		
Regular adding of salt to meals at the table					
Yes	3(6.5)	38(14.1)	41(13.0)	1.99	0.159
No	43(93.5)	232(85.9)	275(87.0)		
Alcohol consumption					
Yes	26(56.5)	130(48.1)	156(49.4)	1.103	0.294
No	20(43.5)	140(51.9)	160(50.6)		
Last consumption of alcohol beverages					
24hrs ago	0(0.0)	6(4.6)	6(3.8)	6.57	0.087
2-7 days ago	5(19.2)	12(9.2)	17(10.9)		
1 months ago	7(26.9)	18(13.8)	25(16.0)		
≥ 6 months	14(53.8)	94(72.3)	108(69.2)		
Water consumption per day(no. of cups)					
2-4 cups	18(39.1)	65(24.1)	83(26.3)	9.670	0.008**
5-7 cups	20(43.5)	96(35.6)	116(36.7)		
≥ 8 cups	8(17.4)	109(40.4)	117(37.0)		
Sleep duration per night (hour)					
1-2	1(2.2)	30(11.1)	31(9.8)	3.944	0.268
3-4	8(17.4)	49(18.1)	57(18.0)		
5-6	26(56.5)	127(47.0)	153(48.4)		
≥ **7**	11(23.9)	64(23.7)	75(23.7)		

***Significant at 1% (P<0.01)*

4. DISCUSSION

It is a known fact that pregnant women are vulnerable target population for dehydration and associated complications [11], yet studies to evaluate the prevalence and associated risk factors of dehydration among pregnant women are limited.

In this cross-sectional study, the prevalence of dehydration among pregnant women was 14.6%. This value is lower than the reported prevalence rates in some countries outside Nigeria. For instance, a similar study in Greece carried out by Malisova et al. [13] found that 34% of the pregnant women were dehydrated. Likewise a study carried out by Mulyani et al. [4] in seven areas of Kebon Jeruk public Health Center reported that 51.5% of pregnant women were dehydrated. In an earlier study, Pieters et al. [12] reported a lower prevalence rate of dehydration (11.8%) among young pregnant women in Hawally, Kuwait. Several factors contribute to the observed differences in the prevalence rates of dehydration among pregnant women across studies including differences in socio-demographic profiles of the participants (age, race, ethnicity, education level, employment status, area of residence, income level, obstetric profile, lifestyle habits, study design, methodo-logical differences and definition of dehydration using different recommended standards or cut off points for assessing hydration status. Others include variation in environmental factors and cultural practices [1,14,15].

In the present study, majority of the participants were young adults (26-35 years of age), married, of Ibibio ethnicity, had tertiary education, small family size, employed, consumed fruits and vegetables daily and with monthly income of ₦20, 000 to ₦50, 000 and > ₦50, 000. Some of these demographic attributes have been found to relate directly or indirectly with the risk of dehydration in previous studies [16,1]. For instance, acquiring a tertiary education, being employed, had a monthly salary of > ₦50, 000 and consumption of fruits and vegetables daily indicate that a higher proportion of the participants were in the upper socioeconomic class which has been shown to be associated with decreased risk of dehydration in previous studies [16], hence the lower prevalence rate of dehydration in the present study compared with studies in other countries.

Variables of upper level of socio-economic status (SES) including high income level, high educational attainment and urban area of residence have been shown to inversely correlate with hydration status. It is a known fact that the income level of an individual may determine the area of residence, diet quality, predicts the availability of air conditioning and other cooling options at home and their use during periods of extreme heat.

Also, high educational level may increase access to hydration related information and leading to good knowledge of adequate hydration level and common presenting symptoms of dehydration (e.g., dry lips, thirst, dry tongue and dry skin). Others include knowledge of adequate fluid intake, causes of dehydration, preventive measures and adverse health consequences of dehydration [17]. Indeed, good knowledge/ perception of risk of dehydration could enhance behavioral modification to reduce lifestyle related risk [16,18]. Likewise low health risk perception and misconception (common among the low SES individuals) could lead to over indulgence in some harmful lifestyle-related behaviors.

In this study, majority of the participants belonged to the younger age group suggesting a protection against age-related increased risk of dehydration due to age-related decreased urine concentrating ability, inadequate water intake (due to decreased thirst) and increased insensible water loss by evaporation through the respiratory tract and the skin [19]. No wonder a study in Kuwait [12] among young pregnant women recorded even a lower prevalence rate of dehydration (11.8%) than the present and previous studies.

