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Research Article

JOURNAL OF PEDIATRICS, PERINATOLOGY AND CHILD HEALTH

ISSN: 2641-7405

# Effect of Umbilical Cord Clamping time of Term Infants on Maternal and Neonatal Outcome

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## Abstract

**Background:** The optimal timing of cord clamping has been controversial for decades, and its effect on maternal and fetal outcomes still needs to be elucidated. Therefore, the present study was planned to evaluate the impact of early versus delayed cord clamping on maternal and neonatal outcomes.

**Methods:** This cross-sectional study was conducted at the Department of Gynecology & Obstetrics in Sir Salimullah Medical College Mitford Hospital for months following protocol approval. Data from 100 pregnant mothers with term pregnancy, irrespective of mode of delivery, were collected and analyzed using SPSS version 23.0. Results were presented in the form of tables and graphs. Before interviewing and hospital record analysis, written informed consent was taken from each subject, and ethical issues were appropriately ensured.

**Results:** The mean age of both the Delayed cord clamping (DCC) and Early cord clamping (ECC) groups had no difference (28.14±3.28 vs 28.40±3.12; p=0.547). The Majority of respondents underwent NVD in both groups (74% vs 68%, p=0.330). There was no significant difference in APGAR scores across both groups at 1 and 5 minutes (p>0.05). Blood transfusion amount (ml/kg 1) was higher in the early clump group (140.26±24.88 vs 164.40±27.34; p<0.01). Following birth, there was a significant increase in infants needing phototherapy for jaundice, as evidenced by hyperbilirubinemia (p<0.05). There is a substantial difference in anemia (p<0.05), and infant ferritin levels remained higher in the late clamping group than in the early clamping group (p<0.05). Admission to NICU was lower among the DCC group than ECC (12% vs 6%; p<0.05). Maternal Hb and ferritin levels were higher in the DCC group (p<0.05), with no significant difference in the incidence of PPH (p>0.05).

**Conclusion:** Delated clumping is relatively beneficial regarding maternal and fetal outcomes. However, before concluding, further study is recommended.

**Keywords:** Umbilical cord; Clamping; Term infants; Maternal and neonatal

## Introduction

Pregnancy is a complex physiological process, and its outcome depends on multiple integrated factors. Active management of the third stage of labor is the key to the safe fourth stage and post-partum period to reduce the risk of post-partum hemorrhage [1]. These interventions include administering uterotonic drugs, cutting cord clamping, and controlling cord traction. The WHO has integrated these interventions as active management of the third stage

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**Citation:** Afreen Kabir Kheya, Fathima Sultana, Lizwana Nusrat Lia, Rezwan Sultana, Jasmin Ara Zaman. Effect of Umbilical Cord Clamping time of Term Infants on Maternal and Neonatal Outcome. Journal of Pediatrics, Perinatology and Child Health. 8 (2024): 62-68.

**Received:** March 27, 2024
**Accepted:** April 12, 2024
**Published:** May 03, 2024

Kheya AK, et al., J Pediatr Perinatol Child Health 2024
DOI:10.26502/jppch.74050182

