



Do pregnant women have adequate knowledge on daily water requirement and dehydration and do they meet with the recommended fluid intake?

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ABSTRACT

Water is the most essential requirement for all living organisms to survive. A safe, adequate water supply is needed for all people. Pregnant women are at a high risk of dehydration due to inadequate fluid intake. This cross-sectional study was conducted to assess the knowledge on daily water requirement and dehydration among the pregnant women in selected MOH areas in Galle district and to measure the total daily fluid intake of them. Participants (n=366) were recruited using purposive sampling method from three MOH areas in Galle district. A pre-tested, self-administered questionnaire was used to assess the knowledge about daily water requirements and dehydration. From each MOH area 20 pregnant women were randomly selected for a sub-group from the main sample to measure daily total fluid intake. Data were analyzed using Statistical Package for Social Sciences (SPSS), version 25.0, using student's t-test, one-way ANOVA and Pearson correlation tests. All participants (n=366, 100%) showed poor knowledge on daily water requirements, and dehydration. The mean (SD) daily total fluid intake was 2117.47±437.69 mL/day. The average total fluid intake range was 1473-3803 mL/day. Only 20% of the pregnant women in the sub sample met with the total fluid intake recommendations for pregnant women. Results concluded that the pregnant women in Galle possess inadequate knowledge on daily water requirements and dehydration. The total daily fluid intake of the majority of the (80%) pregnant women were below the recommendations. However, there was no relationship between levels of knowledge and average total fluid intake of pregnant women. Findings emphasizes the urgent requirement of improving the hydration status of the pregnant mothers and educating them on the daily water requirement, the value of proper hydration and the consequences of dehydration.

KEYWORDS: Dehydration, water requirement, fluid intake, pregnant women, knowledge

1 INTRODUCTION

Water is the most essential component for all living organisms to survive. A safe, adequate water supply is needed for every human being (Sayato 1989). Water is a vital component of the body, and it is 60% of the body weight (42 L) in a 70 kg person. This is less in women as they have a higher proportion of body fat. The amount of total body water is different throughout life; in an infant's body it is 75% and, in the elderly, it is 55%. Water within the cells is called the intracellular compartment, and it is 50% of body water (28 L). The extracellular compartment means water in spaces between cells and the arteries, veins, lymph vessels, and intestines. This compartment comprises 20% of body water (14 L) (Sawka, Cheuvront, & Iii 2005; El-sharkawy, Sahota & Lobo 2015).

1.1 Role of water in life and water intake recommendations

Body water provides a place for all biological reactions in the body. Water is important as a solvent (it dissolves molecules) and for electrolyte homeostasis. It is important for the thermoregulation of the body and helps with food digestion, and helps to maintain acid-base balance (Shaheen et al. 2018).

Water requirements depend on an individual's age and physical activity levels. The body receives water mainly through oral and food metabolism. Healthy people at any age group require 100 mL of water per 100 calories to dissolve and excrete metabolic waste. In a healthy adult, the daily loss of body water is

nearly 2500 mL, through the kidneys as urine, and a small amount of water through the skin, gastrointestinal tract, and lungs (Collins & Claros 2011).

Daily water intake recommendations differ for females and males, pregnant women, lactating women, children, and elderly people (Pender, Boland, & Lee 1998). According to the World Health Organization (WHO) report on "Domestic Water Quantity, Service Level and Health", the water requirement for a 70 kg adult male is 2.5 L/day while a 58 kg female needs 2.2 L/day. For a 10 kg child, the requirement is 1 L/day while a 5 kg child requires 0.75 L/day. The minimum recommended water intake for one person (70 kg) in a temperature zone is 3 L/day (42.2 mL/kg) and for a 70 kg person in a tropical zone is 4.1–6 L/day (56.6–85.7 mL/kg). For men aged 19–70 years and over 70 years, the recommended water intake is 3.7 L/day and for women, it is 2.7 L/day (Galal-Gorchev, Ozolins, & Bonnefoy 1993).

1.2 Dehydration, signs and symptoms of dehydration

Dehydration is defined as a rapid loss of more than 3% of body weight, and it is associated with water and electrolyte disturbances from reduced water or reduced-sodium levels (Collins & Claros 2011). It happens due to inadequate water intake (Galal-Gorchev, Ozolins, & Bonnefoy 1993). Dehydration has three types. There are isotonic dehydration, hypertonic dehydration, and hypotonic dehydration (Collins & Claros 2011).