Also, gestational age of the current pregnancy was significantly associated with higher prevalence of dehydration with those within the third trimester of pregnancy having higher prevalence rate of dehydration than others. This finding is consistent with findings of *Malisova* et al. [13] in Greece, who found increasing prevalence of dehydration among pregnant women in succeeding trimesters of their pregnancies, with 30% in the first trimester, 33.0% in the second trimester and 39.0% in the third trimester [13]. Fluid balance studies indicate that the hemodynamic adjustments during the first and second trimester of pregnancy may remain normal around the new set point despite the various physiological changes occurring during this period, however, during the third trimester, these regulatory mechanisms may not be able to keep pace with the extensive fluid

demand/loss due to the extensive increase physiological changes (e.g., decreased thirst and vasopressin secretion) that affect fluid and electrolyte balance, thereby increasing the vulnerability of pregnant women to dehydration [7]. Furthermore, the prevalence of dehydration was higher among women who were pregnant for the first time (primigravidae) probable because they lacked previous exposure/ experience and hence, physiological adaptation to both fluid and electrolyte imbalance. This observation is consistent with the notion that fluid and electrolyte balance is influenced by parity [7].

Table 4. Associated symptoms of dehydration among dehydrated participants

Frequency of urination per day	Frequency	Percentage (%)
1-3 times	14	30.4
4-6 times	20	43.5
7-10 times	12	26.1
≥ 10 times	0	0.0
Frequency of sweating/day		
Occasionally	30	65.2
Frequently	16	34.8
Frequency of defecation/day		
1-2 times	14	30.4
3-4 times	20	43.5
≥ 5	12	26.1
Recurrent watery stooling		
Yes	6	13.0
No	40	87.0
Previous diagnosis of Urinary tract infection (UTI)		
Yes	7	15.2
No	39	84.8
Vomiting in current pregnancy		
Never	24	52.2
More often	11	23.9
Once of while	11	23.9
Any treatment for diagnosed UTI?		
Yes	7	14.9
No	40	87.1
Previous diagnosis of diabetes mellitus?		
Yes	0	0.0
No	47	100.0
History of dry mouth?		
Yes	9	19.6
No	37	80.4
Stress up?		
Yes	4	8.7
No	42	91.3
Environmental temperature		
Hot	20	43.5
Cold	11	23.9
Air conditioned	5	10.9
Use of fan	10	21.7

Table 5. Distribution of some urinary properties based on the hydration status of participants

Physiochemical Properties of urine	Dehydrated (n=46)	Non dehydrated n=270)	P-value
Urine pH	5.80±0.59	6.18±0.66	0.0000
Urinary specific gravity (USG)	1.03±0.003	1.01±0.06	0.068

Values reported in the form mean ±SD

Table 6. Multiple logistic regression showing the association between life style variables and odds for dehydration among participants

Life style variables	Odd ratio	95% Confidence interval for odd ratio	P-value
Physical activity			
Yes	2.03	1.179-22.953	
No	1.00(reference)		0.007**
Duration of exercise			
5-10	0.26	0.098-0.658	
11-15	0.24	0.082-0.678	0.005**
16-20	0.09	0.022-0.366	0.007**
21-80	0.24	0.064-0.901	0.001**
>30	1.00	(reference)	0.035*
Most consumed food			
Yam, rice, Fufu	3.55	[1.003-12.577	0.040*
Meat, beans milk	3.25	[1.893-11.844]	0.007**
Fruit and vegetable	1.0	[reference]	
Regularity of eating of Fast food			
Daily	0.93	[0.367-2.333]	0.868
Weekly	1.24	[6.392-3.889]	0.718
Monthly	1.00	[reference]	
Eating of strange food			
Yes	3.71	[1.563-8.811]	0.003**
No	1.00	[reference]	
Coffee consumption			
Yes	0.85	[0.138-5.232]	0.860
No	1.00	[reference]	
Energy drink consumption			
Yes	1.37	[0.504-3.705]	0.540
No	1.00	[reference]	
Soft drink consumption			
Yes	2.04	[0.897-4.642]	0.089
No		[reference]	
Adding salt to meal			
Yes	3.09	[3.010-0.761]	0.027*
No	1.00	[reference]	
Alcohol consumption			
Yes	2.46	[1.084-5.603]	0.027*
No	1.00	[reference]	
Number of cups of water taken/day			
2-4	6.10	[2.029-18.360]	0.001*
5-7	4.04	[reference]	0.011*
≥ 8	1.00		

**Significant at 5% (P<0.05), **Significant at 1% (P<0.01)*

Higher prevalence of dehydration found among married pregnant women in the present study is consistent with previous documentation [16], and could be due to role strain and associated stress, especially those who were employed, had lowest educational level and with no spouse present [16]. Such stress can lead to poor lifestyle-related behaviors such as poor dietary habit and inadequate fluid intake which are common causes of dehydration in pregnancy [11].

