Effect of Oral Hydration Therapy on the Prevention of Gestational Hypertension and Preeclampsia: A Randomized Comparative Study

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Abstract

Background: Hypertensive disorders of pregnancy remain a major cause of maternal and perinatal morbidity and mortality. Optimizing maternal plasma volume through simple, low-cost interventions may help reduce the risk and severity of gestational hypertension and preeclampsia.

Objective: To evaluate whether oral hydration therapy (OHT) reduces the incidence of gestational hypertension/preeclampsia and improves selected maternal outcomes compared with routine care.

Methods: A prospective, randomized, comparative study was conducted among antenatal women at 20 weeks' gestation. Participants were allocated to OHT (n=100), counselled to consume at least 3 liters of water per day, and compared with control group receiving routine antenatal advice (n=100). Blood pressure, weight, urine albumin (dipstick), edema, urinary symptoms and amniotic fluid index (AFI) were recorded during routine visits and at delivery. Statistical tests included paired t-test and chi-square tests; $p<0.05$ was considered significant.

Results: Mean systolic blood pressure decreased significantly after OHT (98.0 ± 6.2 mmHg to 93.3 ± 5.8 mmHg; $t=6.21$, $p<0.001$). Pregnancy-induced hypertension/preeclampsia at term occurred in 5.0% of the OHT group vs 11.0% of controls ($\chi^2=4.02$, $p=0.045$). The OHT group had lower severity of pedal edema and lower urine albumin positivity, higher urinary frequency, fewer reported urinary tract infection symptoms, and fewer cases of oligohydramnios at delivery.

Conclusion: Oral hydration therapy is a simple, non-invasive, low-cost adjunct that was associated with reduced incidence of gestational hypertension/preeclampsia and improved selected maternal indicators. Larger studies with objective adherence and urine output measurement are warranted.

Keywords: oral hydration therapy; pregnancy; gestational hypertension; preeclampsia; plasma volume; amniotic fluid index.

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Introduction

Hypertensive disorders of pregnancy (HDP), including gestational hypertension and preeclampsia, affect approximately 5–10% of pregnancies and contribute substantially to maternal and perinatal morbidity and mortality. Recent World Health Organization (WHO) estimates indicate that hypertensive disorders are responsible for around 16% of maternal deaths globally. Preeclampsia is a multisystem disorder that typically presents after 20 weeks' gestation with new-onset hypertension and evidence of maternal organ injury and/or uteroplacental dysfunction.

The pathophysiology of preeclampsia is complex and involves abnormal placentation, endothelial dysfunction, dysregulated angiogenesis and an exaggerated inflammatory response, resulting in generalized vasospasm and reduced organ and uteroplacental perfusion. Maternal intravascular volume contraction and haemoconcentration have been described, alongside increased circulating anti-angiogenic factors such as soluble fms-like tyrosine kinase-1 (sFlt-1), which may further impair endothelial function.

Oral hydration therapy (OHT) represents a potentially scalable, home-based, non-pharmacological intervention that could improve plasma volume, renal perfusion and uteroplacental blood flow. Given its feasibility and low cost, OHT may be particularly relevant in low-resource settings if it can reduce the incidence or severity of HDP or improve associated outcomes such as edema, proteinuria, urinary tract infection and oligohydramnios.

Aim and objectives

Aim: To evaluate the effect of oral hydration therapy on prevention of gestational hypertension and preeclampsia.

Primary objective: To study maternal (and selected perinatal) outcomes among pregnant women receiving oral hydration therapy.

Secondary objectives: To compare the incidence of gestational hypertension/preeclampsia between women receiving OHT and those not receiving OHT; to assess oligohydramnios and the response to OHT; and to evaluate the effect of OHT on prevention of urinary tract infection symptoms.

Methods

Study design and setting: A prospective, randomized, comparative study was conducted among antenatal women attending NRI Institute of Medical Sciences.

Participants: Antenatal women aged 18–40 years with singleton pregnancy between 16–20 weeks of gestation and willing to provide informed consent were eligible. Women with pre-existing medical disorders and women with recurrent pregnancy loss due to unknown etiology were excluded.

Randomization and groups: Participants were randomly allocated into two groups: (1) OHT group (n=100) and (2) control group (n=100).

Intervention: Women in the OHT group were counselled to consume at least 3 liters of water per day. They were advised to measure 3 liters and consume it over 24 hours, consistently from 20 weeks' gestation until term. At each routine antenatal visit, adherence was enquired and reinforced.

Follow-up and data collection: At each visit, blood pressure (BP) and weight were recorded and women were assessed for edema and urinary symptoms. When urinary symptoms were present, routine urine examination was performed. Hemoglobin and glucose challenge test were performed at booking and repeated in the third trimester as per routine care. Participants were followed until delivery and through the postpartum period, during which BP was recorded and urinary symptoms were asked.

