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Original Research

Magnitude and Associated Factors of Congenital Anomalies Among Newborns Delivered at Public Hospitals in Dire Dawa: Eastern, Ethiopia

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Abstract

Background: A congenital anomaly is defined as a structural or functional defect that may be detected during pregnancy, visible at birth, or later in life. Despite the fact that neonatal mortality in Ethiopia is very high and morbidity is a serious neonatal health problem with contributing factors, research done in Ethiopia regarding congenital anomalies among newborns is limited. The aim of this study is to assess the magnitude and associated factors of congenital anomalies among newborns delivered at public hospitals in Dire Dawa, Ethiopia, in 2022.
Methods: A facility-based retrospective cross-sectional study was conducted at a public hospital in Dire Dawa, eastern Ethiopia. The census method was applied. Data were collected from all neonatal birth records and delivery summaries that were delivered at public hospitals from January to June 2022.
Result: Among 2126 newborns, 53 (2.5%), (95% CI: 1.8%, 3.2%) were born with various types of congenital anomalies. Common congenital anomalies were anencephaly and spinal bifida. Neonates born to mothers aged ≤20 years were nearly 80% less likely to develop congenital anomalies than neonates born to mothers aged ≥35 years (AOR = 0.199, 95% CI: 0.06, 0.63, p value: 0.006). Maternal use of iron and folate supplementation during pregnancy is a protective factor for the occurrence of congenital anomalies among newborn (AOR = 0.321, 95% CI: 0.12, 0.86, P value = 0.024).
Conclusion: The study shows that congenital anomaly among newborns was found to be low. Maternal age, iron/folate supplementation, gestational age, and birth weight had significant associations with congenital anomalies. Thus, the risk factors for congenital anomalies and preventive strategies consider expanding corrective surgical centers, and they should also plan to fortify foods with iron/folate.

Keywords: Congenital Anomalies, Newborns, Functional Defect

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1. Introduction

Congenital anomalies are defined as structural or functional defects that may be detected during pregnancy or visible at birth or later in life. Stillbirth, spontaneous abortion, infant mortality and morbidity, disability, and frequent hospital admissions are all caused by congenital anomalies [1]. The cause of mortality and disability among infants and children under five years of age is not recognized as congenital anomalies, which can cause spontaneous abortions and stillbirths. They can, however, be life-threatening, result in long-term disability, and negatively affect individuals, families, healthcare systems, and societies. The risk of congenital anomalies is high during the embryonic period (3rd to 8th week of gestational age), which is the critical period for the development of the fetus [1, 2].

In the world, congenital anomalies cause an estimated 295 000 newborns to die within 28 days of birth every year. Congenital malformations have a greater contribution to long-term disability, which impacts individuals, families, health-care systems, and communities [3]. Congenital anomalies occur in Africa at a rate of 5.2 to 74.5 per 10,000 births. Amazingly, approximately 94% of severe congenital anomalies occur in low- and middle-income countries, of which approximately 190,000 babies are delivered each year with neural tube defects [4, 5].

More than 6% of infant deaths globally are caused by congenital malformations, and more than 70% of infants with CAs die within the first month of life. The majority of infants who survive are mentally, physically and socially disabled [6]. While genetic (non-modified) factors account for more than 50% of CAs, a significant number of congenital malformations can be caused by modifiable environmental factors [5]. Approximately 94% of congenital anomalies and 95% of deaths due to congenital anomalies are found in low- and middle-income countries.

Congenital anomalies account for 17%-42% of infant mortality, according to the World Health Organization. Some studies in different parts of the world have shown that congenital anomalies are an increasing public health concern in which serious attention should be given. In Brazil, congenital anomalies accounted for the second leading cause of death in children under 5 years old in 2017. Every year, 25,000 live births are recorded with some kind of congenital anomaly in Brazil [7]. In Ethiopia, the overall prevalence of congenital anomalies was less than approximately 2%, of which 40.3% were attributable to neural tube defects, which was lower than that in other African studies [8].

An estimated 7.9 million babies are born every year with birth defects. Of these babies, more than 3 million die, and 3.2 million have permanent disability [9]. In both developed and developing countries, although CAs are the most serious cause of infant mortality and disability, approximately 94% of CAs, 95% of deaths and 15-30% of hospital admissions of infants and children due to CAs are in low- and middle-income countries [10].

