**Frequency & risk factors of congenital**

**Anomalies in newborns in the Omdurman military hospital**

## ABSTRACT

**Background:-**

Congenital anomalies are a worldwide problem, causing Perinatal and infant deaths and postnatal physical disabilities.

**Objective:-**

 To determine the frequency and risk factors of congenital anomalies in newborns.

**Materials and methods:-**

This descriptive prospective cross-sectional hospital-based study was conducted in Omdurman Military Hospital from August 2021 to February 2022. The study sample included 42 newborns who fulfilled the study's inclusion criteria. Data was collected using an interview questionnaire filled out by the researcher with women and their deliveries, and then verbal consent was obtained. Collected data analysis was performed using SPSS**.**

**Results and discussion:** The total number of deliveries during the study period was 1.400; 42 newborns had congenital malformation, so the frequency of congenital anomalies was 3%. Central Nervous System (CNS) anomalies were 31 %,> 40% of maternal and paternal age was (31-40) and (>40), 50% (21) of patients were primigravida,83.3%from rural areas,76.2% had CS delivery, pregnancy,76.2%has no medical disease,>78% has no Family History or previous history of congenital anomalies (CAs) 81% of the women were using cosmetic products, correlation between the risk factors and congenital anomalies were studied revealed significant relationship between congenital anomalies and "Blood Type of the mother, blood Type of the Baby, history of previous congenital anomaly, family history of CA and history of cosmetic product abuse Chi-square P value were 0.05,0.05,0.02,0.04 respectively at (p< 0.05).

**Conclusion:** In this study, the frequency of congenital anomalies was 3%. The risk factors socio-demographic factors (age, residence, level of education, social class) and pregnancy-related risk factors (parity, single-tone pregnancy, medical diseases, maternal history of febrile illness, and use of cosmetic products during pregnancy) were the most important factors associated with congenital anomalies.

**Keywords:** congenital anomalies, febrile illness, congenital malformation, fetal development, chromosomal abnormalities, Cystic Fibrosis and Haemophilia C.

## INTRODUCTION

 Congenital anomalies can be defined as structural or functional anomalies that occur during intrauterine life, also commonly referred to as birth defects, congenital disorders, congenital malformations, or congenital abnormalities, are conditions of prenatal origin that are identified before or at birth or later in life and it’s potentially impacting an infant's health, development and/or survival. Congenital anomalies encompass a wide array of structural and functional abnormalities that can occur in isolation (i.e., single defect) or as a group of defects (i.e., multiple defects). An estimated 6% of babies worldwide are born with a congenital anomaly, resulting in hundreds of thousands of associated deaths. However, the true number of cases may be much higher because statistics do not often consider terminated pregnancies and stillbirths. The causes of congenital anomalies are wide-ranging, with many anomalies remaining of undetermined aetiology. Structural anomalies are often due to errors in embryogenesis occurring at critical periods of fetal development. Critical exposure periods during pregnancy can vary by organ system or type of anomaly. However, the first trimester (gestational age 1–13 weeks) is generally considered the highest risk period. Medications, infectious agents, and environmental toxins have all been implicated as teratogens; illicit drugs and other maternal exposures can also disrupt fetal development and increase the risk for one or more congenital abnormalities.

 Although approximately 50% of all congenital anomalies cannot be linked to a specific cause, there are some known causes, such as genetic factors, which play an important role in many congenital anomalies. This might be through inherited genes that code for an anomaly or resulting from sudden changes in genes known as mutations. Consanguinity (when parents are related by blood) also increases the prevalence of rare genetic congenital anomalies and nearly doubles the risk for neonatal and childhood death, intellectual disability, and other anomalies. Some ethnic communities (such as Ashkenazi Jews or Finns) have a comparatively high prevalence of rare genetic mutations such as Cystic Fibrosis and Hemophilia C.

 Low income may be an indirect determinant of congenital anomalies, with a higher frequency among resource-constrained families and countries. It is estimated that about 94% of severe congenital anomalies occur in low- and middle-income countries. An indirect determinant, this higher risk relates to a possible lack of access to sufficient, nutritious foods by pregnant women, an increased exposure to agents or factors such as infection and alcohol, or poorer access to healthcare and screening. Factors often associated with lower income may induce or increase the incidence of abnormal prenatal development.

