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**Systematic Review**

# The effect of birth-weight and instrumental delivery on neonatal birth trauma in Ethiopia: systematic review and meta-analysis

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## ABSTRACT

Birth trauma is one of the most common causes of neonatal mortality in a resource-limited country. However, there is no national evidence on the magnitude and associated factors of neonatal birth trauma in Ethiopia. Therefore, this study aimed to estimate pooled prevalence of neonatal birth trauma and its association with birth-weight and instrumental delivery in the Ethiopian context. PubMed, Scopus, CINAHIL, Cochrane library and Google Scholar were used to search significant articles. Suitable search terms were developed and used to retrieve studies from databases. Searching was limited to cohort, cross-sectional, and case-control studies conducted in Ethiopia and published in English language. Critical appraisal was conducted by using Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI). Heterogeneity across the included studies was evaluated by using the inconsistency index ($I^2$) test. STATA™ version 11 software was used to conduct the meta-analysis. A total of 7 studies with 4063 study participants were included in this systematic review and meta-analysis. The overall pooled prevalence of neonatal birth trauma in Ethiopia was 13.4% (95% CI; (10.86, 15.95). instrumental delivery and ABO large birth weight were significantly associated with the prevalence of neonatal birth trauma. The national pooled prevalence of neonatal birth trauma was found to be high in Ethiopia. Instrumental delivery and large birth-weight were significantly associated with neonatal birth trauma in Ethiopia. Thus, it is better to give strong obstetric care during the use instrumental delivery.

**Keywords:** Neonate, Newborn, Neonatal birth trauma, Birth injury, Ethiopia

## INTRODUCTION

Neonatal birth trauma is the mechanical destruction or functional deterioration of the neonate's body due to traumatic events that occurred during the birth process that ranged from mild to severe and long lasting body injury.[1]

As to the definitions of international classification of diseases-10 (ICD-10) birth trauma includes the mechanical/physical birth injuries.[2]

Despite optimal obstetric care globally, neonatal birth trauma still affects neonates and remains among the most

common cause of neonatal morbidity and mortality especially in low income countries like Ethiopia.[3] Even though, neonatal death reduction remains a priority agenda of sustainable development goal (SDG-2), neonatal mortality still exist as a major public in Ethiopia, which accounts 30 death per 1000 alive births.[4,5]

Previous primary studies conducted in Ethiopia showed that the magnitude of neonatal birth trauma was inconsistent that ranging from 8.09-16.9%.[6-11] There is one systematic review and meta-analysis in Ethiopia that was conducted to assess magnitude and patterns of neonatal birth trauma which was 15% but not incorporate factors associated with neonatal birth trauma.[12]

Various associated factors have been recognized that increases the vulnerability of the neonate to neonatal birth trauma, such as malpresentation, large birth-weight, instrumental delivery, maternal age, prolonged labor, shoulder dystocia, primipara, no formal education, lack of ANC, macrosomia and facility-based delivery.[6-11]

To meet sustainable development goal (SDG) 3 of ensuring healthy lives and promote wellbeing for all at all age and to provide evidence on the national epidemiological situation of neonatal birth trauma, context-specific information on the risk factors and available approach for neonatal birth trauma is necessary. However, in Ethiopia, primary studies were conducted to estimate the prevalence of neonatal birth trauma and to identify factors. In these primary studies there is significant inconsistency in reporting which is difficult for programs and policy makers.

As to researcher's knowledge, there is no study which revealed the overall pooled estimate of neonatal birth trauma and associated factors that will enable to implement hospital and community-based neonatal health promotion packages at national level. In addition, as findings from various studies in Ethiopia showed that the magnitude of neonatal birth trauma is variable and its association with birth-weight and instrumental delivery were reported inconsistent. Therefore, this systematic review and meta-analysis aimed to determine the pooled magnitude of neonatal birth trauma and its association with large birth-weight and instrumental delivery in Ethiopia.

## METHODS

### *Study protocol and registration*

This systematic review that aimed to review the evidence on the magnitude of neonatal birth trauma and its association with large birth-weight, malpresentation and instrumental delivery in Ethiopia followed the preferred reporting items for systematic review and meta-analysis statement (PRISMA) guidelines in identifying and selecting studies for this meta-analysis (PRISMA checklist). The review not yet registered and the protocol for this review not prepared.