The impact of congenital anomalies is more severe in low- and middle-income countries, which may be due to a lack of health facilities, infections, malnutrition, and maternal exposure to different toxic substances [11]. In low- and middle-income countries, congenital anomalies are not the priority health problems due to their low prevalence rate and low proportionate to infant mortality relative to other causes of perinatal deaths, such as infections and malnutrition, and the intervention cost is very high [12]. The use of maternal and child health services may be a factor in the early detection of these birth defects. According to the Ethiopian mini demographic health survey (EMDHS) -2019 report, the prevalence of the utilization of institutional delivery increased from 26% in 2016 to 48% in 2019 [13].

According to EMDHS 2019, the infant mortality rate was 43 per 1000 live births, the under-five mortality rate was 55 per 1000 live births, and the neonatal mortality rate was 29 per 1000 live births. Those deaths may be due to congenital anomalies [14]. Most of the children born with major CA are prone to die, or even if they survive, they may confront long-term morbidity and disability.

Campaigns by aid organizations are used to correct the majority of patients with orofacial clefts. Although the neonatal and under five mortality rates have declined, birth defects or congenital anomalies have become a larger proportion of the causes of neonatal and under five deaths [15]. Providing health education to communities, particularly females of reproductive age, requires evidence-based information on risk factors for congenital anomalies.

2. Methods and Materials

2.1. Study Area and Period

The study was conducted in the health facilities of Dire Dawa city that provide abortion care services. The city is situated 515 km away from Addis Ababa with a projected population size of 466,000 in 2020, of which females account for 51.6% and 67.92% of the population are considered urban inhabitants. There are 9 urban and 38 rural kebeles. The total fertility rate of Dire Dawa was 3.4 in 2014. The administration has two public hospitals, fifteen health centers, thirty-four health posts, sixteen private clinics, four private hospitals and two nongovernmental organizations. To obtain the sample size, we used the 3-month previous pattern of abortion services in each study area. The study was conducted from January – June 2022 in public hospitals in Dire Dawa, Eastern, Ethiopia.

2.2.Study Design

A facility-based retrospective cross-sectional study was conducted in public hospitals in Dire Dawa, Eastern, Ethiopia.

2.3. Study Variables

2.3.1. Dependent variable

- Congenital Anomaly

2.3.2. Independent variables

- Sociodemographic characteristics (maternal age, residency, parity)
- Maternal factors (ANC visit, iron/folate use, maternal infection, chronic medical illness, etc.)
- Neonatal factors (sex of neonate, gestational age and birth weight)

2.4.The Study Population

The source population was all birth records of newborns and delivery summaries who were delivered at public hospitals, and all birth records and delivery summaries of neonates who were delivered from January 2022 – June 2022 at public hospitals of Dire Dawa were the study population. All birth records and delivery summaries in selected public hospitals within the study period were included in the study, and those with incomplete delivery summaries and birth records were excluded from the study.

2.4. Sampling Methods

A census method was applied for this study. All birth records and delivery summaries from January 2022 to June 2022 at Public Hospital in Dire Dawa were reviewed.

2.5. Data Collection Tool and Procedures

Data collection was performed by using a checklist from the register documents of public hospitals in Dire Dawa during the data collection period. The questionnaire (checklist) was prepared in English; it has included questions that accommodate all the required data. Two BSc. Midwives were assigned for the purpose of data collection, and one public health professional was assigned as supervisor. After obtaining informed consent from the responsible body, background information and possible factors were collected in the form of a checklist. The checklist comprised sociodemographic characteristics and maternal and neonatal variables that may contribute to the occurrence of congenital anomalies.

2.6. Operational Definitions

- **Congenital Anomaly:** Any structural congenital anomaly presenting at birth and recorded on charts [16, 17].
- **NTD:** Open and closed central nervous system disorders that include spinal bifidia and anencephaly present at birth and recorded on charts [16, 18].
- **Orofacial Clefts:** Those infants who have either cleft lips or cleft palate or both and recorded on charts [16].

