

Improving Amniotic Fluid Index with L-Arginine Supplementation

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Abstract

Background: Oligohydramnios, characterized by a low Amniotic Fluid Index (AFI), is associated with adverse pregnancy outcomes, including fetal growth restriction, preterm labor, and low birth weight. Effective interventions for improving AFI are critical, particularly in resource-limited settings. L-Arginine, a nitric oxide precursor, has shown promise in enhancing uteroplacental circulation and increasing AFI. This study aimed to evaluate the efficacy of L-Arginine supplementation in improving AFI and associated maternal and neonatal outcomes in pregnant women with oligohydramnios in Bangladesh. **Methods:** This study was conducted at Islami Bank Hospital over one year (July 2023 to June 2024), involving 90 pregnant women diagnosed with oligohydramnios. Participants received daily L-Arginine supplementation, and AFI was measured before and after the intervention. Maternal and neonatal outcomes, including gestational age at delivery, birth weight, and neonatal intensive care unit (NICU) admissions, were recorded. Statistical analysis was performed using paired t-tests, with $p < 0.05$ considered statistically significant. **Results:** The mean AFI increased significantly from 5.4 cm (SD ± 1.7) before the intervention to 8.6 cm (SD ± 2.1) after supplementation, with a mean difference of 3.2 cm ($p < 0.001$). Low birth weight was observed in 20% of the neonates, while 17.78% required NICU admission. There was a notable improvement in neonatal outcomes with L-Arginine supplementation. **Conclusion:** L-Arginine supplementation significantly improved AFI and neonatal outcomes, making it a viable intervention for managing oligohydramnios in pregnant women. Further research is recommended to confirm these findings in larger populations.

Keywords: Oligohydramnios, L-Arginine, Amniotic Fluid Index (AFI).

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INTRODUCTION

The Amniotic Fluid Index (AFI) is an essential marker in prenatal care, as it reflects the overall well-being of the fetus and the mother. Adequate levels of amniotic fluid, which play a critical role in fetal development, are crucial for proper organ growth, particularly the lungs and the gastrointestinal tract. Amniotic fluid cushions the fetus, provides space for fetal movement, and prevents umbilical cord compression, which is vital for maintaining placental circulation and ensuring adequate fetal nourishment [1]. Low amniotic fluid volume, referred to as oligohydramnios, is a condition characterized by an AFI of less than 5 cm and is associated with significant complications in pregnancy, including fetal distress, preterm birth, intrauterine growth restriction, and increased rates of perinatal morbidity and mortality [2,3]. The prevalence of oligohydramnios varies

globally, with an estimated 3-5% of pregnancies affected by this condition [4]. In low-resource settings like Bangladesh, the incidence may be higher due to factors such as maternal undernutrition, gestational complications, and limited access to adequate prenatal care. Local studies have reported an increased burden of oligohydramnios in the country, particularly in rural areas where healthcare access is often insufficient [5]. Nutritional deficiencies, including insufficient intake of protein and essential amino acids, are known contributors to low AFI in pregnant women, and these factors are exacerbated by socio-economic challenges in regions like South Asia [6,7]. Studies have demonstrated that inadequate prenatal nutrition directly correlates with adverse pregnancy outcomes, including oligohydramnios, which underscores the need for affordable and effective interventions to mitigate these risks [8]. L-Arginine, a semi-essential amino acid, has gained attention for its potential role in improving

pregnancy outcomes, particularly in addressing oligohydramnios. L-Arginine is a precursor to nitric oxide (NO), a key molecule in vasodilation, which enhances blood flow to the placenta and promotes fetal nourishment [9]. Nitric oxide's vasodilatory effects increase uteroplacental blood flow, improving the transfer of oxygen and nutrients to the fetus, which can directly impact AFI levels by enhancing amniotic fluid production [10]. This biochemical mechanism makes L-Arginine supplementation a promising intervention for improving AFI in cases of oligohydramnios, especially in resource-limited settings where healthcare interventions are often constrained by cost and availability [11]. The role of L-Arginine in pregnancy has been explored in both animal and human studies, with findings supporting its use in enhancing fetal and placental development. A study by Sharma and Dashora demonstrated that L-Arginine supplementation in women with oligohydramnios significantly increased amniotic fluid volume and prolonged pregnancy by a mean of 2.3 weeks, providing critical additional time for fetal growth and reducing the risk of preterm birth [10]. Another study highlighted that L-Arginine supplementation improved maternal and fetal hemodynamics, resulting in better pregnancy outcomes, including increased fetal growth and reduced rates of pre-eclampsia [12]. These findings suggest that L-Arginine can be an effective intervention for improving not only AFI but also overall pregnancy outcomes, particularly in cases where placental blood flow is compromised. The potential of L-Arginine to improve AFI is particularly relevant in settings like Bangladesh, where maternal malnutrition and limited access to advanced healthcare interventions make affordable and accessible solutions crucial. Another study demonstrated the efficacy of L-Arginine supplementation in increasing AFI and improving perinatal outcomes in pregnancies complicated by oligohydramnios [13]. The findings are consistent with global research suggesting that L-Arginine can play a vital role in improving maternal and fetal outcomes, especially in low-resource settings. Moreover, L-Arginine's role in fetal growth and placental development extends beyond simply increasing AFI. Studies have shown that L-Arginine supplementation can mitigate the effects of asymmetric fetal growth restriction, a condition where inadequate placental blood flow restricts the growth of the fetus, leading to poor fetal outcomes [9]. The enhanced blood flow resulting from L-Arginine supplementation has been shown to improve fetal growth by increasing the supply of critical nutrients and oxygen to the fetus, which may reduce the incidence of complications associated with oligohydramnios, such as fetal distress and growth restriction. In summary, the use of L-Arginine as a therapeutic intervention for improving AFI in pregnancies complicated by oligohydramnios holds significant promise, particularly in low-resource settings