 Maternal folate insufficiency increases the risk of having a baby with a neural tube defect, while excessive vitamin A intake may affect the normal development of an embryo or fetus. Many other risk factors for congenital anomalies, such as multiple pregnancies and chronic maternal conditions (e.g. diabetes, hypertension, autoimmune diseases such as lupus, myasthenia gravis or Graves’ disease) can negatively affect the developing fetus. Maternal hypertension can affect blood flow to the fetus and impair fetal growth.

 Some congenital anomalies can be treated with surgical and non-surgical options, such as cleft lip and palate, clubfoot, and hernias. Others, including heart defects, neural tube defects, and Down syndrome, can cause lifelong impacts. Many structural congenital anomalies can be corrected with pediatric surgery, and early treatment can be administered to children with functional problems such as thalassemia (inherited recessive blood disorders), sickle cell disorders, and congenital hypothyroidism (reduced function of the thyroid).

Congenital anomalies are one of the main causes of the global burden of disease, and low- and middle-income countries are disproportionately affected. These areas are also less likely to have facilities to treat reversible conditions such as clubfoot, leading to more pronounced and long-lasting effects.

 Congenital anomalies can be structural or developmental. If they are structural, it means that they relate to body parts. If they are developmental, it means that they affect the way the body works, how a person learns, or the senses. Some congenital anomalies have both structural and developmental effects. Examples of these include [fragile X syndrome,](https://www.medicalnewstoday.com/articles/fragile-x-syndrome) spina bifida, and [Down syndrome](https://www.medicalnewstoday.com/articles/145554).

**Methodology:**

* **Study design:-**

It is a prospective cross-sectional hospital-based study

* **Study area:-**
* Omdurman military hospital Neonatal care unit at department of obstetrics and gynecology

Omdurman military hospital was established at the beginning of November 1958. The hospital is open 24 hours a day and receives cold, hot, and referred cases. It accepts any patient who has military health insurance or not.

The department of obstetrics and gynaecology has refer clinic works 5 times per week (70-200 patients seen per day), and has two theatres for elective and emergency obstetrics and gynaecology operations, it also have HDU (contain 6 beds) and NICU (contain 6 incubators and 10 beds) units.

The average total of deliveries per month is 465 deliveries (100 caesarean sections and 335 vaginal deliveries).

There are 12 consultants, 5 specialists, 50 registrars, 18 medical officers, and 12 house officers. All other paramedical staff are available and well-trained. There is a subunit for any specialty.

* **Study duration:-**

Started from January 2022 to June 2022

* **Study population:-**

All the live or dead newborn babies born in this hospital during this period were included.

* **Inclusion criteria:-**
* All live babies born and diagnosed with congenital anomaly.
* All dead or stillbirth babies diagnosed with congenital anomaly.
* Both parents.
* **Exclusion criteria:-**
* Parents who refuse to participate in the research.
* Babies that are born with no anomalies are excluded.
* **Sample size:-**

42 patients 

* **Sampling technique:-**

It was a randomized selection based on convenience criteria

The newborns were examined for the presence of congenital anomalies, and both parents were interviewed for socio-demographic variables.

* **Data collection tools and methods:-**

Information will be taken through structural questionnaires by the researcher after counseling the parents and taking approval of both of them.

* **Study variables :-** • Dependent variables:-
* Congenital anomalies (yes/no)
* Types of congenital anomalies
* Independent variables:-

 1. Type of congenital anomalies: - {CNS, MS, CP, GIT, GU, NTDs, Skin, MCA}

 2. {Maternal and paternal risk factor:- for CA{Maternal age, socioeconomic status, educational background, maternal health status (medical disorder such diabetes mellitus), maternal exposure to drugs, maternal exposure to infection, maternal exposure to pesticides, medications, alcohol, tobacco, khat and waste disposal areas and sources of drinking water, mode of deliveries, gestational age, sex…. etc. as associated risk factors for the CAs (malformation) and were the focus of the study.

* **Plane of analysis:-**

The collected data were revised, coded, and entered into an Excel data sheet, and appropriate statistical analysis was performed using SPSS.