Outcomes: The primary outcome was development of pregnancy-induced hypertension/preeclampsia at term. Secondary outcomes included change in systolic BP, severity of pedal edema, urine albumin dipstick grading, urinary frequency, reported urinary tract infection (UTI) symptoms, and AFI category at delivery.

Statistical analysis: Categorical variables were compared using chi-square tests (including chi-square for trend where applicable). Continuous variables were analyzed using paired Student's t-test for within-group comparisons and independent t-tests for between-group comparisons. A p-value <0.05 was considered statistically significant.

Ethics: Institutional ethics approval and written informed consent were obtained (approval number: IEC/NRI/110/2024).

Results

A total of 200 women were enrolled and analyzed (100 in the OHT group and 100 controls). Baseline age and gravidity distribution were comparable between groups (Tables 1 and 2).

Table 1. Age distribution of study participants

Age (years)	OHT group (n=100)	Control group (n=100)
19-25	49	48
26-30	40	41
30-35	10	9
>35	1	2

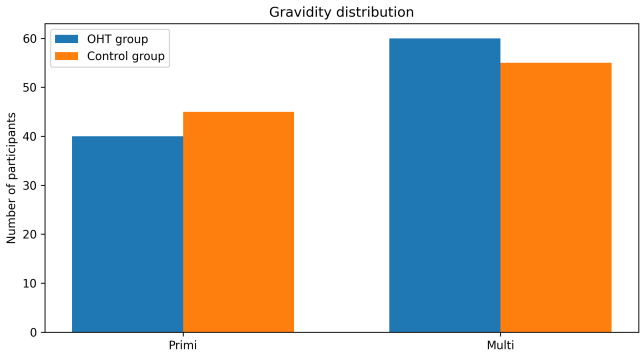
Chi-square test: $\chi^2=1.42$, df=2, p=0.49.

The Chi-square test showed no statistically significant difference in age distribution between groups (χ^2 = 1.42, df = 2, p = 0.49), indicating baseline comparability.

Table 2. Gravidity distribution

Gravidity	OHT group (n=100)	Control group (n=100)
Primigravida	40 (40%)	45 (45%)
Multigravida	60 (60%)	55 (55%)

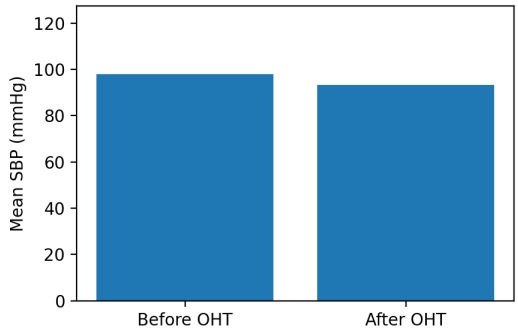
Chi-square test: $\chi^2=0.36$, df=1, p=0.55.



The difference in gravidity distribution between groups was not statistically significant (χ^2 = 0.36, df = 1, p = 0.55).

Table 3. Systolic blood pressure before and after oral hydration therapy (OHT)

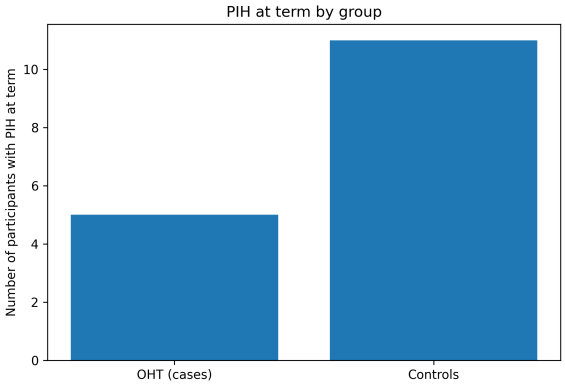
Measure	OHT group (n=100)
Mean systolic BP before OHT (mmHg)	98.0 ± 6.2
Mean systolic BP after OHT (mmHg)	93.3 ± 5.8
Paired t-test	t=6.21, df=99, p<0.001



Systolic blood pressure decreased significantly in the OHT group after initiation of therapy (Table 3).