### *Searching strategy*

The PRISMA guideline was used to report the results of this systematic review and meta-analysis.[13] In order to obtain the significant articles that fit the study objectives international electronics databases such as PubMed, Google Scholar, Cochrane library and list of references were used. Furthermore, experts in the field were consulted to obtain unpublished articles, and the bibliography of selected articles was reviewed for additional relevant studies.

Two independent authors were conducted the article searching process independently and systematically. In addition, other significant articles were retrieved manually from the gray literature by cross-referencing. The core search terms and phrases were "newborn", "neonate", "neonatal birth trauma", "neonatal birth injury", "magnitude of neonatal birth trauma", "associated factors", "Ethiopia". The search strategies were developed using different Boolean operators. Particularly, to fit the advanced PubMed database, the following search strategy was applied: [(newborn [MeSH Terms] or neonate and (neonatal birth trauma [MeSH Terms] or neonatal birth injury) and (associated factors) and ("Ethiopia")].

### *Eligibility criteria*

Studies reported the magnitude or associated factor of neonatal birth trauma, conducted with analytical cross-sectional, cohort and case-control studies and published in English language before 20 December 2023 were included. On the other hand, articles without abstract and/or full-text, the study failed to determine the anticipated outcome of interest, and those studies with qualitative study design were excluded.

### *Study selection process*

In order to remove duplicated studies, the retrieved articles were exported to reference management software, Endnote version 7. Two authors screened and assessed the titles and abstracts of studies followed by full-text assessments independently and systematically. Disagreements were resolved by consensus and discussion with other authors.

### *Exposure variables*

In this systematic review and meta-analysis, associated factors (prolonged labour, birth-weight, fetal malpresentation and instrumental delivery) that increase the occurrence of neonatal birth trauma were considered as exposure variables to estimate their effects on the magnitude neonatal birth trauma.

### *Outcome variable*

In this systematic review and meta-analysis, the magnitude of birth trauma was considered as the outcome variable of this study.

### *Methods of data extraction and quality assessment*

Data were extracted by using the standardized Microsoft excel data extraction form. Name of the first author, year of publication, region, study design, sample size, number of outcomes, prevalence (magnitude), risk estimate (odds ratio, RR) with 95% confidence interval (CI) of associated factors were extracted from the included articles. The quality of the included studies was evaluated by using The Joanna Briggs Institute (JBI) quality appraisal checklist.[14] Studies were considered for meta-analysis and categorized as low risk for poor quality when it scored 50% and above of the quality assessment indicators (Table 1).

### *Data processing and analysis*

The data were extracted from Microsoft excel and analyzed by using STATA version 11 statistical software was used for meta-analysis. Publication bias was checked by funnel plot and more objectively through Egger's regression test.[15] Heterogeneity of studies was quantified using the I-squared statistic, in which 25, 50, and 75% represented low, moderate, and high heterogeneity respectively.[16,17] Given that we found significant heterogeneity among the studies ($I^2$=80.4%), pooled analysis was conducted by using a weighted inverse variance random-effects model.[18] Sensitivity analysis was employed to see the effect of a single study on the overall estimation. For the second outcome, the odds ratio was used to ascertain the association between determinant factors and outcome variables in the included articles.

## RESULTS

### *Searching results*

The search strategy was retrieved 26 from PubMed, 15 from Cochrane library and 12,200 from Google Scholar. 9567 articles were removed due to duplicates, 2123 due to unmatched title and abstracts, and 520 due to study area. After duplication removed 31 articles were selected for the full-text review. After full-text reviews, 24 articles didn't report the outcome of interest as a result they excluded from the analysis. Finally, seven articles were included in this systematic review and meta-analysis to estimate the magnitude of neonatal birth trauma and its association with neonatal large birth-weight, instrumental delivery, and malpresentation in Ethiopia (Figure 1).