According to the amount of water deficit, acute dehydration symptoms are different. If the fluid loss from bodyweight is 1%, it causes impairment of thermoregulation and increased thirst. Thirst is increased when it is 2%. Vague discomfort, loss of appetite, and dry mouth occur at approximately 3%. If it is of 4%, 20-30% decrement of work capacity can be seen. At 5%, it causes difficulty in concentrating, headaches, and sleepiness. At 6%, people can feel tingling and numbness in their extremities. Around 7% of dehydration causes collapse, and 10% of dehydration causes death (Galal-Gorchev, Ozolins, & Bonnefoy 1993).

Mild dehydration causes reduced endurance, increased fatigue, reduced thermoregulatory capability, reduced motivation, and increased perceived effort. This disrupts mood and cognitive function, such as concentration, alertness, and short-term memory in children, young adults (18-25 years), and older adults (50-82 years), and impairs perceptual discrimination, arithmetic ability, and psychomotor skills. Dehydration can also cause delirium and dementia in the elderly and the very ill. Dehydration also leads to constipation (Popkin, D'anci, & Rosenberg 2010; Kempton et al. 2011). Dehydration further causes rapid breathing, reduced capillary refill time, dry tongue and dry skin, urinary tract infections, hypotension, orthostatic hypotension, sunken eyes, and increased blood urea nitrogen, hematocrits, and serum sodium levels. Most of these symptoms occur in older adults (Collins & Claros 2011).

1.3 Causes and complications of dehydration

Dehydration occurs when the water balance is disrupted by a decrease in total body water from fluid loss, a decrease in fluid intake, or both (Shaheen et al. 2018). Normally, water is released from the body as urine, feces, respiration, and evaporation of individuals under temperate conditions, sedentary to moderately active (Galal-Gorchev, Ozolins, & Bonnefoy 1993). Some gastro-intestinal conditions lead to dehydration. These are gastroenteritis, cholera, shigellosis, yellow fever, or other infections. They cause a loss of fluid by diarrhea and vomiting. It may lead to dehydration. Excessive sweating can lead to dehydration. This can occur due to vigorous exercise, sports, fever, and hot climates. Excessive blood loss leads to hypovolemia, which causes dehydration. Diabetes mellitus may lead to polyuria and, due to this, excessive fluid loss.

Severe burns are also a cause of dehydration due to excessive fluid loss (Mandal, Robertson, & Sc 2019). Dehydration can cause urolithiasis, urinary tract infections, bronchopulmonary disorders, morphological and functional changes in the kidney, hypertension, venous thrombosis, fatal coronary heart diseases, gallstones, and constipation (Manz & Wentz, 2005; El-sharkawy, Sahota, & Lobo 2015).

1.4 Pregnancy and hydration

Pregnancy is a special physical status (Zhou et al. 2019). When a woman becomes pregnant, she needs more water than the normal, non-pregnant woman (WHO 2005). During

pregnancy, a woman gains 10-12.5 kg (22-28 lb) of weight (Byrom et al. 2009; Agostoni et al. 2010). Extra weight gain occurs due to the growing fetus (Byrom et al. 2009). Pregnant women's weight gain is significantly correlated with the increase in total body water. Weight gain during the gestational period is at its highest in the 2nd trimester and the lowest during the 1st and 3rd trimesters. The total weight gain occurs at a rate of 25% from the fetus, 5% from the placenta, and 6% from the amniotic fluid. The pregnant women's weight increases by 62% from water with a wide variability (Agostoni et al. 2010).

During pregnancy, the woman's weight and energy intake increases. That causes a proportional increase in water intake. In the 2nd trimester, energy intake is increased by 15% (300 kcal/day), and the additional total water intake is increased by 300 mL. During the 2nd trimester, plasma volume expansion is at its maximum (50%) (Agostoni et al. 2010). The adequate total water intake for pregnant women (aged 14-50 years) is 3 L/day. This includes 2.3 L of total beverages and drinking water (Institute of Medicine 2005).

Pregnant women have a high risk of dehydration due to special physical status (Zhou et al. 2019). During the first half of pregnancy, up to 50-85% of women suffer from nausea and vomiting. These symptoms usually start between 6-8 weeks, and they most often resolve by the 20th week. Nausea and vomiting can be severe for 30-35% of women (O'donnell et al. 2016). Nausea and vomiting affect the hydration status of the pregnant women.

