

**BIRTH INCIDENCE OF TALIPES EQUINOVARUS (CLUBFOOT) DEFORMITY IN
DUHOK GOVERNORATE, IRAQ**

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ABSTRACT

Background: Talipes equinovarus (TEV), or "clubfoot," is a common congenital deformity of the foot, and it is considered the most common congenital deformity in the world. TEV has a varying incidence in different regions due to many factors, including genetic, environmental, and socio-economic factors. Many studies have been conducted on the incidence of TEV, but there are limited data on its incidence in Iraq and Kurdistan region. This study aimed to determine the birth incidence of TEV in the Duhok Governorate, Iraq.

Methods: The study was carried out using a surveillance method with consecutive sampling form from August 2024 to July 2025. This study included all governorate or public maternity hospitals in the five districts of the Duhok Governorate, Iraq. All newly diagnosed TEV cases among live-born infants were included in this study. The incidence rate of TEV was calculated by dividing the total number of TEV cases by 1,000 live births, as in previous epidemiological studies.

Results: A total of 32 new TEV cases were detected among 26,582 live births, giving an incidence rate of 1.2 TEV/1,000 live births. Male predominance was noted, as previously reported, with a male-to-female ratio of 1.5:1. Bilateral TEV deformity was the most common presentation, representing 65.6% of all TEV cases, as previously reported in international studies. Although most TEV cases were from Duhok district, the highest incidence rate was detected in Semel district, due to a lower number of total births.

Conclusions: The incidence of TEV in the Duhok Governorate is comparable to regional and global figures. These results offer useful epidemiological information that may be one of references to help healthcare planners in improving the management of congenital musculoskeletal deformities in the region.

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Keywords: Talipes equinovarus; Clubfoot; Incidence; Newborns; Duhok; Iraq

Talipes equinovarus (TEV), or clubfoot, is the most common congenital deformity of the foot that is usually evident at birth and is characterized by inward turning and twisting of the foot. This deformity has four components: heel equinus (downward-pointing/plantar flexed foot), hind foot Varus (inward-turning heel), supination and adductus of midfoot and forefoot (inward-turning forefoot), and cavus (high arch) deformities of the foot^[1-3]. It is a deformity of the foot caused by a complex interaction of abnormalities of the

bones, muscles, tendons, and ligaments of the foot and lower leg^[1,2].

The exact etiology of congenital clubfoot remains unknown; however, several mechanisms have been proposed, including a primary germ cell defect or arrested fetal development. Its association with neurological disorders and neural tube defects, such as myelomeningocele and spinal dysraphism, suggests a neuromuscular component. Severe forms of clubfoot are frequently linked to genetic and syndromic conditions, including

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arthrogryposis, diastrophic dysplasia, Freeman–Sheldon syndrome, and amniotic constriction bands, while some cases may result from postural deformity caused by intrauterine constraint in an overcrowded uterus. Further clarification is idiopathic type (infants born with foot deformity only) and the syndromic type (infants born with multiple apparent deformities in addition to foot deformity). In severe cases, the plantar surface faces posteromedially. Clinical severity is commonly assessed using the Pirani scoring system^[3], which grades six features—medial crease, curvature of the lateral border of the foot, prominence of the lateral head of the talus, posterior crease, empty heel, and ankle dorsiflexion; allowing evaluation at presentation and monitoring of treatment progress. Management includes both conservative and surgical approaches, with the Ponseti method as the mainstay of initial treatment^[1], involving early serial manipulation and casting over 5–6 weeks followed by prolonged bracing using a Dennis Browne splint until approximately four years of age, while surgical intervention is reserved for resistant or delayed cases.

If untreated or inappropriately treated, it may cause lifelong disability in the patient, which has a major impact on the patient's life in terms of physical disability, reduced mobility, and psychosocial and economic consequences^[3,4]. The incidence of clubfoot varies in the world population. According to recent systematic reviews and meta-analyses, the overall incidence of TEV in the world is approximately 1.18 per 1000 live births, with a higher incidence in low- and middle-income countries, especially in Southeast Asia and sub-Saharan Africa^[5,6]. Genetic predisposition, environmental factors, and differences in the standard of care received by the mother and the newborn have been cited as causes of TEV^[2].