We also found that some lifestyle-related habits were associated with higher prevalence and odds of dehydration including poor dietary habits (daily fast food /restaurant patronage, consumption of mainly carbohydrate containing

foods (yam, rice, fufu and garri),eating 3-4 times/day and craving for certain diets). Others include daily consumption of energy/soft drink, alcohol consumption, inadequate water consumption (2-4cups/day or 5-7cups/day), high physical activity level (e.g., walking for >30 min every day) and short sleep duration (>7 hrs/night).

The finding of a significant association between inadequate water intake and increased prevalence and risk of dehydration among the participants in the present study is in line with previous assertion that water constitute a greater proportion of the total body fluid and that a high proportion of pregnant women do not drink enough water. In a cross-sectional study to assess the fluid intake of pregnant women in Indonesia, Bardosono et al. [11] found that water intake in 42% of the pregnant women was below the adequate intake limit as recommended by the European Food Safety Authority (EFSA) and Institute of Medicine (IOM). In a parallel animal study, Mulyani et al. [4] reported lower water intake among dehydrated pregnant animals compared with the non-dehydrated group. Water is especially important in pregnancy and contributes to maternal wellbeing and fetal growth and development. In a total fluid intake study among pregnant women, Bardosono et al. [11] found that compared with other fluids, water intake constituted the largest proportion (72%) of the total fluid intake. This underscores the notion that water intake has a significant clinical importance in the overall hydration status of pregnant women probable due to its physiochemical properties. At this point time, it should also be noted that although adequate water intake plays a significant role in maintaining a state of normal hydration, not all pregnant women who took adequate water had normal hydration level suggesting that inadequate intake of water is not the only risk factor of dehydration in pregnancy. Water content of foods is also important in achieving a state of adequate hydration. It contributes about 20-30% of the total water intake, however, the extent of its contribution depends on the type and quantity of food consumed [11] which is also determined by several other factors including the cultural practices/ ethnicity, economic status, age, agricultural practices, religious and climatic factors. Liquid foods contain, and contribute more water than the solid type. This could provide explanation for the higher prevalence of dehydration in some ethnic groups than others and among those who indulged in eating only high carbohydrate containing solid foods (yam, rice, fufu and garri) 3-4 times per day while excluding a lot of vegetables and fruits from their diets.

The risk of dehydration was also higher among pregnant women who consumed alcohol likely due to the diuretic effect of alcohol induced by the inhibition of the secretion of anti diuretic hormone [16]. Regular physical activity also increased the risk of dehydration among pregnant women in the present study especially when there was no concomitant increase in fluid intake. High/regular physical activity level leads to excessive fluid loss through sweating, perspiration and hyperventilation which if not met by increasing fluid intake could lead to dehydration.

Short sleep duration especially sleeping for 5-6hr per night was associated with higher prevalence of dehydration. This finding is consistent with data of Rosinger et al. [20] who reported a significant association between sleep duration and inadequate hydration in US and Chinese adults relative to 8hr. Mechanistic studies in both humans and animals relate the link between short sleep duration and dehydration to the alteration in the circadian rhythm release of anti-diuretic hormone which helps to moderate hydration status during the late sleep [20]. Therefore, if the late sleep is disrupted, the vasopressin will not be released for fluid homeostasis. This may increase the vulnerability to dehydration [21].

Regular consumption of energy drink was associated with increased prevalence and odds for dehydration probably because of the caffeine content of most of the energy drinks that mediates the diuretic and natriuretic effects and leading to dehydration.

The limitations of this study were those related to the cross-sectional nature of the study design. Also, self-reported personal characteristics are prone to over, or under estimation. However, the study obtained its strength from the fact that the participants were carefully selected and characterized while controlling for other confounding factors.

5. CONCLUSION

The prevalence of dehydration among pregnant women is high and is associated with physiological and non-physiological factors

including personal, obstetric and lifestyle- related risk factors.

CONSENT AND ETHICAL APPROVAL

All participants signed written informed consent and the study protocol was approved by the Institutional Research Ethics Committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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