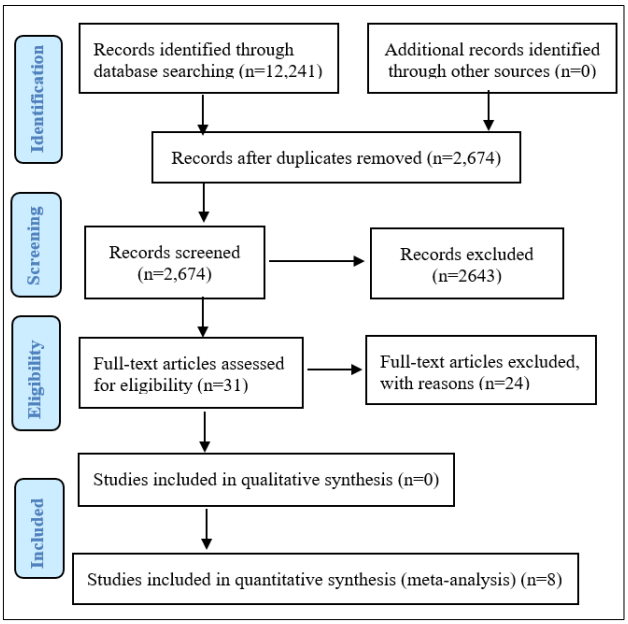


**Figure 1: A PRISMA flow diagram of articles screening and process of selection.**

### *Characteristics of the included studies*

Two studies were found in the Amhara region, one in Oromia, two in Addis Ababa, one in Harar and one in SNNPR.[6,7,9-11,19,20] Six of the studies were done by cross-sectional study design and one study by case-control study design. Regarding the year of publication, two studies were published before 2021 and five studies were published from 2021-2023 (Table 1).

**Table 1: Characteristics and quality status of the studies included to assess the pooled magnitude of neonatal birth trauma and its associated factors in Ethiopia.**

| Author | Year of publication | Region | Study design | Study population | Sample size | Outcome | Prevalence | Quality status |
|---|---|---|---|---|---|---|---|---|
| **Abie et al[19]** | 2023 | Amhara | Case-control | Neonate | 300 | - | | Low risk |
| **Tesfaye et al[20]** | 2017 | Oromia | Cross-sectional | Neonate | 272 | 22 | 8.088 | Low risk |
| **Yemane et al[11]** | 2019 | Addis Ababa | Cross-sectional | Neonate | 717 | 88 | 12.27 | Low risk |
| **Biset et al[7]** | 2021 | Amhara | Cross-sectional | Neonate | 594 | 78 | 13.13 | Low risk |
| **Belay et al[6]** | 2022 | SNNPR | Cross-sectional | Neonate | 1315 | 220 | 16.73 | Low risk |
| **Tibebu et al[9]** | 2023 | Addis Ababa | Cross-sectional | Neonate | 373 | 48 | 12.87 | Low risk |
| **Tolosa et al[10]** | 2023 | Harar | Cross-sectional | Neonate | 492 | 83 | 16.9 | Low risk |

### *Quality of studies*

The JBI quality appraisal criteria established for cross-sectional and case-control study design were used. The studies included in this systematic review and meta-analysis had no considerable risk. Therefore, all the studies were considered (Table 1).[6,7,9-11,19,20]

### *The pooled magnitude of neonatal birth trauma in Ethiopia*

A total of 6 studies with 3763 study participants were analyzed in the meta-analysis to estimate the pooled magnitude of neonatal Birth trauma in Ethiopia. Consequently, the overall pooled prevalence of neonatal birth trauma was 13.4% (95% CI; (10.86,15.59.); $I^2$=80.4% (Figure 2).