In Iraq, there is limited information on the occurrence of clubfoot. The available

information was mostly collected from central and southern regions of the country. The reported rates of clubfoot occurrence varied between 0.33 and 1.39 per 1,000 births^[7,8]. Duhok Governorate is situated in the Kurdistan Region of northern Iraq. It has unique demographic and health profiles compared with other regions of Iraq. So far, no surveillance study has been conducted to determine the occurrence of TEV. This study was designed to determine the occurrence of TEV in Duhok Governorate and its distribution by sex, laterality, and district of birth.

METHODS

A descriptive surveillance study with consecutive sampling method was conducted from 1st August 2024 to 31st July 2025. The purpose of the study was to determine the incidence of TEV in the Duhok Governorate of the Kurdistan Region/Iraq. All public maternity hospitals were included in this study. These hospitals are located in the five districts of Duhok Governorate: Duhok, Zakho, Akre, Amedi, and Semel. All live births diagnosed with TEV clinically during this period were included. TEV was defined as rigid deformity of equinus, varus, adductus, and cavus that were not correctable by passive manipulation, as per standard clinical criteria^[1]. Stillbirths and neonates with other forms of congenital deformity of the feet were excluded. Medical staff working in the delivery rooms and neonatal units of the maternity hospitals were asked to notify the surveillance team of any suspected cases of congenital foot deformities. Regular communication was maintained with the orthopedic senior house officer doctor.

This data was collected using a standardized form and Excel software that included the sex of the child, laterality, district of birth, and associated anomalies. Data on the total number of live births was obtained from the statistical department of the hospital. Ethical approval was obtained

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from the relevant authorities (Research Ethics Committee/General Directorate of Duhok Health, Duhok/Kurdistan Region/Iraq (Reference number: 30102024-9-15, received on 30 October, 2024)). Informed consent was obtained from the parents or legal guardians of the affected children. The required information was obtained from the parents of the affected children. The confidentiality and anonymity of the participants were maintained. The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0. The results were summarized using descriptive statistics. The primary outcome measure of this study is the incidence of TEV per 1,000 live births, while the secondary outcomes are the sex

distribution, laterality, and associated anomalies, as mentioned in other epidemiological studies^[9-11]. Local epidemiological information is important for proper health care planning, especially for diseases such as clubfoot, which require early detection and prompt treatment^[12-17].

RESULTS

During the study period, the total number of live births in the participating maternity hospitals in Duhok Governorate was 26,582, out of which 32 new cases of TEV clubfoot deformity were recorded, giving an incidence rate of 1.2 cases per 1,000 live births as shown in table 1.

Table 1: The districts' differences regarding live births, number of clubfoot cases, and incidence rate.

District	Live births	Number of clubfoot cases	Incidence rate
Duhok	12814	27	2.107
Akre	6976	1	0.143
Zakho	6180	1	0.161
Amedi	569	1	1.757
Semel	43	2	46.511
Total	26582	32	1.203

Out of the recorded cases, 19 were male (59.4%), and 13 were female (40.6%), giving a male-to-female ratio of 1.5:1, with males being predominant in most districts. The majority of the cases, 21 (65.6%), were bilateral, while 11 cases were unilateral, with six being right-sided (18.8%) and five

being left-sided (15.6%) (Figure 1). it can be observed that the incidence rate of bilateral TEV is higher, as it accounts for almost two-thirds of the total cases, whereas the incidence rate of right and left unilateral TEV is relatively less.