## RESULTS

The total number of deliveries during the study period was 1.400. Concerning congenital malformation, 42 newborns had anomalies, so the frequency of congenital anomalies was 3%.

Regarding the mothers’ age, 40.5% (17) of mothers their age was 31-40 years, 23.8% (10) of mothers their age was 26-30 years, 16.7% (7) of mothers their age was 21-25 years, 9.5% (4) of mothers their age was <20 years and 9.5% (4) of mothers their age was > 40 years.

About the age of fathers, 45.2% (19) of fathers their age was > 40 years, 28.6% (12) of fathers their age was 31-40 years, 19% (8) of fathers their age was 26-30 years and 7.1% (3) of father their age was 21-25 years.

In terms of parity, 50% (21) of patients were primigravida, 33.3% (14) of patients had 1-5 pregnancies, and 16.7% (7) of patients had > 5 pregnancies. In terms of the number of pregnancies, all patients 100% (42) were singleton.

According to the type of delivery, SC delivery was in 76.2% (32) of patients while VD was in 23.8% (10) of patients.

Based on the presence of medical disease, 76.2% (32) of patients did not have any medical disease, 16.7% (7) of patients had DM, 4.8% (2) of patients had HTN, and 2.4% (1) of patients were Asthmatic.

Regarding the blood type of mother, O positive was in 47.6% (20) of patients, B positive was in 19% (8) of patients, A positive was in 14.3% (6) of patients, AB positive was in 9.5% (4) of patients, B negative was in 4.8% (2) of patients, A negative was in 2.4% (1) of patients and O negative was in 2.4%.

Regarding the history of previous congenital anomalies, 85.7% (36) of patients did not have a history of previous congenital anomaly, while 14.3% (6) of patients had a history of previous congenital anomalies,

In terms of the Family history of CA, 78.6% (33) of patients did not have a Family history of CA, while 21.4% (9) of patients had a Family history of CA.

Regarding the gestational age, 61.9% (26) of patients were term while 38.1% (16) of patients were preterm.

In terms of socio-economic status, 85.7% (36) of patients their socio-economic status, 7.1% of patients their socio-economic status was low and 7.1% (3) of patients their socio-economic status was high.

According to Maternal history of febrile illness, 81% (34) of patients did not have a maternal history of febrile illness, while 19% (8) of patients had it.

In terms of bad habits, 92.9% (39) of patients did not have bad habits, 4.8% (2) of patients were smokers, and 2.4% (1) of patients were alcohol consumers.

Regarding the exposure, 95.2% (40) of patients did not have exposure, 2.4% (1) of patients had medication, and 2.4% (1) of patients had radiation.

About the CA diagnosed antenatal, 52.4% (22) of patients were CA diagnosed antenatal, while 47.6% (20) of patients were not CA diagnosed antenatal.

Regarding the folic acid used, 92.9% (39) of patients used folic acid, while 7.1% (3) of patients did not use it. About the gender of the outcome, 52.4% (22) of neonates were males, while 47.6% (20) of neonates were females.

Correlation between the risk factors and congenital anomalies were studied revealed significant relationship between congenital anomalies and "Blood Type of the mother, blood Type of the Baby, history of previous congenital anomaly, family history of CA and history of cosmetic product abuse Chi square P value were 0.05,0.05,0.02,0.04 respectively at (p< 0.05).

## Discussion

 Several studies described that the human embryo is well protected in the uterus by the extra embryonic membranes, although teratogens may cause developmental disruptions after maternal exposure to them in a specific period of organogenesis during the critical period in early pregnancy.

The frequency of congenital anomalies in newborns in this study was 3%, and it is closer to some studies like in Bangladesh 2.03%, in Iraqi 2%, in Gambia 5.95%, in Brazil 6.4% and 13.9% in Nigeria.

 Maternal age is considered an important parameter in the birth of a fetus with CAs and mothers aged (30-40) 45% years old may showed increased risk of having children with certain birth defects in this study not like other result from reviewed study such as (Bangladesh <35 years, India 21-30 years, Nigeria and Egypt >35 years, Ethiopia 26-35 years).