Constipation can occur and may experience a short transient period of polyuria during early gestation and frequency (passing urine often) (Byrom et al. 2009; Institute of Medicine, 2005). Increasing fluid intake can reduce constipation (Montgomery 2002).

After 20 weeks of pregnancy, weight gain has more effect on the growth and birth weight of the baby. During the 3rd trimester, poor weight gain is especially associated with low birth weight. Low birth weight is linked to an increased risk of infant morbidity and mortality, as well as cognitive development (resulting in poor cognitive development) and learning disabilities (Hemachandra 2011). Low Body Mass Index (BMI) and height in early pregnancy cause lower extracellular water and body water during the early, mid, and late periods of pregnancy, and this increases the risk of fetal growth retardation (Mulyani et al. 2017). Further, dehydration during pregnancy causes preeclampsia, preterm delivery, and abortion (Zhou et al. 2019).

The objective of this study was to study the knowledge of dehydration and water requirements in a group of Sri Lankan pregnant women and to measure the total fluid intakes of them.

2 MATERIALS, METHODS AND TECHNIQUES

2.1 Study design, study setting and sample size

This was a cross-sectional study, conducted in selected three MOH areas, Galle, Bope-Poddala, and Akmeemana in Galle District.

The study was conducted during the COVID-19 pandemic and therefore, these MOH areas were selected by considering feasibility. Population of the study was the pregnant women who live in Galle District. The sample size (n=366) was calculated using the equation suggested by Lwanga and Lemeshow (1991) for a finite population. The required sample was divided similarly into three to get an equal number of participants from each MOH area (n=122). Antenatal clinics of the selected MOH areas were visited and data was collected until completing the required sample size taking into consideration the inclusion and exclusion criteria. Inclusion criteria includes; pregnant women who were confirmed pregnant and registered in one of the MOHs in Galle district, pregnant women who were literate, willing to participate and had given informed consent, pregnant women without any congenital diseases, chronic diseases, or pregnancy complications (gestational diabetes, pregnancy-induced hypertension, hyperemesis gravidarum, preeclampsia), pregnant women who were healthy and did not have any history of malnutrition disorders (anemia, iodine deficiency, osteoporosis, etc.), and pregnant women over the age of 18 years. A sub-sample (n=60) was selected by using a random sampling method from the selected participants to measure 24-hours of total fluid intake for 3 days (Monday, Thursday, and Sunday) within one week.

2.2 Assessment of knowledge on daily water requirement and dehydration

Data was collected from eligible pregnant women by using a pre-tested, self-administered questionnaire. There were 3 sections in the questionnaire to collect data on socio-demographic factors (part A with 18 questions), knowledge of daily water requirements and water intake practices (part B with 25 practices), and knowledge of dehydration (part C with 19 questions). This questionnaire was developed by the investigators based on the literature review as there is no validated questionnaire for the purpose. Participants height was measured by using a stadiometer, weight was measured by using a standard scale and the BMI was calculated. Marks were given to each question in the questionnaire, and a knowledge score were calculated according to the given marks. The knowledge scores were calculated out of 100. Participants who obtained scores of less than 50%, 50-75%, 75-90%, and more than 90% for the knowledge score were categorized as poor, average, good, and excellent respectively.

2.3 Assessment of daily total fluid intake by measuring the fluid intake using a 24-hour fluid intake recording charts

Sixty pregnant women (20 from each selected MOH area) were taken as a sub-group to measure fluid intake for 3 days within one week (Monday, Thursday, and Sunday). The 24hour fluid intake recording charts and measuring cups were provided to the participants in the sub-group and instructions were provided to measure the intake of plain water and all types

of beverages by using the given measuring cup. Participants were instructed to record volumes throughout the day in given spaces of the chart with the correct times of consumption.

2.4 Data analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS), version 25.0. Statistical comparisons were performed between the total knowledge scores about daily water requirements and dehydration with their education level, BMI, occupation, monthly income, gestational age, residence, and level of physical activity. This was carried out utilizing Student's t-tests. Multiple comparisons between samples were done by using one-way ANOVA. Total fluid intake and total knowledge scores were analyzed by using Pearson correlation test for assessed relationship between them. Demographic data was compared with fluid intake by using t-test and one-way ANOVA.