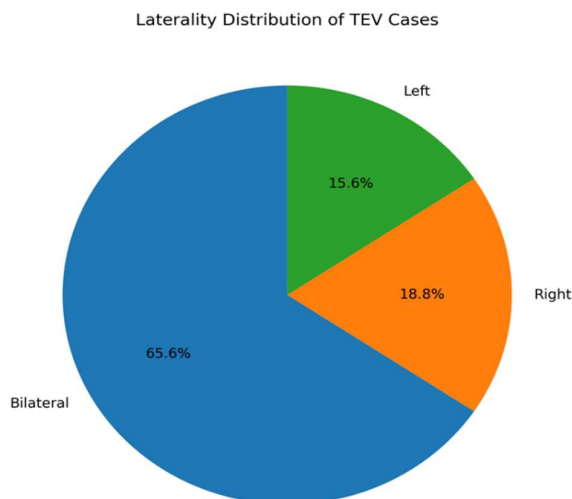


Figure 1. Distribution of talipes equinovarus cases according to laterality.

The majority of the cases were from Duhok district, 27 (84.4%), due to the large number of births (12814) and the large population in this district; however, when the incidence rate was calculated for each district, the highest incidence rate was recorded in the Semel district, 46.5 cases per 1,000 live births, from two cases out of a small number of total births, while the

incidence rate in the remaining districts ranged from 0.14 to 2.107 cases per 1,000 live births (Table 1) and (Figure 2). Isolated clubfoot deformity was recorded in 26 cases (81.25%), while associated anomalies were recorded in six cases (18.75%), which included tibial hemimelia, arthrogryposis, and meningocele.

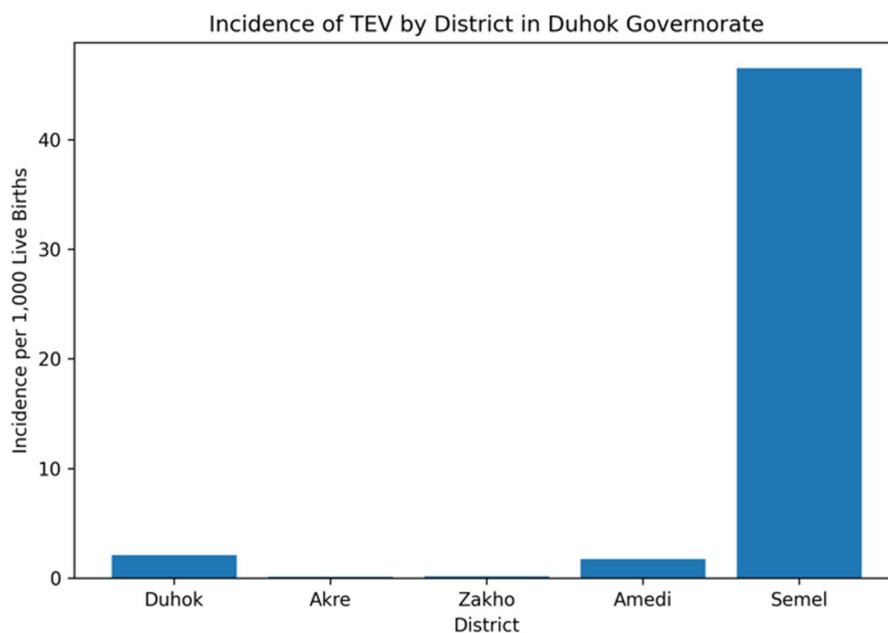


Figure 2. Incidence of talipes equinovarus per 1,000 live births by district in Duhok Governorate.

This bar chart shows the higher rate of TEV in the Semel district, as the number of live births was relatively small, while the rates in the other districts were close to the average.