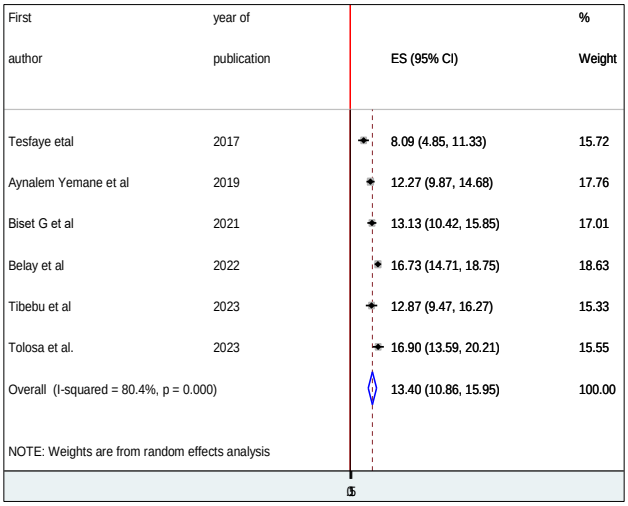


**Figure 2: Forest plot of the pooled magnitude of neonatal birth trauma in Ethiopia, 2023.**

### *Subgroup analysis*

We have done subgroup analysis by using the region of the included studies. The subgroup analysis based on the regions of the included studies showed that there is no significant difference in the magnitude of neonatal birth trauma (Figure 3).

*Publication bias*

Publication bias was evaluated by a funnel plot and Egger's regression test. A funnel plot showed asymmetrical distribution (Figure 4) subjectively indicating the presence of publication bias. However, objectively the Egger's regression test p value was 0.339, which indicated the absence of publication bias.

### *Sensitivity analysis*

We have conducted a sensitivity analysis to assess the weight of every study on the pooled effect size of magnitude of neonatal birth trauma. The sensitivity analysis using the Der Simonian-Laird random-effects model (Figure 5).

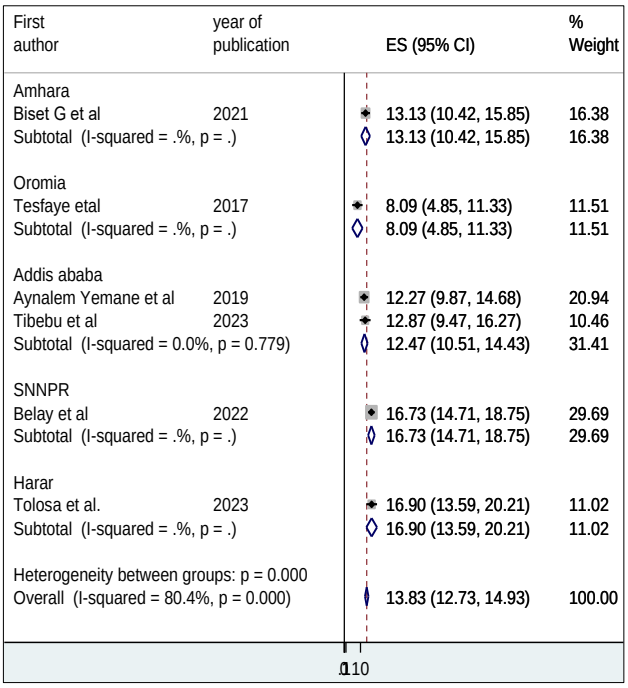


**Figure 3: Forest plot of sub group analysis by region on the pooled magnitude of neonatal birth trauma in Ethiopia, 2023.**

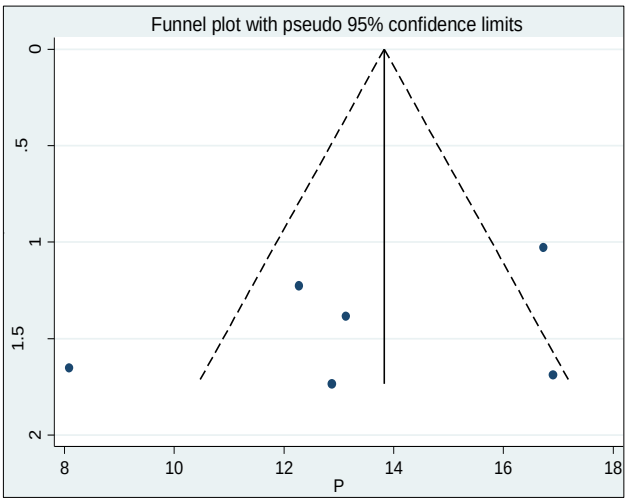


**Figure 4: Funnel plot to determine publication bias among the included studies.**

### *Factors associated with neonatal birth trauma*

*The effect of prolonged labor on neonatal birth trauma*

Among the included seven studies, three studies reported the association between prolonged labor and neonatal birth trauma.[7,9,19] The pooled odds ratio from these studies was 2.46 (95% CI:0.97, 6.21), which showed that the odds of

neonatal jaundice were 2.46 higher in neonates born with prolonged labor of time than their counterparts (Figure 6).