Ethical approval for the study was obtained from the Ethics review committee, Faculty of Allied Health Sciences, University of Ruhuna, Sri Lanka (Reference no: 2021.11.68). Informed written consent was obtained from all participants from the study.

3 RESULTS AND DISCUSSION

3.1 Socio demographic characteristics of the sample

The participants' overall response rate was 100%. The majority 193 (52.7%) of the participants, were in the 18-30 age range. Majority 327 (89.3%) were Sinhala, 36 (9.8%) were Muslim and 3 (0.8%) were Tamil. In this

sample population, 316 (86.3%) were Buddhist, 36 (9.8%) were Islam, 11 (3.0%) were Catholic, and 3 (0.8%) were Hindu. More than half of the pregnant women, 205 (56.0%) were from rural areas; 80 (21.9%) were from semi-urban areas; and 81 (22.1%) were from urban areas. Of the subjects who participated in the research, the majority 146 (39.9%) had received education up to Advanced level (A/L) and 220 (60.0%) were housewives. Others were trained, untrained, and professional workers (10.4%, 0.8%, and 28.7%) respectively. In this sample, 203 (55.5%) were in the Rs. 20,000-50,000 range of monthly income. Among the participants, there were more normal weight (50.8%) than overweight (33.1%) or obese (11.5%) subjects. Of the pregnant women, 4.6% were underweight. When considering their physical activity level, 79.8% were in medium active level. The majority of pregnant women were in between 12-26 weeks of gestation (41.5%). The socio-demographic characteristics of the participants are shown in Table 1.

Table 1: Socio-demographic characteristics of the participants

Information	n (%)
Sample size	366 (100%)
Age (years)	
18-30	193 (52.7%)
30-45	173 (47.3%)
BMI Groups	
Underweight	17 (4.6%)
Normal	186 (50.8%)
Overweight	121 (33.1%)
Obese	42 (11.5%)
Gestational Age (weeks)	
Less than 12	69 (18.9%)
12-26	152 (41.5%)
26-36	114 (31.1%)
Above 36	31 (8.5%)

Parity	
Zero	71 (19.4%)
1	122 (33.3%)
2	105 (28.7%)
3	51 (13.9%)
4	13 (3.6%)
More than 4	4 (1.1%)
Ethnicity	
Sinhala	327 (89.3%)
Tamil	3 (0.8%)
Muslim	36 (9.8%)
Religion	
Buddhist	316 (86.3%)
Hindu	3 (0.8%)
Catholic	11 (3.0%)
Islam	36 (9.8%)
Residence	
Rural	205 (56.0%)
Semi-urban	80 (21.9%)
Urban	81 (22.1%)
Educational level	
Up to O/L	133 (36.3%)
Up to A/L	146 (39.9%)
Diploma	43 (11.7%)
Graduate	43 (11.7%)
Occupation	
House wife	220 (60.1%)
Trained worker	38 (10.4%)
Untrained worker	3 (0.8%)
Professional worker	105 (28.7%)
Monthly income (LKR)	
< 10,000	14 (3.8%)
10,000-20,000	99 (27.0%)
20,000-50,000	203 (55.5%)
> 50,000	50 (13.7%)
Physical activity level	
Less	23 (6.3%)
Medium	292 (79.8%)
High	51 (13.9%)

Values are presented as numbers (percentages)

3.2 Knowledge on daily water requirement and water intake practices

The mean (\pm SD) knowledge score was 15.57 ± 5.14 . The participant knowledge score ranged between 2-32%. All study participants had a poor level of knowledge about water intake recommendations and water intake practices. None of the participants could reach the average, good, or excellent levels as indicated in table 2. The majority of the participants 189 (51.6%) gave the correct answer for the minimum water requirement for an average weight human and 105 (28.7%)

gave the correct answer about the water recommendation for pregnant women.

Table 2: Levels of knowledge of the participants regarding daily water requirement and water intake practices

Level of knowledge	n (%)	
Less than 50%	Poor	366 (100%)
50-75%	Average	0 (0.0%)
75-90%	Good	0 (0.0%)
>90%	Excellent	0 (0.0%)

3.3 Knowledge about dehydration

The questionnaire sought data on the knowledge of participants regarding the definition of dehydration, causes, complications, signs and symptoms of dehydration, and its prevention. The majority (245, 66.9%) of pregnant mothers knew the correct answer to the dehydration definition. Majority of the participants (222, 72.3%) knew the causes of dehydration. About half of the participants (146, 49.5%) identified the dehydration complications. Among the complications during the pregnancy period, most of the participants (162, 60.7%) reported that the complication was intra-uterine growth retardation. Among the common signs and symptoms of dehydration, dry skin was chosen by more than two-thirds of participants (247, 80.5%). The least (50, 16.3%) selected sign was lightheadedness as presented. Majority of the participants stated that drinking more fluids is useful to prevent dehydration (313, 94.8%).