DISCUSSION

This study is the first prospective surveillance study designed to estimate the birth incidence of TEV in Duhok Governorate, Kurdistan Region of Iraq. The incidence of TEV was found to be 1.2 per 1,000 live births. This is similar to the pooled incidence of TEV in the worldwide population, according to a number of recent systematic reviews and meta-analyses. Globally, the range of TEV incidence per 1,000 live births varies from 0.5 to 2. The global pooled estimate of TEV incidence

per 1,000 live births was found to be approximately 1.18^[5]. These results are also similar to those found in neighboring countries and in other parts of Iraq (mostly from southern and central parts (0.33-1.39 per 1000 live births.))^[7,8]. The predominance of the male population in the present study, with a male-to-female ratio of 1.5:1, is consistent with the findings of several international and regional studies. Various theories have been put forward to explain the reason for the increased incidence of TEV in the male population. Although the exact reason for the increased incidence of TEV in the male population is still unknown, the consistency of the present finding with the findings of several other studies suggests that there may be a biological basis for the increased incidence of TEV in the male population [9-12].

Bilateral cases were 21 cases found in 65.6%, while unilateral cases were less common, as mentioned in other regional and international studies^[9,10,15]. That supports the theory that the more severe and genetically determined forms of TEV tend to manifest bilaterally. The unilateral manifestations were fewer and were not significant on either side. Isolated clubfoot and associated anomalies with clubfoot were found in 81.25% and 18.75%, respectively, as mentioned in other epidemiological studies^[4,11,17-19].

Although the majority of the manifestations were reported from the Duhok district, this is likely due to the larger population size and the higher number of births. When the incidence rate was calculated for the different districts, the highest incidence rate was reported for the Semel district. However, it should be noted that the incidence rate for the Semel district is likely due to the very low number of total births. However, this study has some limitations. First of all, the two districts in the governorate, Bardarash and Shekhan, were not surveyed since there were no maternity hospitals (only delivery rooms with no documented records). Therefore, pregnant women of these districts usually deliver in the maternity hospitals of the neighboring districts. Secondly, the study did not survey the private medical institutions. These two points might cause a slight underestimation of the actual incidence. Thirdly, the study did not examine the potential risk factors such as the health of the mothers, the environment, and the genetic background.

CONCLUSION

This study has yielded the first population-based estimate of the birth incidence of TEV, or clubfoot, in Duhok Governorate, Iraq. The incidence of TEV (clubfoot) in the Duhok Governorate of Iraq was found to be 1.2 per 1,000 live births. The incidence of TEV is comparable to the incidence rates reported in the region and worldwide. Most of these cases were in Duhok (84.4%). The

study has shown that there was predominance male (59.4%), as well as a greater incidence of bilateral clubfoot (65.6%), and most had isolated TEV foot deformities (81.25%), that all are consistent with previous studies on this condition conducted globally and nationally. There was a variation in incidence rates between districts, which was due to differences in population size and number of live births, thus showing that it should not be taken for granted when dealing with incidence rates per district. The current study provides useful information regarding the incidence of congenital musculoskeletal deformities. These will help the governorate health authority in developing health care plans and programs.

Acknowledgement

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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REFERENCE

1. Cady R, Hennessey TA, Schwend RM. Diagnosis and treatment of idiopathic congenital clubfoot. *Pediatrics*. 2022 Feb 1;149(2):e2021055555. doi: 10.1542/peds.2021-055555.
2. Basit S, Khoshhal KI. Genetics of clubfoot; recent progress and future perspectives. *European Journal of Medical Genetics*. 2018 ;61(2):107-13. <https://doi.org/10.1016/j.ejmg.2017.09.006>.
3. O'Shea RM, Sabatini CS. What is new in idiopathic clubfoot?. *Current*