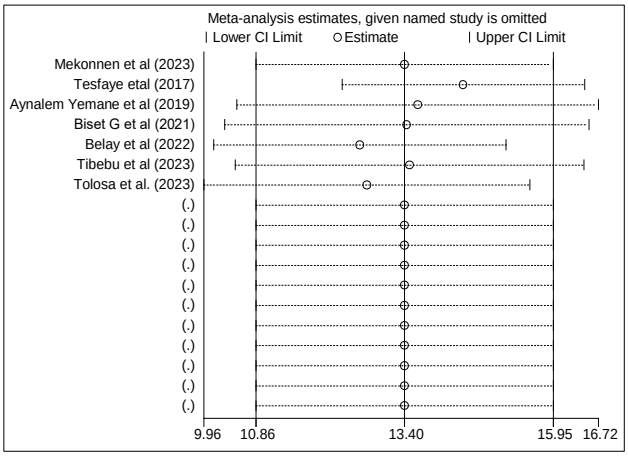


**Figure 5: Sensitivity analysis of the included studies.**

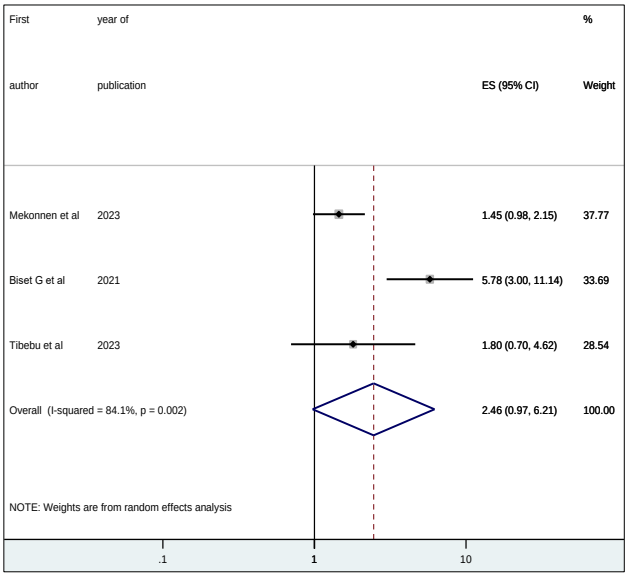


**Figure 6: The pooled effect of prolonged labor on the magnitude of neonatal birth trauma in Ethiopia.**

*The effect of malpresentation on neonatal birth trauma*

Of the included seven studies, six studies reported the association between fetal malpresentation and neonatal birth trauma.[7,9-11,19,20] The pooled odds ratio from these studies was 2.99 (95% CI: 0.28, 31.57), which showed that the odds of neonatal jaundice were 2.99 higher in neonates born with malpresentation than their counterparts (Figure 7).

*The association between instrumental delivery and neonatal birth trauma*

Out of the included seven studies, six studies reported the association between instrumental delivery and neonatal birth trauma.[6,9-11,19,20] The pooled odds ratio from these studies was 5.64 (95% CI: 3.46,9.22), which showed that the odds of neonatal jaundice were 5.64 higher in neonates born with malpresentation than their counterparts (Figure 8).