The total knowledge score was calculated out of 100. Participants who obtained scores of less

than 50%, 50-75%, 75-90%, and more than 90% for the knowledge scores were categorized as poor, average, good, and excellent, respectively. All of the participants had demonstrated poor knowledge of dehydration. The mean knowledge score was 16.87 (SD±5.57). The range of knowledge score was 3-35%. Participants' knowledge levels on dehydration is indicated in table 3.

Table 3: Levels of knowledge scores of the participants regarding dehydration

Level of knowledge		n (%)
Less than 50%	Poor	366 (100%)
50-75%	Average	0 (0.0%)
75-90%	Good	0 (0.0%)
>90%	Excellent	0 (0.0%)

3.4 Total knowledge score of the participants regarding daily water requirements and dehydration

The total knowledge score of the participants regarding daily water requirements and dehydration was calculated out of 100. Participants who obtained scores of less than 50%, 50-75%, 75-90%, and more than 90% for the knowledge score were categorized as poor, average, good, and excellent respectively. The majority of participants (348, 95.08%) had a poor knowledge of daily water requirements and dehydration, while 18 (4.92%) had average knowledge. The mean total knowledge score was 32.44 (SD±10.71). The participants' total knowledge score ranged between 5-67%.

3.5 The factors affecting total knowledge scores

On one-way ANOVA analysis, BMI showed a statistically significant difference ($p=0.020$) with total knowledge scores. The total knowledge score was significantly higher in participants with the normal BMI level (34.01 ± 11.65) compared to the participants who were underweight, overweight, and obese (31.53 ± 8.46 , 30.13 ± 9.11 , and 32.50 ± 10.55 , respectively). Residence showed a statistically significant difference ($p=0.001$) with total knowledge scores as shown in table 4. The total knowledge score was significantly higher in participants who live in urban areas (35.70 ± 11.43) compared to the participants who live in rural areas (30.65 ± 10.05) and semi-urban areas (33.71 ± 10.79).

A statistically significant difference was observed in the total knowledge scores of pregnant women in different educational levels ($p<0.001$). It showed that the total knowledge scores were significantly higher in subjects educated above graduation (48) compared to the educated up to O/L, educated up to A/L, diploma, and graduated (29.33 ± 11.27 , 31.58 ± 8.73 , 41.06 ± 9.53 , and 35.99 ± 10.78 , respectively).

There was a statistically significant difference in the total knowledge scores in pregnant women in relation to their monthly income as shown in table 4. The total knowledge score did not show a significant difference with age, gestational age, parity, number of children, ethnicity, religion, occupation, and the level of physical activity.

3.6 Measurement of fluid intake of the pregnant mothers

From the main sample, 60 pregnant women (20 from each MOH area) were randomly selected as a sub-group to measure fluid intake for 3 days within one week (Monday, Thursday, and Sunday). The mean (\pm SD) average total fluid intake was 2117.47 (\pm 437.69) ml. The mean (\pm SD) average total plain water intake for 3 days within a week was 1583.92 (\pm 397.75) ml. The mean (\pm SD) average total beverage intake was 530.22 (\pm 161.40) ml. Only 12 (20%) participants met with the fluid intake recommendation for pregnant women. They recorded their average total fluid intake for 3 days within a week more than 2.3 L per day. Others 48 (80%) participants' fluid intake was below the recommendations.

3.7 The factors affecting average total fluid intake of the participants

There was a statistically significant difference in the average total fluid intake in pregnant women in different age groups as determined by student t-test ($p=0.027$). The total fluid intake was significantly higher in participants between 30 and 45 years of age (2254.63 ± 490.16 ml) compared to the participants between 18 and 30 years of age (2005.25 ± 359.36 mL). However, there was no significant differences in the average total fluid intake with reference to BMI ($p=0.181$), gestational age ($p=0.158$), parity ($p=0.363$), ethnicity ($p=0.838$), religion ($p=0.911$), residence ($p=0.143$), educational level ($p=0.300$), occupation ($p=0.853$), monthly income ($p=0.975$), and the level of physical activities ($p=0.586$) as shown in Table 5.