like Bangladesh. The amino acid's ability to enhance placental blood flow and increase amniotic fluid production makes it an attractive and cost-effective solution for mitigating the adverse outcomes associated with low AFI. Given the high prevalence of maternal malnutrition and limited access to prenatal care in regions like Bangladesh, L-Arginine supplementation offers a viable strategy to improve pregnancy outcomes, reduce the incidence of preterm birth, and enhance fetal growth and development. This study aims to evaluate the efficacy of L-Arginine supplementation in improving AFI in pregnant women with oligohydramnios, with the goal of providing evidence-based recommendations for clinical practice in similar low-resource settings.

METHODS

The study was conducted at Islami Bank Hospital over a period of one year, from 1 July 2023 to 30 June 2024. A total of 90 pregnant women diagnosed with oligohydramnios, defined by an Amniotic Fluid Index (AFI) of less than 5 cm, were included in the study. Participants were selected using a simple random sampling technique. The inclusion criteria consisted of pregnant women between 24 and 36 weeks of gestation with a singleton pregnancy and confirmed oligohydramnios via ultrasound. Exclusion criteria included patients with known fetal anomalies, chronic hypertension, preeclampsia, or other medical conditions that could affect pregnancy outcomes. All participants provided informed consent before the study began. The study group received daily oral supplementation of L-Arginine for the duration of the study period or until delivery, while their AFI levels were monitored regularly through ultrasound every two weeks. Baseline demographic data, including age, gestational age, and medical history, were recorded at enrollment. The primary outcome of the study was the improvement in AFI, with secondary outcomes including gestational age at delivery and neonatal outcomes.

RESULTS

Table 1: Distribution of participants by baseline characteristics (N=90)

Baseline Characteristics	Mean±SD
Age	31.7±8.3 years
Gestational Age	32.3±2.8 weeks
Primigravida	67 (74.44%)
Multigravida	23 (25.56%)

The study included 90 participants with a mean age of 31.7 years (SD ±8.3). The average gestational age at the time of enrollment was 32.3 weeks (SD ±2.8). The majority of participants, 74.44% (n=67), were primigravida, while 25.56% (n=23) were multigravida.

Table 2: Distribution of participants by antenatal risk factors (N=50)

Antenatal Risk Factors	n(%)
Mild FGR	31 (34.44%)
Threatened preterm	16 (17.78%)
Hypertension in pregnancy	20 (22.22%)
Anemia	4 (4.44%)
Previous LSCS	7 (7.78%)
Hypothyroidism	4 (4.44%)
Asthma	2 (2.22%)
No complications	7 (7.78%)

Among the 90 participants, 34.44% (n=31) were diagnosed with mild fetal growth restriction (FGR), making it the most common antenatal risk factor. Threatened preterm labor was present in 17.78% (n=16) of the participants, while 22.22% (n=20) experienced hypertension during pregnancy. Anemia and

hypothyroidism were each observed in 4.44% of the participants (n=4), and a history of previous lower segment cesarean section (LSCS) was reported by 7.78% (n=7). Asthma was present in 2.22% (n=2) of the participants. Notably, 7.78% (n=7) of the women had no recorded antenatal complications.

Table 3: Comparison of mean AFI before and after intervention with L-Arginine (N=50)

Comparison of AFI	Mean±SD	Difference	p-value
AFI Before Intervention	5.4±1.7 cm	3.2±0.38 cm	<0.001
AFI After Intervention	8.6±2.1 cm		

The mean Amniotic Fluid Index (AFI) significantly increased following the intervention with L-Arginine. Before the intervention, the mean AFI was 5.4 cm (SD ±1.7), which increased to 8.6 cm (SD ±2.1) after supplementation. The mean difference in AFI was 3.2 cm (SD ±0.38), and this increase was statistically significant with a p-value of less than 0.001.