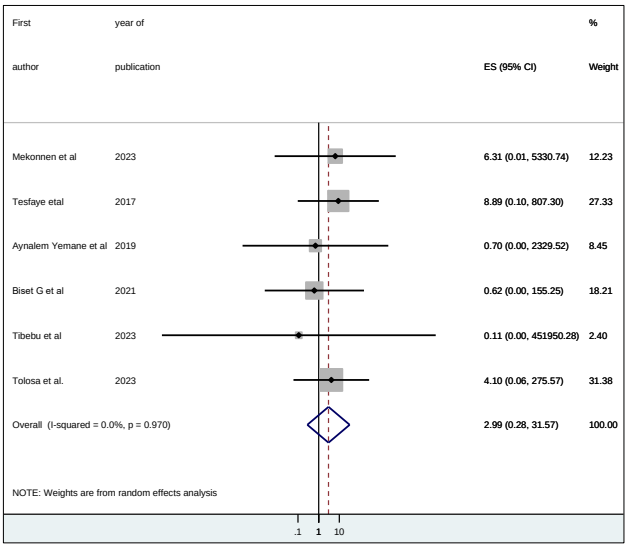


**Figure 7: The pooled effect of fetal malpresentation on the magnitude of neonatal birth trauma in Ethiopia.**

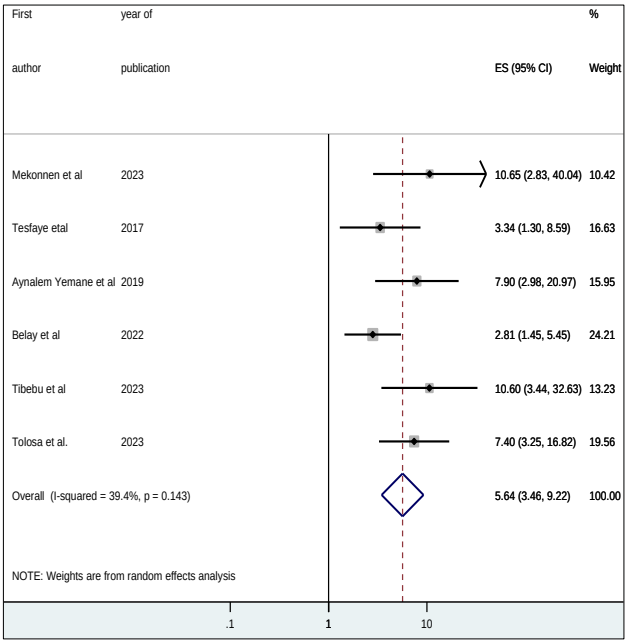


**Figure 8: The pooled effect of instrumental delivery on the magnitude of neonatal birth trauma in Ethiopia.**

*The effect of large birth-weight and neonatal birth trauma*

Among the included seven studies, six studies reported the association between fetal malpresentation and neonatal birth trauma.[7,9-11] The pooled odds ratio from these studies was 6.97 (95% CI: 2.93, 16.56), which showed that the odds of neonatal birth trauma were 6.97 higher in neonates

born with large birth-weight than neonates born with normal birth weight (Figure 9).

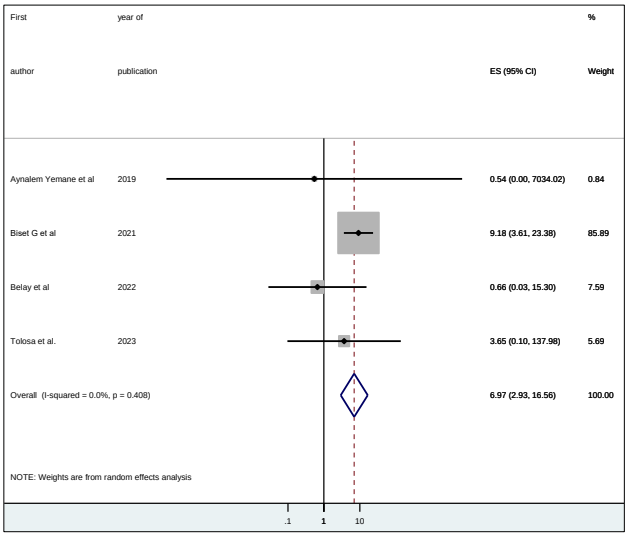


**Figure 9: The pooled effect of large birth weight on the magnitude of neonatal birth trauma in Ethiopia.**

## DISCUSSION

In resource-limited countries like Ethiopia, neonatal birth trauma remains the main cause of neonatal morbidity and mortality.[5] This systematic review and meta- analysis was aimed to estimate the pooled magnitude and associated factors of neonatal birth trauma in Ethiopia.

As far as our exhaustive searching, there is no previous systematic review and/meta-analyses conducted to estimate the prevalence and associated factors of neonatal birth trauma at national level in Ethiopia. As findings from various studies showed that the magnitude of neonatal birth trauma is variable and its association with Birth-weight, prolonged labor, fetal mal-presentation and instrumental delivery were reported inconsistently.