Table 4: Group comparison of the total knowledge levels

Factor	N	Mean (SD)	F value	p-value
Age (Years)				
18-30	193	31.33 \pm 10.73	0.010	0.922
30-45	173	33.67 \pm 10.59		
BMI				
Underweight	17	31.53 \pm 8.46	3.309	0.020
Normal	186	34.01 \pm 11.65		
Overweight	121	30.13 \pm 9.11		
Obese	42	32.50 \pm 10.55		
Gestational age (weeks)				
Less than 12	69	32.77 \pm 12.56	0.799	0.495
12-26	152	33.01 \pm 9.40		
26-36	114	32.19 \pm 9.98		
Above 36	31	29.82 \pm 14.50		
Parity				
Zero	71	32.87 \pm 11.46	1.156	0.330
1	122	33.50 \pm 9.06		
2	105	31.04 \pm 11.81		
3	51	33.13 \pm 11.30		
4	13	27.96 \pm 9.36		
More than 4	04	34.75 \pm 7.36		
Number of children				
None	114	32.87 \pm 10.70	0.765	0.549
1	152	32.26 \pm 10.36		
2	80	32.81 \pm 11.85		
3	16	28.32 \pm 9.10		
4	4	35.75 \pm 5.43		
Ethnicity	327	32.77 \pm 10.66		

Sinhala	3	29.84±16.02	1.450	0.236
Tamil	36	29.67±10.70		
Muslim				
Religion				
Buddhist	316	32.69±10.78		
Hindu	3	38.84±19.21	1.224	0.301
Catholic	11	32.36±3.72		
Islam	36	29.67±10.70		
Residence				
Rural	205	30.65±10.05		
Seni urban	80	33.71±10.79	7.422	0.001
Urban	81	35.70±11.43		
Educational level				
Up to O/L	133	29.33±11.27		
Up to A/L	146	31.58±8.73		
Diploma	43	41.06±9.53	13.293	0.000
Graduate	43	35.99±10.78		
Above	1	48.00		
Occupation				
House wife	220	31.62±10.84		
Trained worker	38	32.08±9.57	1.826	0.142
Untrained worker	3	27.93±13.74		
Professional worker	105	34.42±10.63		
Monthly Income (LKR)				
< 10,000	14	21.98±8.80		
10,000-20,000	99	32.91±10.26	7.204	0.000
20,000-50,000	203	31.97±10.50		
>50,000	50	36.34±10.99		
Level of physical activity				
Less	23	30.60±8.92	0.369	0.691
Medium	292	32.59±10.44		
High	51	32.37±12.90		

*These group comparisons were made using student *t*- test and one-way ANOVA; at the $p < 0.05$ level

Table 5: Factors affecting total fluid intake

Factor	N	Mean (SD) (mL)	F value	p-value
Sub- sample (n=60)				
Age (years)				
18-30	33	2005.25±359.36	5.545	0.027
30-45	27	2254.63±490.16		
BMI				
Underweight	3	2085.56±930.77		
Normal	32	2024.17±311.10	1.684	0.181
Overweight	19	2299.56±547.80		
Obese	6	2054.44±215.73		
Gestational age (weeks)				
Less than 12	15	1938.11±376.17		
12-26	22	2160.91±506.14	1.796	0.158
26-36	18	2129.07±393.83		
Above 36	5	2422.67±279.71		
Parity				
Zero (first pregnancy)	10	2087.83±415.53		
1	25	2114.93±413.86	1.106	0.363
2	14	2293.10±569.43		
3	10	1927.00±254.20		
4	1	1923.33		
Ethnicity				
Sinhala	53	2129.25±443.99	0.177	0.838
Tamil	2	1979.17±347.66		
Muslim	5	2048.00±464.06		
Religion				