of labor (AMTSL). Since the mid-18th century, the timing of umbilical cord clamping has been, and still is, the focus of controversy [2]. In the past decades, early cord clamping had markedly prevailed. Later on, several randomized controlled trials have demonstrated the benefits of delayed cord clamping (at 1-5 minutes) [3-5]. WHO has conducted numerous research studies to evaluate the effectiveness of each AMTSL component, revealing that benefits from early cord clamping and controlled cord traction are still controversial. Now, WHO recommends delayed cord clamping for all births while initiating simultaneous newborn care [5]; early cord clamping (ECC) usually means clamping and cutting it within 30 seconds of delivery of the baby, whereas delayed cord clamping (DCC) means delayed clamping of the cord greater than 1 minute to maximum 5 minutes after delivery or when the cord pulsation has ceased. Some studies consider DCC if cut after 30 seconds [6]. Delayed cord clamping has been practiced in obstetrics based on the recommendations made by scientific societies and in systematic reviews, which have provided solid evidence to support this practice in term infants [7,8]. Placental transfusion is the transfer of blood from the placenta to the infant. At 1 minute, newborns receive 80 mL of blood; at 2-3 minutes, 100 mL, accounting for approximately 30-35 mL/kg, a volume that is 75% higher than with early clamping [8]. Iron deficiency in the early stages may harm the central nervous system and result in neurocognitive disorders [9]. In addition, iron deficiency is the leading cause of anemia, a severe condition in developing countries, although less serious in developed countries. The presence of early anemia was observed to be significantly higher among newborn infants with early cord clamping [10]. Mercer et al. [12] have demonstrated that cord clamping timing is incredibly relevant for the time of the first breath and other significant aspects of the physiological adaptation to extra-uterine life. Narenda et al. studied the influence of delayed cord clamping on ventilation and cardiovascular and cerebral hemodynamic stability. Their results showed that cardiovascular function improved markedly when clamping was postponed, at least until after the first breath and cerebral hemodynamic stability were achieved. There is a growing trend of encouraging resuscitation of term infants while leaving the cord unclamped. It was found that the APGAR score at 1 minute was higher (≥7) among term infants subjected to delayed cord clamping [11]. Also, there was a remarkable reduction in term infants requiring supplemental oxygen and ventilation at birth. In 2014, Mathew JL et al. published the first study that assessed the impact of early and delayed clamping on oxidative stress. Results were conclusive and demonstrated that all protective elements measured in the study were significantly higher among term infants with delayed cord clamping. However, these potential benefits must be balanced against possible harmful effects for the mother and infant. Disadvantages of delayed clamping are increased risk of hypervolemia, hyperviscosity, polycythemia, respiratory symptoms, and hyperbilirubinemia [12]. On the other hand, early cord clamping Is associated with less respiratory distress in the newborn, and more stem cells can be collected from the cord blood [13]. In Bangladesh, several studies have been done in this field. Mitra et al. [14] researched the timing of cord clamping and its effect on hematocrit and the clinical outcomes of neonates [14]. Haque et al. also contributed to this field. Even then, no unanimous practice was established, nor were national guidelines made to standardize this practice. In this study, an endeavor will be made to compare early versus delayed cord clamping in terms of various maternal and neonatal outcome parameters.

## Methodology and Materials

This cross-sectional analytical study was conducted at the Obstetrics & Gynaecology department of Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh. During the six months from January 2015 to June 2015, a total of 100 women were enrolled and analyzed in this study. Before the commencement of the study, formal ethical approval was obtained from the ERC of SSMC and informed written consent was obtained from the patients and guardians. All data were collected by a preplanned questionnaire from 100 pregnant women with term pregnancy, irrespective of mode of delivery, ensuring inclusion and exclusion criteria. The sample was divided into two groups: 50 with Early Cord Clamping (ECC) and 50 with Delayed Cord Clamping (DCC).

### Inclusion criteria:

Pregnant women with gestational age between 37 to 42 weeks completed without any obstetric complications.

### Exclusion criteria:

Pregnant woman with any obstetric complications like pre-eclampsia or eclampsia, ante or intrapartum hemorrhage, prolonged or obstructed labor, Rh incompatibility, preterm infants, evident infection or sepsis, etc.

### Data processing and analysis:

Data were purposely collected in semi-structured case record form. The researcher herself conducted the interview and recorded the collected data. Following checking the data and removing all the inconsistencies, all data were transferred into a spreadsheet of statistical software. Data analysis was done using SPSS 23.0 (IBM Inc., Armonk, NY, USA). The procedures involved were transcription, preliminary data inspection, content analysis, and interpretation. Data were presented as the proportion of valid cases for discrete variables and as means±standard deviations for continuous variables, and the frequencies of categorical variables were presented as percentages. The chi-square test was used to compare the proportions of categorical variables, and the

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DOI:10.26502/jppch.74050182

student t-test was used to compare the mean of continuous variables. A P value < 0.05 was considered significant.