Despite the inconsistency of finding in the primary studies was reported, in this study, the overall pooled prevalence of neonatal birth trauma was found to be 13.4% (95% CI; (10.86, 15.59.). The findings of this study was higher than findings from the previous studies conducted in Iran 2.7%, India 1.4%, Nigeria 5.7%, and Cameron 1.8%.[21-24] Whereas, the finding of this study was lower than findings from a study conducted in Romania 16.2%.[25] The possible justification for the difference could be the availability and accessibility of quality obstetrics care and the variety of maternal care, the difference in socio-demographics, socio-economics, sample size, sampling methods and time across the nation.

This systematic review and metal analysis revealed that neonates delivered with instrument were 5.64 times more likely traumatized than neonates born with spontaneous vaginal delivery. This finding is in line with a studies conducted in Ethiopia.[7,11] The possible justification could be using instrument on the fetal head could result in extra cranial hemorrhage, intracranial hemorrhage, and soft tissue trauma or laceration, and these complications could result in neonatal birth trauma.[26]

The finding of this study showed the presence of a strong association between neonatal birth trauma and large birth weight. The odds of a neonate developing neonatal birth trauma were 6.97 higher in neonates born with large birth-weight than neonates born with normal birth weight. This finding is inconsistent with previous studies conducted in the world.[10,11,19,27-29]

### *Limitations*

This study had its limitations. Primarily, most of the studies included for this analysis had a small sample size, which could have a significant effect on the estimated pooled prevalence of neonatal birth trauma. Furthermore, this systematic review and meta-analysis represented only studies from five regions of Ethiopia, which may be an underrepresentation for the region of Ethiopia. Lack of enough literature and use odds ratio to estimate the predictor variables may be affected by other confounding variables.

## CONCLUSION

Findings from this study indicated that neonatal birth trauma in Ethiopia was highly prevalent. This study also noted that neonatal birth trauma was significantly associated with instrumental delivery. Hence, it is better to take strong precautions during the implementations of instrumental delivery. Moreover, further research is needed to identify other predictors of neonatal birth trauma.

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## REFERENCES

1. Rouma BS, Lakhoo K. Chapter 64: Vitelline duct anomalies. Paediatric Surgery: A Comprehensive Text For Africa. Googleapis. 2020;671-7.
2. World Health Organization. International Classification of Diseases 10 (ICD-10). 2010. Available at: https://www.who.int/standards/classifications/classification-of-diseases. Accessed on 12 March 2024.
3. Abedzadeh-Kalahroudi M, Talebian A, Jahangiri M, Mesdaghinia E, Mohammadzadeh M. Incidence of Neonatal Birth Injuries and Related Factors in Kashan, Iran. Arch Trauma Res. 2015;4(1):e22831.
4. GBD 2015 Maternal Mortality Collaborators. Global, regional, and national levels of maternal mortality, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388(10053):1775-12.