2.7. Data Quality Assurance

Data collectors were recruited from health professionals. Both data collectors and supervisors were trained before the actual data collection process to ensure the quality of data for one day by the principal investigator. The prepared tool was pretested on 5% of the sample at Hiwot Fana specialized hospital, Harar, before starting the actual data collection. Then, amendments were made accordingly. Additionally, daily counter checking of completed questionnaires was performed by the supervisor and principal investigator to ensure data completeness. A variable was coded to make the data more consistent, and the data were cleaned to reduce obvious data entry errors.

2.8. Statistical Analysis

Each collected data point was checked for completeness and consistency before data entry. The checked data were coded and entered into the computer with Epi-data version 3.1 and exported to SPSS version 26 for analysis. Descriptive statistics such as frequencies and percentages were used to describe respondents' results as appropriate. The data were presented using tables and bar graphs as appropriate. Bivariate analyses were performed for each variable and the respective crude odds ratio (COR). Independent variables with marginal associations ($P < 0.2$) in the bivariate analysis were entered in a multivariable logistic regression analysis to detect independent variables. The significant association of independent variables with the dependent variable was assessed by using a 95% confidence interval. The Hosmer and Lemeshow test were used for the model fitness test. The adjusted odds ratio (AOR) with 95% confidence intervals was computed to identify the strength of association, and statistical significance was declared at a p value <0.05.

3. Results

3.1. Sociodemographic Characteristics

A total of 2187 birth records and delivery summaries were reviewed. The mean age and standard deviation of mothers were 26.84 and 5.5, respectively. Of the mothers who delivered during the study period, 55.8% were multiparas. Among the participants, 1605 (75.5%) were urban, and 1810 (85.1%) were neonates delivered with normal birth weight (2.5 to 4 kg). Approximately 51.2% of infants were female, and regarding gestational age at the time of delivery, 91.3% of infants were born at term. Among total deliveries during the study period, 4.3% of mothers had various chronic medical illnesses, and 2.5% had infections during pregnancy (Table 1).

Table 1: Frequency distribution of socio-demographic characteristics of the mothers and neonatal factors in at Public Hospitals in Dire Dawa, Ethiopia, 2022.

Variables	Frequency (*n*= 2126)	Percent
Age of Mother		
≤ 20	291	13.7%
21-34	1597	75.1%
≥ 35	238	11.2%
Residency of mother		
Urban	1605	75.5%
Rural	521	24.5%
Sex of the infant		
Male	1037	48.8%
Female	1089	51.2%
Gestational age		
Preterm	117	5.5%
Term	1941	91.3%
Post term	68	3.2%

3.2. Magnitude of Congenital Anomaly

Out of 2126 births, 53 newborns were diagnosed with congenital anomalies, resulting in a prevalence rate of 2.5% [95%, CI; 1.8%-3.2%]. Of the neonates with congenital anomalies, 60.4% were males. From a total of congenital anomalies, the most common congenital anomalies found in this study were anencephaly, 14 (26.4%); spinal bifidia, 13 (24.5%); and hydrocephalus (18.8%) (Table 2), (Figure 1).

Table 2: The Frequency Distribution of Congenital Anomalies of Newborns by Sex Who Delivered from January 2022 to June 2022 at Public Hospitals in Dire Dawa, Ethiopia.

Congenital anomaly	Male		Female	
	Frequency	Percentage	Frequency	Percentage
Anencephaly	7	13.2%	7	13.2%
Spinal Bifida	8	15.1%	5	9.4%

Hydrocephalus	7	13.2%	3	5.66%
Orofacial clefts	3	5.66%	3	5.66%
Musculoskeletal Abnormality	2	3.77%	2	3.77%
Others	3	5.66%	2	3.77%