## Result

Table 1 shows the demographical characteristics of the study population where: 54% of respondents were aged between 26 to 31 years, 24% were 20 to 25 years, 22% were between 32 to 36 years in the DCC group, and 52% of respondents were age between 26 to 31 years, 26% were 32 to 36 years and 22% were 20 to 25 years in ECC group. There was no significant difference among the two groups (p=0.547). Among the ECC group, 88% were housewives, 12% were Service holders, and among the DCC group, 82% were housewives, and 18% were service holders. There was no significant difference among the two groups (p=0.401). Table 1 also shows that in the DCC group, the highest no of respondents' monthly income was between 20-30k, the percentage of which was 38%, & the lowest no of respondents' monthly income was between 5-10k, 4%. In the ECC group, the highest no was between 20-30k, the percentage was 44% & the lowest no was between 5-10K taka, which was 6%. Table 2 shows that 74% of respondents underwent NVD, 26% underwent LUCS in the DCC group, 68% underwent NVD, and 32% experienced LUCS in the DCC group. There was no significant difference among the two groups (p=0.330). Table 3 shows that 88% of the respondents have taken iron supplements In the DCC group, and 92% have taken iron supplements in the ECC group during pregnancy. No significant difference was found between the two groups (p=0.505). Table 4 shows 42% had Gravida 1, 34% had Gravida 2, and 24% had >2 Gravida in the DCC group, whereas 48% had Gravida 1, 30% had Gravida 2, and 22% had >2 Gravida in the ECC group no statistical differences were found in both groups (p=0.832). Table 5 shows Hematocrit mean value of 45.02±1.81 at four hours, 41.69±1.24 at two weeks, 36.38±1.11 at four weeks, and 34.7±2.09 at six weeks, and 32.50±1.66 before discharge in DCC group. At the same time, the Hematocrit mean value was 40.72±2.13 at four hours, 37.45±1.52 at two weeks, 35.60±0.99 at four weeks, 33.51±0.95 at six weeks, and 31.52±0.86 before discharge in ECC group. Table 6 shows Apgar's mean score at 1 min was 4.03±0.67, and Apgar's score at 5 min was 6.02±1.06 in the DCC group. Apgar mean score at 1 min was 4.56±0.77, and Apgar's mean score at 5 min was 6.18±0.92 in the DCC group. Bar diagram showing 72% male baby and 28% female baby in DCC group. 68% were male baby and 32% female baby in ECC group. No statistical difference between two groups (Figure 1). Table 7 shows the mean birth weight was 1055.60±880, Gestation weeks 26.96±1.86, Blood transfused 140.26±24.88 ml/kg-1, and SGA was 1 in the DCC group. The mean birth weight was 936.46±624.74, Gestation weeks 26.80±1.71 Blood transfused 164.40±27.34ml/kg-1, and SGA was 2 in the ECC group. Both groups had a highly significant difference between birth weight and blood transfusion groups01). Ferritin and bilirubin levels were significantly higher in the DCC group than in the ECC group, and anemia was considerably higher in the ECC group than in the DCC group. Table 8 shows the mean hemoglobin of the DCC group was 12.27±0.872, and maternal ferritin was 117±1, Whereas the mean hemoglobin of the ECC group was 13.48 and maternal ferritin was 80.78±1.16. There was a highly significant difference between both groups. Pie diagram showing that among the infants, 12% of DCC group were admitted in NICU and 6% of ECC group were admitted in NICU. There is a significant difference across the group (p<0.05) estimated by chi-square test (Figure 2). The maternal BMI of the DCC group was 23.62±1.53kg/m2, and the ECC group was 23.32±1.47kg/m2. There was no significant difference among both groups. Table 9 shows that 6% had PPH >500ml in the DCC and ECC groups, and 4% had severe maternal PPH >1000ml in the DCC group. There was no significant difference among both groups.

**Table 1:** Demographical characteristics of the study population.

| Variables | DCC (N=50) | | ECC (N=50) | | P value* |
|---|---|---|---|---|---|
| | n | % | n | % | |
| **Age group** | | | | | |
| 20-25 | 12 | 24 | 11 | 22 | 0.547* |
| 26-31 | 27 | 54 | 26 | 52 | |
| 32-36 | 11 | 22 | 13 | 26 | |
| Mean±SD | 28.14±3.28 | | 28.40±3.28 | | |
| Occupation | | | | | |
| Service Holder | 9 | 18 | 6 | 12 | - |
| Housewife | 41 | 82 | 44 | 88 | |
| **Monthly family income (BDT)** | | | | | |
| 5-10k | 2 | 4 | 3 | 6 | 0.912* |
| 10-20k | 10 | 20 | 10 | 20 | |
| 20-30k | 19 | 38 | 22 | 44 | |
| 30-40k | 13 | 26 | 11 | 22 | |
| Above 40k | 6 | 12 | 4 | 8 | |