5. Ethiopian Public Health Institute (EPHI) [Ethiopia] and ICF. Ethiopia Mini Demographic and Health Survey 2019: Final Report. Rockville, Maryland, USA: EPHI and ICF. 2021.
6. Belay AS, Negese K, Manaye GA, Debebe S. Prevalence and associated factors of birth injury among neonates admitted at neonatal intensive care unit (NICU) in governmental hospitals of Southwest Ethiopian people regional state, Ethiopia: A multicenteric cross-sectional study. Front Pediatr. 2022;10:1052396.
7. Biset G, Mihret S, Mekonen AM, Workie A. Magnitude of birth trauma and its associated factors in South Wollo public hospitals, northeast Ethiopia, August 2021: Institutional-Based Cross-Sectional Study. BMJ Open. 2022;12(9):e057567.
8. Hailu D, Worku B. Birth trauma among live born term neonates at a referral hospital in Addis Ababa, Ethiopia. Ethiop Med J. 2006;44(3):231-6.
9. Tibebu EA, Desta KW, Ashagre FM, Jemberu AA. Prevalence of birth injuries and associated factors among newborns delivered in public hospitals Addis Ababa, Ethiopia, 2021. Crossectional study. PLoS One. 2023;18(1):e0281066.
10. Tolosa G, Assefa N, Keneni M, Lonsako AA, Desalew A. Neonatal Birth Trauma and Its Predisposing Factors Among Newborns Admitted to Public Hospitals in Eastern Ethiopia: A Cross-Sectional Study. Glob Pediatr Health. 2023;10:2333794X231183814.
11. Yemane A. Birth trauma among neonates admitted to neonatal unit in a tertiary hospital in Addis Ababa. Ethio J Pediatr Child Health. 2019;14(1).
12. Balis B, Diriba Hunde A, Lami M. Prevalence and Patterns of Neonatal Birth Trauma in Ethiopia: Systematic Review and Meta-Analysis. Glob Pediatr Health. 2023;10:2333794X231191982.
13. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71.
14. Peters M, Godfrey C, McInerney P, Soares C, Khalil H, Parker D. The Joanna Briggs Institute reviewers' manual 2015: methodology for JBI scoping reviews. The Joanna Briggs Institute. 2015.
15. Egger M SG, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. BMJ. 1997;315(7109):629-34.
16. Ioannidis JP. Interpretation of tests of heterogeneity and bias in meta-analysis. J Eval Clin Pract. 2008;14(5):951-7.
17. Higgins J TS. Quantifying heterogeneity in a meta-analysis. Stat Med. 2002;21(11):1539-58.
18. Marín-Martínez F, Sánchez-Meca J. Weighting by inverse variance or by sample size in random-effects meta-analysis. Educ Psychol Measurement. 2010;70(1):56-73.
19. Abie B, Shehibo A, Terefe BJ. Determinants of mechanical birth trauma among live born neonates admitted at University of Gondar Comprehensive Specialized Hospital neonatal intensive care unit, Northwest Ethiopia, a case-control study. Ethio J Pediatr Child Health. 2023;18(1).
20. Tesfaye W. Birth injury and associated factors in jimma university specialized hospital, southwest ethiopia. Thesis Submitted to Jimma University. 2014.
21. Shokri M, Nayyeri S, Salimi N. Prevalence of Neonatal birth trauma in Iran: a systematic review and meta-analysis. Int J Pediatr. 2021;9(10):14520-31.
22. Prabhu RS, Sajjid M, Anandan H. Incidence and predisposing factors of birth trauma in a tertiary care hospital in Chennai, India: a prospective study. Int J Scientific Study. 2017;4(10):29-33.
23. Pius S, Ibrahim H, Ibrahim B, Farouk A, Machoko Y, Bello MJNJoP. Incidence and characteristics of neonatal birth injuries in Maiduguri North-Eastern Nigeria. Niger J Pediatr. 2018;45(2):99-105.
24. Mah E, Foumane P, Ngwanou D. Birth injuries in neonates at a university teaching hospital in Cameroon: epidemiological, clinical and therapeutic aspects. Open J pediatr. 2017;7(01):51.
25. Luca A, Vinturache A, Ilea C, Avasiloaiei A, Paduraru L, Carauleanu A, et al. Birth trauma in preterm spontaneous vaginal and cesarean section deliveries: A 10-years retrospective study. PLoS One. 2022;17(10):e0275726.
26. Tesfay N, Tariku R, Zenebe A, Dejene Z, Woldeyohannes F. Cause and risk factors of early neonatal death in Ethiopia. Plos One. 2022;17(9):e0275475.
27. Tesfay N, Tariku R, Zenebe A, Dejene Z, Woldeyohannes FJPo. Cause and risk factors of early neonatal death in Ethiopia. PLoS One. 2022;17(9):e0275475.
28. Ray S, Mondal R, Samanta M, Hazra A, Sabui TK, Debnath A, et al. Prospective study of neonatal birth trauma: Indian perspective. J Clin Neonatol. 2016;5(2):91-5.
29. Martinho N, Friedman T, Turel F, Robledo K, Riccetto C, Dietz HP. Birthweight and pelvic floor trauma after vaginal childbirth. Int Urogynecol J. 2019;30(6):985-90.

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