 Paternal age was also considered one of the risk factors in this study. The fathers of the cases were 45.2%>40 years old, the result similar to those in Egypt, where fathers were>45 years old, and not like in Ethiopia, where all fathers were 26-35 years old. In this study, 83.3% of the cases were outside Khartoum, most of them were from Aljazeera state which is a rural area that Residence is one of the risk factor of congenital anomalies since the mother will be exposed to different environment, ethnic group, tribe and type of diet. Just like another study in Egypt. In the study, all the pregnancies were single.

 In this study, 85.7% of the mothers don’t have a previous history of CAs, like the other studies. Pregnant women who have had children with some CA have a higher chance of having other children with malformations. The present study showed that there is no strong association between insufficient maternal folic acid supplementation during early pregnancy and the occurrence of CAs since 92.9% of the mothers use it.

 In this study, most of the mothers of the cases most of them get folic acid supplementation during early pregnancy were 7.1% didn’t use it. However, a study in the Tigray region, northeastern Ethiopia, had a similar result to this study and revealed that 40.9% participants were adhered to iron folate supplementation.

##  Conclusion

 In the findings of the present study, the frequency of congenital anomalies was 3%.

Socio-demographic factors such as maternal and paternal age, level of education, rural residence, and average monthly income showed association with the occurrence of CAs.

There are other pregnancy-related risk factors such as parity, single-tone pregnancy, mode of delivery, gestational age, and maternal history of febrile illness in the first trimester.

 Cosmetic product use preconception and during pregnancy showed a significant association with the occurrence of congenital anomalies.

 Associated risk factors such as maternal active or passive smoking, medical diseases such as DM and HT, exposure to radiation, exposure to chemicals, and use of unidentified medicine during the first three months had no significant association with the occurrence of CAs since most of the cases mothers don’t have this type of habit. The blood type of the mother and the baby's previous history of CAs and family history of CAs also showed there is no close association to the occurrence of CAs in this study.

 Differently, from the other studies, the use of folic acid during the indexed pregnancy had no significant protective effect against the occurrence of CAs because 95.2 % of the mothers in this study used folic acid during pregnancy.

52.4% of the mothers were diagnosed with having a baby with CAs during antenatal care visits, and 52.4% of the mothers said their baby's gender was male.

• Ethical consideration Approval and consent :

• Ethical approval was obtained from:- Sudan medical specialization board obs & gyn research committee and EDC

• Omdurman military hospital department of Obstetrics and Gynecology permission

• Written Informed consent was obtained from individual participants.

 Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.No AI tool was used

2.

3.

##  References

1. Khoury M.J. Epidemiology of birth defects. Epidemiol Rev. 1989;11:244–248. [PubMed] [Google Scholar]
2. Wellesley D., Boyd P., Dolk H., Pattenden S. An aetiological classification of birth defects for epidemiological research. J Med Genet. 2005;42:54–57. [PMC free article] [PubMed] [Google Scholar]
3. Prevalence of Congenital Anomalies in Neonates and Associated Risk Factors in a Tertiary Care Hospital in Eastern India 2013 Jul-Sep {NCBI} Shatanik Sarkar, Chaitali Patra, Malay Kumar Dasgupta, Kaustav Nayek, and Prasanta Ray Karmakar1

|  |  |
| --- | --- |
| 1 | , A K |

1. Fetal Congenital Anomaly in Tertiary Hospital in Lagos, South-West Nigeria: A Review of Presentation and its Outcome Jan-Apr 2019 [PubMed] G E Osanyin Odeseye, O O Okojie, O R Akinajo, B O Okusanya
2. Congenital malformations among newborns admitted in the neonatal unit of a tertiary hospital in Enugu, South-East Nigeria--a retrospective study 2012 Jul Herbert A Obu 1, Josephat M Chinawa, Nwachinemere D Uleanya, Gilbert N Adimora, Ikechukwu E Obi [PubMed]
3. Ajao, A. E., & Adeoye, I. A. (2019). Prevalence, risk factors and outcome of congenital anomalies among neonatal admissions in OGBOMOSO, Nigeria. *BMC pediatrics*, *19*, 1-10.
4. E Ajao Prevalence and Trends of Congenital Anomalies Among Neonates at Jimma Medical

Center, Jimma, Ethiopia: A Three-Year Retrospective Study 2021 Feb [PubMed]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | , Tesfanesh Lemma  | 1 | , Belete Fenta  | 2 | , Tsegaw Biyazin  | 2 |