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Buddhist	54	2121.91±443.07	0.093	0.911
Hindu	1	2225.00		
Islam	5	2048.00±464.06		
Residence				
Rural	35	2147.76±477.82		
Seni urban	16	2147.76±477.82	2.013	0.143
Urban	9	1857.04±299.16		
Educational level				
Up to O/L	17	2218.14±388.35		
Up to A/L	26	2120.77±512.69	1.253	0.300
Diploma	7	2207.38±364.37		
Graduate	9	1912.22±268.83		
Above	1	1538.33		
Occupation				
House wife	35	2119.33±422.28	0.160	0.853
Trained worker	5	2215.00±196.60		
Professional worker	20	2089.83±514.14		
Monthly income				
10,000-20,000	15	2138.89±443.76		
20,000-50,000	36	2108.06±429.53	0.026	0.975
Above 50,000	9	2119.44±509.70		
Level of physical activity				
Less	1	2565.00		
Medium	51	2113.89±445.71	0.539	0.586
High	8	2084.38±407.11		

* These group comparisons were made using student t-test and one-way ANOVA; at the $p < 0.05$ level

The correlation between the levels of knowledge and average total fluid intake was statistically not significant as determined by the Pearson correlation test ($r=+0.052$, $p=0.693$). It shows that there is no relationship between the levels of knowledge and average total fluid intake.

This study has focused on the knowledge of daily water requirement and dehydration among the pregnant women in selected MOH areas in Galle district and the measurement of the fluid intake. According to the literature available, this is the first research conducted in Sri Lanka on the pregnant women to assess their hydration knowledge and to measure their fluid intake. Some studies have been conducted in other countries to assess dehydration knowledge or status, water intake practices among public and adults (Shaheen et al. 2018; Zuo et al. 2011; Malisova et al. 2016). In this

study, all pregnant women displayed a poor knowledge on daily water requirements and water intake practices. None of them could reach the average, good or excellent levels. According to the World Health Organization (WHO) report on ‘Domestic Water Quantity, Service Level and Health’, the water requirement of a 70 kg adult male is 2.5 L/day and a 58 kg female wants 2.2 L/day (Galal-Gorchev, Ozolins, and Bonnefoy 1993). Majority of participants gave the correct answer about the minimum water requirement per day for a human with an average weight (189, 51.65%). In a study conducted in Saudi Arabia, 74% have reported a good knowledge about water intake recommendations (Shaheen et al., 2018). In China, among the adults, the unawareness rate of the minimum drinking water volume was 28.4% (Zuo et.al. 2011). Adequate intake for pregnant women, aged

between 14 and 50 years, is 3L/day of total water. This includes 2.3 L of total beverages and drinking water (Institute of Medicine 2005). According to this recommendation, less than half of the participants gave the correct answer about the recommendations for pregnant women 105 (28.7%). A study conducted in Indonesia, reported that the adequate intake was known by only 14% of the pregnant women (Bardosono et al. 2016).

When the knowledge on dehydration is considered, majority of the subjects in this study knew the correct answer to the dehydration definition (245, 66.9%). In the study conducted in Saudi Arabia, the majority (93%) had a good knowledge of dehydration definition (Shaheen et al. 2018). In this sample, the most identified dehydration complication was constipation (146, 49.5%) and among the complications during pregnancy period, most of the participants reported that the complication was intra uterine growth retardation (162, 60.7%). In this sample, 43 (11.7%) of participants were suffering from constipation. In a study conducted in Saudi Arabia, recognized causes for dehydration by people were diarrhea (81%), sweating (68%), and vomiting (62%) (Shaheen et al. 2018). In the current study, more than half of the participants knew the cause of dehydration as the inadequate fluid intake (222, 72.3%) and diarrhea (88, 28.7%), sweating (30, 9.8%), and vomiting (83, 27.0%) were least recognized causes of dehydration. In this study 139 (38.0%) of participants were suffering from vomiting and among them 78 (56.1%) were

mild cases. More than half of the participants identified that dehydration signs and symptoms were dry skin, dry mouth, thirst, decrease in urination, fatigue and constipation (80.5%, 68.7%, 69.1%, 79.8%, 67.8%, and 64.8%, respectively). Less than half of the participants recognized the symptoms such as the lack of focus, headache or dizziness, lightheadedness, muscle weakness, muscle cramp, rapid breathing, increased pulse, and decreased blood pressure (21.8%, 47.6%, 16.3%, 40.4%, 26.1%, 23.8%, 25.7%, and 42.1%, respectively). According to the research conducted in Saudi Arabia, their top 3 recognized dehydration symptoms were dry lips (87%), thirst (84%), dry tongue (76%), and less recognized symptoms were fatigue (44.28%), lack of focus (43.5%), headache/dizziness (40.71%), light headedness (29.7%), muscle weakness (24.94%), rapid breathing (22.9%), and muscle cramps (16.28%) (Shaheen et al. 2018). In our study also, dry mouth and thirst were found under the top selected symptoms, together with fatigue. However, in the Saudi Arabian study, fatigue has been recognized as a lesser selected symptom. When considering lesser selected symptoms, most of them were the same in the current study and the study conducted in Saudi Arabia. Majority of the subjects selected drinking more fluids (313, 94.8%) as the prevention method to prevent dehydration and in Saudi Arabia, the subjects had a good knowledge about dehydration prevention (84%) (Shaheen et al. 2018). Overall, participants displayed poor knowledge about the dehydration. When considering knowledge as a whole regarding daily water requirement