- reviews in musculoskeletal medicine. 2016;9(4):470-7.
<https://doi.org/10.1007/s12178-016-9375-2>.
4. El Koumi MA, Al Banna EA, Lebda I. Pattern of congenital anomalies in newborn: a hospital-based study. *Pediatric reports*. 2013;5(1):e5. doi: 10.4081/pr.2013.e5.
 5. Smythe T, Rotenberg S, Lavy C. The global birth prevalence of clubfoot: a systematic review and meta-analysis. *EClinicalMedicine*. 2023;63:102178. <https://doi.org/10.1016/j.eclinm.2023.102178>.
 6. Smythe T, Kuper H, Macleod D, Foster A, Lavy C. Birth prevalence of congenital talipes equinovarus in low- and middle-income countries: a systematic review and meta-analysis. *Tropical medicine & international health*. 2017;22(3):269-85. <https://doi.org/10.1111/tmi.12833>.
 7. Al-Ani ZR, Al-Haj SA, Al-Ani MM, Al-Dulaimy KM, Al-Maraie AK, Al-Ubaidi BK. Incidence, types, geographical distribution, and risk factors of congenital anomalies in Al-Ramadi Maternity and Children's Teaching Hospital, Western Iraq. *Saudi Med J*. 2012;33(9):979-89.
 8. Al-Azzawi AT. Incidence Rate of musculoskeletal congenital anomalies of neonates in Muthanna province from 1/1/2008 to 1/1/2009. *Al-Qadisiyah Medical Journal*. 2016;12(21):177-92. <https://doi.org/10.28922/qmj.2016.12.21.177-192>
 9. Zionts LE, Jew MH, Ebramzadeh E, Sangiorgio SN. The influence of sex and laterality on clubfoot severity. *Journal of Pediatric Orthopaedics*. 2017;37(2):e129-33.
<https://doi.org/10.1097/BPO.0000000000000603>
 10. Salvatori G, Bettuzzi C, Abati CN, Cucca G, Zanardi A, Lampasi M. The influence of laterality, sex and family history on clubfoot severity. *Journal of Children's Orthopaedics*. 2020;14(2):145-50.
<https://doi.org/10.1302/1863-2548.14.190184>.
 11. Werler MM, Yazdy MM, Mitchell AA, Meyer RE, Druschel CM, Anderka M, Kasser JR, Mahan ST. Descriptive epidemiology of idiopathic clubfoot. *American journal of medical genetics Part A*. 2013;161(7):1569-78. <https://doi.org/10.1002/ajmg.a.35955>.
 12. Kruse LM, Dobbs MB, Gurnett CA. Polygenic threshold model with sex dimorphism in clubfoot inheritance: the Carter effect. *JBJS*. 2008;90(12):2688-94.
<https://doi.org/10.2106/JBJS.G.01346>.
 13. Abdu SM, Seyoum G, Ayana B. Prevalence and pattern of congenital clubfoot among less than 5-year-old children in Ethiopia; cross-sectional based study. *BMC Musculoskeletal Disorders*. 2024;25(1):604. <https://doi.org/10.1186/s12891-024-07734-1>.
 14. Besselaar AT, Kamp MC, Reijman M, Van Der Steen M. Incidence of congenital idiopathic clubfoot in the Netherlands. *Journal of Pediatric Orthopaedics B*. 2018;27(6):563-7. <https://doi.org/10.1097/BPB.0000000000000525>
 15. Portilla-Rojas E, Pineda-Sanabria P, Ramírez L, Cuevas MI, Lores J, Sarmiento K, Zarante I.

- Epidemiological characterization of clubfoot: a population-based study of a surveillance program in Colombia. *Journal of Pediatric Orthopaedics B*. 2025;34(1):9-13.
<https://doi.org/10.1097/BPB.00000000000001184>.
16. Nguyen MC, Nhi HM, Nam VQ, Van Thanh D, Romitti P, Morcuende JA. Descriptive epidemiology of clubfoot in Vietnam: a clinic-based study. *The Iowa orthopaedic journal*. 2012;32:120.
 17. Wang H, Barisic I, Loane M, Addor MC, Bailey LM, Gatt M, Klungsoyr K, Mokoroa O, Nelen V, Neville AJ, O'Mahony M. Congenital clubfoot in Europe: A population-based study. *American Journal of Medical Genetics Part A*. 2019;179(4):595-601.
<https://doi.org/10.1002/ajmg.a.61067>.
 18. Panza R, Albano F, Casto A, Del Vecchio C, Laforgia N, Dibello D. Incidence and prevalence of congenital clubfoot in Apulia: a regional model for future prospective national studies. *Italian Journal of Pediatrics*. 2023;49(1):151.
<https://doi.org/10.1186/s13052-023-01559-9>.
 19. Kardm SM, Al Zomia AS, Alqahtani AA, Al Fae FM, Al Zehefa IA, Alshahrani YS, et al. Congenital Talipes Equinovarus management and outcomes: The experiences of pediatric tertiary centers in Abha, Saudi Arabia. *Cureus*. 2023;15(8).
<https://doi.org/10.7759/cureus.43264>.