Mulualem Silesh

1. Predictors of congenital anomalies among newborns in Arsi zone public hospitals,

|  |  |
| --- | --- |
| 1 | , Engidaw |

Southeast Ethiopia: a case-control study 2021 Jun [PubMed] Sudi Jemal

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | , Mohammed Oumer  | 1 | , Abebe Muche  | 2 |

Fentahun

1. Congenital Anomalies and Associated Factors among Newborns in Bishoftu General Hospital, Oromia, Ethiopia: A Retrospective Study 2021 Mar [PubMed] Samuel

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | , Endalew Gemechu Sendo  | 2 | , Workinesh Daba  | 2 |

Gedamu

1. WHO website, December 2020
2. Pattern of congenital anomalies at birth and their correlations with maternal characteristics in the maternity teaching hospital, Erbil city, Iraq.---Sozan K. Ameen,--Shahla Kareem Alalaf .---18 December 2018 [BMC]

|  |  |
| --- | --- |
| [1](https://pubmed.ncbi.nlm.nih.gov/28919624/) | [,](https://pubmed.ncbi.nlm.nih.gov/28919624/) |

1. Frequency, Distribution of Congenital Anomaly and Associated Maternal Risk Factors K [Fatema](https://pubmed.ncbi.nlm.nih.gov/?term=Fatema+K&cauthor_id=28919624)[T Das,](https://pubmed.ncbi.nlm.nih.gov/?term=Das+T&cauthor_id=28919624) [A Mannan,](https://pubmed.ncbi.nlm.nih.gov/?term=Mannan+A&cauthor_id=28919624) [S M Zaman](https://pubmed.ncbi.nlm.nih.gov/?term=Zaman+SM&cauthor_id=28919624) 2017 Jul [PubMed]
2. Pattern and Risk Factors of Congenital Anomaly in Newborns in a Tertiary Level Private

|  |  |
| --- | --- |
| [1](https://pubmed.ncbi.nlm.nih.gov/30487498/) | [,](https://pubmed.ncbi.nlm.nih.gov/30487498/) [S Sen,](https://pubmed.ncbi.nlm.nih.gov/?term=Sen+S&cauthor_id=30487498) [M N Islam,](https://pubmed.ncbi.nlm.nih.gov/?term=Islam+MN&cauthor_id=30487498) [M K Bhuiyan](https://pubmed.ncbi.nlm.nih.gov/?term=Bhuiyan+MK&cauthor_id=30487498) |

Medical College Hospital, Bangladesh [M Siddika](https://pubmed.ncbi.nlm.nih.gov/?term=Siddika+M&cauthor_id=30487498)

2018 Oct [PubMed]

1. Frequency of Congenital Anomalies in the Brazilian Midwest and the Association with Maternal Risk Factors Apr 2020 [scielo.br] Carolina Leão de MoraesNatália Cruz e MeloWaldemar Naves do Amaral

17. Ferdousi, M. A., Hasnat, M. F., & Rahman, M. S. (2024). Pattern of Congenital Anomalies at Birth and their Associated Maternal Characteristics in Combined Military Hospital, Dhaka and Chattogram. Chattagram Maa-O-Shishu Hospital Medical College Journal, 23(1), 47-51.

18. Zhang, Y., & Jingli, S. U. N. (2023). Epidemiological investigation and influencing factors of birth defects in military children in cold region. Journal of Army Medical University, 45(15), 1666-1670.

19. Oumer, M., Tazebew, A., & Silamsaw, M. (2021). Birth prevalence of neural tube defects and associated risk factors in Africa: a systematic review and meta-analysis. BMC pediatrics, 21, 1-13.

20. Abdelrahman, O., Diab, R., & Diab, R. A. (2022). Prevalence and pattern of congenital heart disease among children in Khartoum State, Sudan: a reflection of the current cardiac profile. Cureus, 14(1).

 21. Shaikh, N., Shaikh, A. H., Khokhar, I. R., Larik, S., Shaikh, A. R., & Chohan, M. N. Frequency of Common Congenital Anomalies among Neonates in Tertiary Care Hospital: A Cross-sectional Study. *J Pharm Res Int*, *34*(28B), 1-6.