**Table 2:** Distribution of the respondents by Methods of delivery.

| Method of delivery | DCC (N=50) | | ECC (N=50) | | P value* |
|---|---|---|---|---|---|
| | n | % | n | % | |
| NVD | 37 | 74 | 34 | 68 | 0.330* |
| LUCS | 13 | 26 | 16 | 32 | |

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DOI:10.26502/jppch.74050182

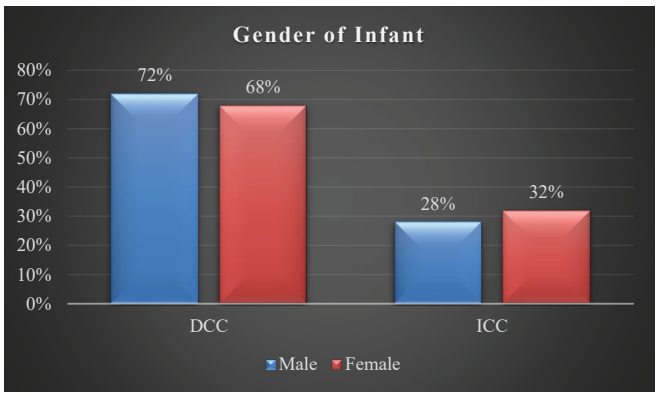


**Figure 1:** Distribution of infants by gender.

**Table 3:** Distribution of the respondents by Iron supplement during pregnancy.

| Iron supplement | DCC (N=50) | | ECC (N=50) | | P value* |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Yes | 44 | 88 | 46 | 92 | 0.505* |
| No | 6 | 12 | 4 | 8 | |

**Table 4:** Distribution of the respondents by Gravida.

| Gravida | DCC (N=50) | | ECC (N=50) | | P value* |
|---|---|---|---|---|---|
| | n | % | n | % | |
| 1 | 21 | 42 | 24 | 48 | 0.832* |
| 2 | 17 | 34 | 15 | 30 | |
| >2 | 12 | 24 | 11 | 22 | |

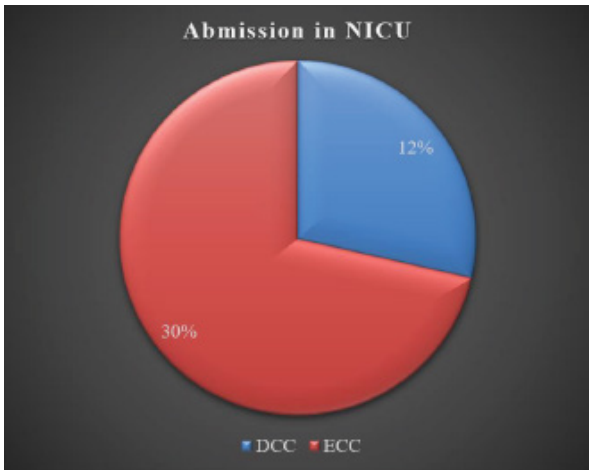


**Figure 2:** Distribution of the infants by Admission in NICU.

**Table 5:** Hematocrit values of study infants.

| Hematocrit value | DCC (N=50) | ECC (N=50) |
|---|---|---|
| | Mean±SD | Mean±SD |
| Four hours | 45.02±1.81 | 40.72±.2.13 |
| Two weeks | 41.69±1.24 | 37.45±1.52 |
| Four weeks | 36.38±1.11 | 35.60±0.99 |
| Six weeks | 34.7±2.09 | 33.51±0.95 |
| Before discharge | 32.50±1.66 | 31.52±0.86 |

**Table 6:** APGAR score of study infants.

| APGAR score | DCC (N=50) | ECC (N=50) | P value* |
|---|---|---|---|
| | Mean±SD | Mean±SD | |
| Apgar score at 1 min | 4.03±0.67 | 4.56±0.77 | 0.078 |
| Apgar score at 5 min | 6.02±1.06 | 6.18±0.92 | 0.06 |