Table 4. Incidence of pregnancy-induced hypertension/preeclampsia at term

Outcome at term	OHT group (n=100)	Control group (n=100)
Pregnancy-induced hypertension / preeclampsia, n (%)	5 (5.0%)	11 (11.0%)
Chi-square test	χ^2=4.02, df=1, p=0.045	

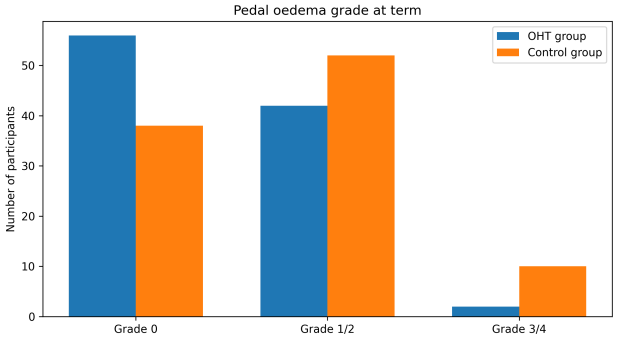


The incidence of pregnancy-induced hypertension/preeclampsia at term was significantly lower in the OHT group compared with controls (Table 4).

Table 5. Pedal edema grading at term

Pedal edema grade	OHT group (n=100)	Control group (n=100)
Grade 0	56	38
Grade 1-2	42	52
Grade 3-4	2	10

Chi-square for trend: χ^2=6.18, p=0.013.

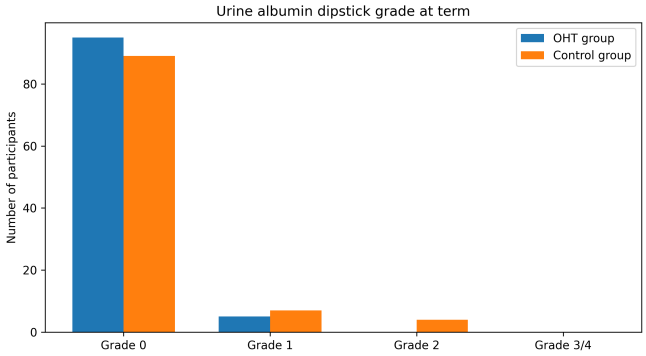


Severity of pedal edema was lower among women receiving OHT compared with controls (Table 5).

Table 6. Urine albumin dipstick grading at term

Urine albumin dipstick	OHT group (n=100)	Control group (n=100)
Negative (Grade 0)	95	89
1+	5	7
2+	0	4
3+	0	0

Chi-square test: χ^2=5.67, df=1, p=0.017.



Urine albumin dipstick positivity was lower in the OHT group (Table 6).

Table 7. Blood pressure category distribution at term (counts, n=100 per group).

Gest. age	BP <120/80 mmHg		BP 121/81-140/90 mmHg		BP >140/90 mmHg	
	Cases	Controls	Cases	Controls	Cases	Controls
Term	45	34	50	55	5	11

Note: Chi-square test reported χ^2=4.02, df=1, p=0.045.

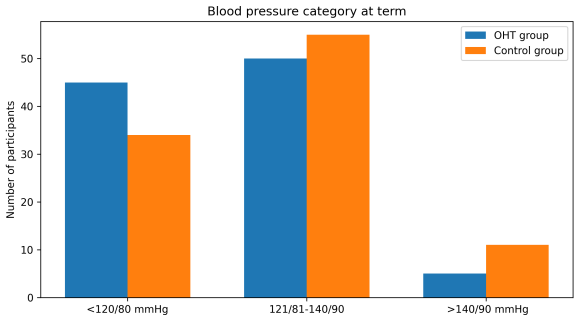


Table 8a. Urine output frequency at term

Urine output frequency at term	OHT group (n=100)	Control group (n=100)
<5 times/day	10	51
5-10 times/day	83	44
10-15 times/day	7	5

Chi-square test: $\chi^2=12.84$, df=2, p=0.002.

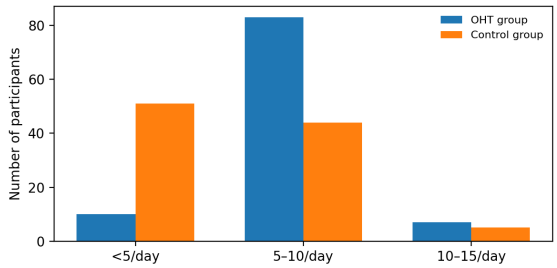


Table 8b. Reported urinary tract infection symptoms at term

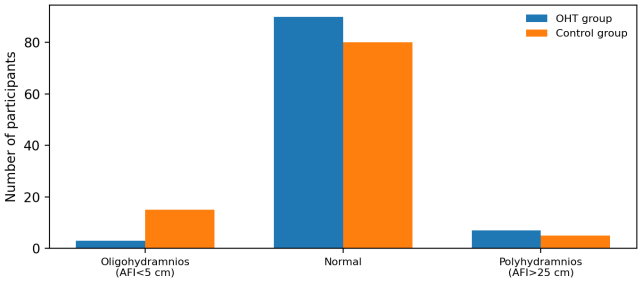
Urinary tract infection symptoms at term	OHT group (n=100)	Control group (n=100)
Reported UTI symptoms, n (%)	4 (4.0%)	15 (15.0%)

Women receiving OHT reported higher urinary frequency and fewer UTI symptoms at term (Tables 8a and 8b).