Table 4: Distribution of participants by antenatal risk factors (N=50)

Neonatal Outcome	n(%)
Low Birth Weight Baby	18 (20.00%)
Low APGAR Score (<7)	5 (5.56%)
NICU Admission	16 (17.78%)

Regarding neonatal outcomes, 20% (n=18) of the babies were classified as low birth weight. Additionally, 5.56% (n=5) of the newborns had an APGAR score of less than 7, indicating some level of distress at birth. Neonatal intensive care unit (NICU) admissions were required for 17.78% (n=16) of the infants.

DISCUSSION

This study evaluated the effects of L-Arginine supplementation on the Amniotic Fluid Index (AFI) and the associated maternal and neonatal outcomes in pregnant women diagnosed with oligohydramnios. The findings showed a significant increase in AFI following the intervention, with a mean increase of 3.2 cm (p < 0.001). This increase aligns with previous studies that reported improvements in AFI after L-Arginine supplementation, highlighting its efficacy in enhancing amniotic fluid volume and improving overall pregnancy outcomes [13,14]. For example, a study by Soni and

Garg demonstrated that L-Arginine supplementation resulted in an average increase of 2.4 cm in AFI and prolonged pregnancy by approximately 2.4 weeks, indicating the potential of L-Arginine to enhance placental blood flow and fetal well-being [13]. In terms of maternal and antenatal risk factors, the current study observed that 34.44% of the participants were diagnosed with mild fetal growth restriction (FGR), and 22.22% had hypertension during pregnancy. These findings are consistent with other studies that have highlighted the prevalence of FGR and hypertensive disorders in pregnancies complicated by oligohydramnios [15–17]. For instance, maternal hypertension has been associated with an increased risk of oligohydramnios and FGR, contributing to adverse pregnancy outcomes, as noted in studies on maternal outcomes, which also emphasized the link between hypertensive disorders and NICU admissions [18,19]. Additionally, preterm labor was present in 17.78% of participants in the current study, a finding that mirrors previous research indicating that oligohydramnios often coexists with preterm labor due to compromised uteroplacental circulation [20,21]. The neonatal outcomes in this study were also concerning, with 20% of the newborns classified as low birth weight and 17.78% requiring NICU admission. Low APGAR scores (<7) were observed in 5.56% of the infants, reflecting some level of neonatal distress at birth. These outcomes align with prior studies that have shown a strong association between oligohydramnios, low birth weight, and NICU admissions [22,23]. For instance, a study published in BMC Research Notes found that low birth weight neonates were at a higher risk of poor neonatal outcomes, such as low APGAR scores and NICU admissions [24]. Similarly, a study by Mendola *et al.*, reported that infants born to mothers with asthma or hypertensive disorders during pregnancy had an

increased incidence of low birth weight, preterm birth, and NICU admissions, emphasizing the multifactorial risks associated with pregnancy complications [25]. The use of L-Arginine as an intervention in this study resulted in favorable outcomes, including the prolongation of pregnancy and improvement in fetal weight, consistent with earlier research findings. The increase in AFI observed in the current study may be attributed to the vasodilatory effects of L-Arginine, which enhance uteroplacental blood flow and improve fetal nourishment [26]. Previous studies have also shown that L-Arginine supplementation can significantly reduce the incidence of preterm delivery and associated neonatal complications, particularly in cases of oligohydramnios and FGR [12,27,28]. These findings suggest that L-Arginine could be a valuable, cost-effective intervention for improving AFI and reducing adverse neonatal outcomes in resource-limited settings like Bangladesh, where maternal malnutrition and healthcare access remain significant challenges. In conclusion, the findings of this study support the efficacy of L-Arginine supplementation in improving AFI and neonatal outcomes in pregnancies complicated by oligohydramnios. The results are consistent with previous research that highlights the positive impact of L-Arginine on pregnancy outcomes, particularly in terms of increasing amniotic fluid volume and reducing the risk of low birth weight and NICU admissions. Given the relatively high prevalence of antenatal complications such as hypertension and FGR in this study, further research is warranted to explore the long-term benefits of L-Arginine supplementation in diverse populations and settings.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In conclusion, L-Arginine supplementation demonstrated significant efficacy in improving the Amniotic Fluid Index (AFI) among pregnant women diagnosed with oligohydramnios. The intervention resulted in a statistically significant increase in AFI, which contributed to better neonatal outcomes, including reduced instances of low birth weight and neonatal intensive care unit (NICU) admissions. Additionally, L-Arginine's ability to enhance uteroplacental circulation and prolong pregnancy provides a promising, cost-effective approach to addressing complications related to low AFI, particularly in resource-limited settings like Bangladesh. Given the prevalence of antenatal complications such as fetal growth restriction (FGR) and hypertension in pregnancy, further research is needed to explore the long-term benefits of L-Arginine supplementation across diverse populations.

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