**Table 7:** Infants gender and characteristics.

| Variables | DCC (N=50) | | ECC (N=50) | | P value* |
|---|---|---|---|---|---|
| | n | % | n | % | |
| **Gender of Infant** | | | | | |
| Male | 36 | 72 | 34 | 68 | - |
| Female | 14 | 28 | 16 | 32 | |
| | Mean±SD | | Mean±SD | | |
| Birth weight (g) | 1055.60±880 | | 936.46±624.74 | | <0.01* |
| Gestation (weeks) | 26.96±1.86 | | 26.80±1.71 | | 0.528* |
| Blood transfused ml/kg 1 | 140.26±24.88 | | 164.40±27.34 | | <0.01* |
| SGA (n) | 1 | 2 | 2 | 4 | 0.558* |
| **Investigations** | | | | | |
| Ferritin <200g/1 | 1 | 2 | 7 | 14 | 0.027* |
| Hyperbilirubinemia | 43 | 86 | 6 | 12 | <0.01* |
| Anaemia | 13 | 26 | 33 | 66 | <0.01* |
| **Abmission in NICU** | | | | | |
| Admitted | 6 | 12 | 3 | 6 | <0.05 |
| Not admitted | 44 | 88 | 47 | 94 | |

**Table 8:** Maternal Characteristics.

| Variables | DCC (N=50) | ECC (N=50) | P value* |
|---|---|---|---|
| | Mean±SD | Mean±SD | |
| BMI kg/m² | 23.62±1.53 | 23.32±1.47 | 0.655* |
| Maternal hemoglobin g/dl | 12.27±0.872 | 13.48 | <0.01* |
| Maternal ferritin (µg/l) | 117±1 | 80.78±1.16 | <0.01* |

**Table 9:** Distribution of the respondents by post-partum hemorrhage.

| Variables | DCC (N=50) | | ECC (N=50) | | P value* |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Maternal PPH>500-1000 ml | 3 | 6 | 3 | 6 | 0.661* |
| Severe maternal PPH >1000ml | 2 | 4 | 0 | 0 | 0.247* |

## Discussion

At birth, the infant is still attached to the mother via the umbilical cord, a part of the placenta. The infant is usually separated from the placenta by clamping the cord. The timing of umbilical cord clamping has been and still is a highly controversial issue worldwide, the controversy about the best time to clamp the cord. Delayed cord clamping (DCC) may be beneficial in very preterm and very low-birth-weight infants.