Table 9. AFI category at delivery (term)

AFI category at delivery (term)	OHT group (n=100)	Control group (n=100)
Oligohydramnios (AFI <5 cm)	3	15
Normal AFI	90	80
Polyhydramnios (AFI >25 cm)	7	5

Reported independent t-test for mean AFI at delivery: t=2.94, df=198, p=0.004.



At delivery, oligohydramnios (AFI <5 cm) was less frequent in the OHT group compared with controls (Table 9).

Effect estimate: The absolute risk reduction for pregnancy-induced hypertension/preeclampsia at term was 6.0% (11.0% to 5.0%), corresponding to a risk ratio of 0.45 and an approximate number needed to treat of 17.

Table 10: Comparison of neonatal outcome in the study population

Neonatal outcome	Cases (n=100)	Controls (n=100)
Live births	100	100
Still birth	0	0
Preterm neonates(<37weeks)	2	6
Term neonates(>37weeks)	98	94
Low birth weight (<2.5kgs)	5	10
Very low birth weight(<1.5kgs)	-	-
APGAR score <7 at 1min	3	7
APGAR score <7 at 5 min	-	-
Respiratory distress	10	17

The incidence of preterm delivery (< 37 weeks) was lower among cases (2%) compared to controls (6%), while term deliveries (>37 weeks) were more frequent in the case group (88%) than in controls (94%).

LBW neonates (<2.5kgs) were observed less frequently in cases (5%) compared to controls (10%). There were no VLBW neonates in either groups.

An APGAR score<7 at 1 minute was noted in 3% of neonates in the case group and 7% in the control group, while no neonates in either group had an APGAR score <7 at 5minutes.

Respiratory distress was observed in 10% of neonates in the case group compared to 17% in the control group.

Overall, neonatal outcomes appeared numerically better in the case group compared to controls; however, these differences were not subjected to formal statistical testing.

Discussion

In this randomized comparative study, oral hydration therapy (at least 3 liters/day from 20 weeks' gestation) was associated with a statistically significant reduction in pregnancy-induced hypertension/preeclampsia at term (5% vs 11%) and a significant reduction in mean systolic blood pressure within the OHT group. The findings suggest that improving maternal hydration and plasma volume may have favorable effects on maternal hemodynamics and downstream clinical indicators such as edema and proteinuria.

Potential mechanisms: Preeclampsia is associated with vasospasm, haemoconcentration and reduced organ and uteroplacental perfusion. Elevated circulating anti-angiogenic factors such as soluble fms-like tyrosine kinase-1 (sFlt-1) and soluble endoglin (sEng) antagonize the actions of key pro-angiogenic factors, including vascular endothelial growth factor (VEGF) and placental growth factor (PlGF), leading to widespread endothelial dysfunction. With sustained oral fluid intake, fluids enter the vascular compartment, potentially increasing plasma volume, improving renal excretion and uteroplacental perfusion and increasing urine output. These proposed mechanisms remain hypothetical and were not directly assessed in the present study.

Comparison with literature: Hydration-based interventions have been explored in obstetric settings, including improvement of amniotic fluid volume in isolated oligohydramnios. Our observation of fewer oligohydramnios cases at delivery among women receiving OHT is consistent with prior reports that maternal hydration can improve AFI. Similarly, prior small studies in hypertensive disorders suggest that optimization of intravascular volume may improve blood pressure profiles and maternal symptoms.

Clinical relevance: OHT is inexpensive, non-invasive and can be incorporated into routine antenatal counselling. While OHT should not replace evidence-based prevention strategies (e.g., risk-based low-dose aspirin) or standard antenatal surveillance, it may serve as an adjunct, particularly in low-resource settings where scalable interventions are needed.

Strengths and limitations: Strengths include prospective follow-up through delivery and evaluation of multiple clinically relevant indicators. Limitations include reliance on self-reported fluid intake and the absence of objective daily urine output measurement, which limits adherence assessment.

Conclusion

Oral hydration therapy (≥3 liters/day) from mid-pregnancy was associated with a reduced incidence of pregnancy-induced hypertension/preeclampsia at term and improved maternal indicators such as edema, urine albumin positivity, urinary symptoms and oligohydramnios. OHT is a simple, low-cost adjunct that may be incorporated into routine antenatal care, alongside standard monitoring and established preventive strategies.

Declarations

Ethics approval and consent to participate: Institutional ethics approval was obtained (IEC approval number: IEC/NRI/110/2024. Informed consent was obtained from all participants.

Consent for publication: Not applicable.

Availability of data and materials: The dataset is available from the corresponding author on reasonable request.

Competing interests: The authors declare no competing interests.

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