ریزا ناریشا خواربونا پی زاروکا بی زیکماکی لده ف زاروکی نی بوین ل پاریزگه ها دهوکی

پوخته

پیشەکی و نارمانج: خواربونا پی زاروکا بی زیکماکی بهر به لاقتترین ناریشا بی زاروکیه. ریژه یا یی یا جیاوازه د ناف ملله تان. نارمانجا نهقی قهکولیکی دیار کرنا ریژا وئ ل پاریزگه ها دهوکی.

رێکین قهکولینی: د ناف بهرا مه ها تهباخا 2024 و تیرمه ها 2025 دیفجونا هه می زاروکان ها ته کرن نه وین نه خوشخانین زاروکیونی ل پاریزگه ها دهوکی ها ته کرن. نه و زاروکی ناریشا خواربونا پی زاروکا بی زیکماکی هه ی هاتنه هژمارتن و ریژا وا ها ته حسیبکرن ب دابه شکرنا زمارا وان ل سه ر زمارا زاروکی نی بوین و لیکدان د که ل 1000.

نه نجام: 32 زاروکان ناریشا خواربونا پی زاروکا بی زیکماکی هه بو ژ 26582 زاروکی نی بوین ل پاریزگه ها دهوکی ب ریژا 1.2 بو هه ر 1000 زاروکی نی بوین (19 کور و 13 کج). به را بتر زوان ل بازیری دهوکی بوون. به لی ریزا هه را بلند ل قه زا سیمیلی بوون.

دهر نه نجام: ریزا ناریشا خواربونا پی زاروکا بی زیکماکی ل پاریزگه ها دهوکی 1.2 بو هه ر 1000 زاروکی نی بوین .

نسبة حالات حنف القدم الولادي بين اطفال حديثي الولادة في محافظة دهوك

الخلاصة

الخلفية والأهداف: يُعدّ حَنَفُ القَدَمِ الولادي أكثر تشوهات القدم شيوعًا لدى الأطفال. ويختلف معدل انتشاره باختلاف البلدان. هدفت هذه الدراسة إلى تقدير معدل انتشار هذا التشوه بين حديثي الولادة في محافظة دهوك/العراق.

الطرق: بين شهر اب 2024 و تموز 2025 (عام واحد)، شَمِلَ جميع الأطفال المولودين بتشوهات حَنَفُ القَدَمِ الولادي في مستشفيات الأمومة بمحافظة دهوك في هذه الدراسة المقطعية الاستشراعية. حُسِبَت معدلات الانتشار بقسمة عدد حالات حَنَفُ القَدَمِ الولادي على إجمالي عدد المواليد الجدد في المحافظة وضرب الناتج في 1000.

النتائج: لوحظت 32 حالة من تشوه حَنَفُ القَدَمِ الولادي بين 26582 مولودًا جديدًا في محافظة دهوك، بمعدل انتشار بلغ 1.2 حالة لكل 1000 مولود جديد. كان تسعة عشر منهم من الذكور وثلاث عشرة من الإناث، بنسبة 1.5 إلى 1. معظمهم (84.4%) في قضاء دهوك، لكن أعلى معدل سُجِّلَ في قضاء سميل (46.5 لكل 1000 ولادة حية).

الاستنتاجات: بلغ معدل انتشار حنف القدم الولادي في محافظة دهوك، العراق، 1.2 حالة لكل 1000 ولادة حية.