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DOI:10.26502/jppch.74050182

The study's main aim is to identify the effect of early and late cord clamping on newborns' blood analysis. In this study, the total number of respondents was 100. Among them, 50 respondents were from the delayed cord clamping group, and 50 were from the early cord clamping group. The mean age of the respondents in the DCC group was 28.14±3.28 years, and the ECC group was 28.40±3.12 years. There was no significant difference between the mean age, education, and occupation of both groups. A similar finding was observed in the previous study, where 540 women admitted to MNSC agreed to participate. Among them, 270 women were randomly assigned to cord clamping early, and 270 were assigned to cord clamping delayed. They found no significant difference between the ages of both groups [15]. In this study, we observed that the mean time of umbilical cord clamping in the DCC group was 9.30±3.12s, and the mean umbilical cord clamping in the ECC group was 37.86±3.72s. Two groups had a highly significant relationship (p<the 0.01groupsother study showed among 33 infants, the umbilical cords were clamped at 7.9±25.2s in the ICC group and 35.2±10.1s in the DCC group where p-value < 0.01 [16]. We also observed that the DCC group's mean birth weight was 1055.60±880. The mean Gestation week was 26.96±21.86, Blood transfused was 140.26±24.88 ml/kg 1 in the DCC group, and the mean birth weight was 936.46±624.74 in the ECC group. The mean Gestation week was 26 80±1.71, and Blood transfused 164.40±27.34ml/kg 1 in the ECC group. There was higher birth weight in the DCC group than in the ECC group, and blood transfusion was higher in the ECC group than in the DCC group. Both groups had a highly significant difference between birth weight and blood transfusion (p<0.01). SGA was 1 in the DCC group and 2 in the ECC group. The previous study observed a significant birthweight increase with late cord clamping compared with early cord clamping [15]. Another study by Prendiville et al. showed the average term infant weighs approximately 3500g at birth and has a blood volume of 80-85 ml/kg, which equates to approximately 290 ml. of blood volume. During placental transfusion, an additional 15-40 ml of blood volume per kg birthweight is transferred from the placenta to the infant through the umbilical cord.34 Therefore, waiting to clamp the umbilical cord and allowing placental transfusion to complete can increase a term neonate's blood volume by approximately 30-50% [17]. In this study, serum ferritin and bilirubin levels were significantly higher in the DCin the C than in the ECC group (p<0.01). In the previous study, they observed beyond the neonatal period that the main effect of comparing DCC versus ECC is that DCC leads to an increase in ferritin, which has been considered public health significance [18]. Another study showed that serum ferritin at six weeks of age was the primary outcome measure, and this showed a statistically significant increase in the DCC group's life [19]. We also found that anemia was significantly higher in the ECC group than in the DCC group (p<0.01). In the previous study, they also found that during the early neonatal period, there was less anemia in the delayed cord clamping group [20]. Another study by O. Andersson et al. [20] observed that Delayed clamping reduced neonatal anemia prevalence at two days of age without increasing the rate of respiratory symptoms [20]. We observed that the Hematocrit mean value was 45.02-1.81 at four hours, 41.69±1.24 at two weeks, 36.38±1.11 at four weeks, 34.7-2.09 at six weeks, and 32.50±1.66 before discharge in DCC group. Whereas Hematocrit mean value was 40.72-2.13 at four hours, 37.45±1.52 at two weeks, 35.60±0.99 at four weeks, 33.51±0.95 at six weeks, and 31.52+0.86 before discharge in ECC group. The hematocrit level was higher in the DCC group than in the ECC group (p<0.01). Similar findings were observed in the previous study [19]. Another study showed Venous hematocrit values were higher in the DCC group (44.9±7.8 vs 40.225.1 (s.d., P<0.05)). At 2, 4, and 6 weeks of age and at the time of discharge, hematocrit values were still higher in the DCC group, but the differences were not statistically significant [16]. We also observed that Apgar's mean score at 1 min was 4,03±0.67, and Apgar's score at 5 min was 6.02±1.06 in the DCC group. Apgar mean score at 1 min was 4.56±0.77, and Apgar's mean score at 5 min was 6.18±0.92 in the DCC group. Apgar score is higher in the DCC group than in the ECC group. A similar finding was observed in the previous studies. They showed that the two groups Apgar scores at 1 and 5 minutes were almost identical [16]. Another study showed Apgar scores at 1, 5, and 10 minutes were similar in the two groups [13]. In this study, we observed that 6% of infants in the ECC group needed to be admitted to the NICU, and 12% Of the DCC group needed to be admitted to the NICU. There was no statistical difference found in both groups. Another small pilot study in which 29 infants < 33 weeks' gestation received assisted ventilation during DCC observed a similar rate of NICU admission hypothermia compared with ECC [21]. The debate about when the umbilical cord should be clamped after birth has focused on the potential for a time-dependent net placental to infant blood transfusion. However, as many factors flow in the umbilical arteries and veins immediately after birth, some infants may be at risk, maybe by blood volume. If UCC is to be delayed, there is now excellent evidence demonstrating that the timing of UCC should be based on the infant's physiology rather than on a stopwatch. Our results suggest that delayed cord clamping also benefits infant health in regions with a relatively low prevalence of anemia.

## Conclusion and Recommendations

Late cord clamping can benefit the infant by improving iron status, which may be of clinical value, particularly in infants with poor access to good nutrition. However, delaying clamping increases the risk of jaundice requiring

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DOI:10.26502/jppch.74050182

phototherapy. However, before the final comment, more extensive clinical trials should be done regarding this topic. A larger randomized control trial is recommended to validate this finding.

## Limitations of the Study:

The limitation of a single-center study means that the findings may need to be more generalizable to other populations or settings. The small sample size can affect the statistical power and reliability of the results, making it challenging to draw definitive conclusions. Cross-sectional study design only provides a snapshot of data at a single point in time, limiting the ability to establish causality or determine changes over time. The lack of randomization means biases may present in the sample selection process, potentially impacting the validity of the findings.

**Funding:** No funding sources

**Conflict of Interest:** None declared.

**Ethical Approval:** The study was approved by the Institutional Ethics Committee.

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