and dehydration, 95.08% showed a poor knowledge and 4.92% showed an average knowledge. According to the results, BMI, residence, educational levels, and monthly income affected the total knowledge scores. Total knowledge scores were significantly higher in participants who have a normal BMI, live in urban areas, educated above graduation, and have a monthly income above Rs. 50,000.

Among the participants, their mean (\pm SD) average total fluid intake for 3 days within a week was 2117.47 ± 437.69 ml. It included a mean average total plain water intake (1583 ± 397.75 ml), and a mean average of other beverages (530.22 ± 161.40 ml). In Indonesia and Mexico similar studies have been conducted focusing on the total fluid intake of pregnant and breastfeeding women (Martinez 2014; Bardosono et al., 2016). In Mexico and Indonesia mean total fluid intake of pregnant women was 2.62L per day, and 2332 ± 746 ml per day respectively (Martinez 2014; Bardosono et al. 2016). In Mexican and Indonesian pregnant women's mean total fluid intakes were higher than the total fluid intake of the present study sample. Another study has been conducted in China to investigate the fluid intake behaviors among pregnant women ($n=324$) in their second trimester. This study has used a 7-day 24hour fluid intake questionnaire. According to their results, the median total fluid intake was 1485 mL. Only 3.4% of the participants attained the recommended value following an adequate water intake (1.7 L) level for pregnant women in China (Song et al. 2023).

A survey conducted in China focused on the total water intake among pregnant and breast-feeding women (Zhou et al. 2019). The adequate intake for pregnant women, aged between 14 and 50 years, is 3L/day of total water. This includes 2.3 L of total beverages and drinking water (Institute of Medicine 2005). Only 12 (20%) from the sub sample met the fluid intake recommendations for pregnant women and 48 (80%) did not met the recommendations. In other countries, researches indicate that their participants also did not meet with the recommendations for pregnant women. In Mexico, 41% of pregnant women drank less than recommended 2.3 L fluids per day (Martinez, 2014). In Indonesia, 42% of pregnant women did not reach the adequate intake of water from fluids (Bardosono et al. 2016). In China 52.9% was water received from beverages. Only 16.4% and 43.8% of the total population met the total water intake recommendations set by the Chinese Nutrition Society (CNS) and European Food Safety Authority (EFSA) respectively (Zhou et al. 2019).

When considering about the factors affecting the total fluid intake of the participants, age is a factor affecting to the total fluid intake according to the results of this study. Total fluid intake was significantly higher in participants between 30 and 45 years of age (2254.63 ± 490.16 mL) compared to participants between 18 and 30 years of age (2005.25 ± 359.36 mL). However, according to the results, no relationship was found between the levels of knowledge and average total fluid

intake. An Indonesian study has also reported that the knowledge about adequate intake did not increase the odds of reaching the adequate fluid intake (Bardosono et al. 2016).

Limitations of the study

Three MOH areas were selected for the study considering feasibility, and sample was recruited by using purposive convenience sampling method. It may cause selection bias. The fluid intake was assessed by using a sub-sample and not using the whole sample. The self-reported fluid intake may carry over or be under estimation. Water coming from food was not accounted for when calculating the daily total fluid intake and the hydration status of the pregnant women was not assessed during the study.

4. CONCLUSIONS AND RECOMMENDATIONS

Pregnant women in Galle possess poor knowledge of daily water requirements and dehydration. The total daily fluid intake of the pregnant women in the majority of the sample (80%) was below the recommendations. There was no relationship between levels of knowledge and the average total fluid intake of the pregnant women. Findings emphasize the urgent requirement of improving the hydration status of the pregnant mothers, educating them on the daily water requirement, the value of proper hydration and the consequences of dehydration.

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