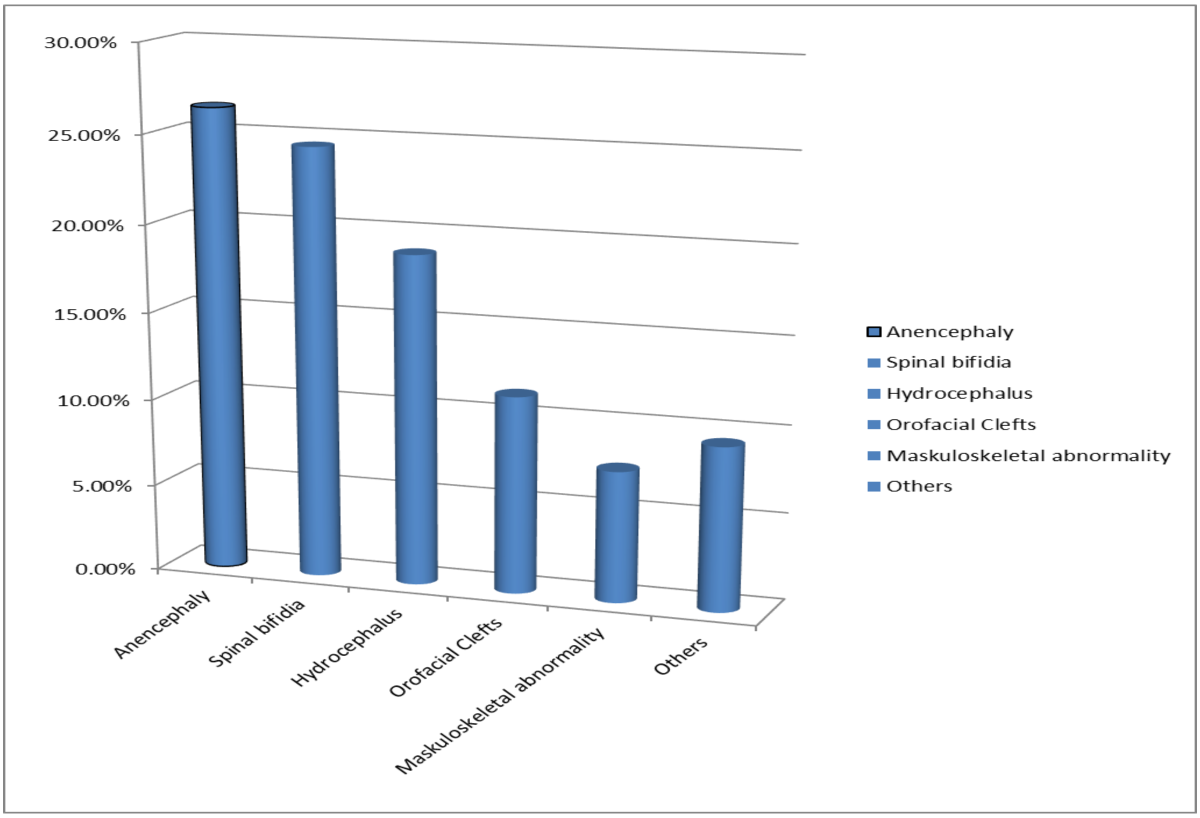

Figure 1: The percentage distribution of congenital anomalies in newborns delivered at public hospitals, Dire Dawa, Ethiopia, 2022.

3.3. Factors Associated with Congenital Anomaly

Among the variables entered into bivariate logistic analysis, maternal age above 35, ANC follow-up, maternal history of stillbirth or abortion, iron or foliate supplementation, presence of chronic medical illness, prematurity, being a male neonate, and infants with low birth weight had a crude association with congenital anomalies and entered multivariate analysis. Variables with a P value less than 0.2 had a significant association with the incidence of congenital anomalies, and those variables entered multiple logistic regression analysis.

In multiple logistic regression analysis, four variables remained independent predictors of congenital anomalies. These are maternal age, iron/foliate supplementation, gestational age and birth weight. Neonates born to mothers aged ≥35 years were nearly 80% more likely to develop congenital anomalies than neonates born to mothers aged ≤20 years (AOR = 0.199, 95% CI: 0.063, 0.629, p = 0.006).

Nearly 70% of mothers who used iron/foliate supplementation during pregnancy were less likely to be born a neonate with a congenital anomaly than those who did not use (AOR = 0.321, 95% CI: 0.120, 0.859, P value = 0.024). Preterm neonates were 3.02 times more likely to be born with congenital anomalies than neonates than term neonates (AOR = 3.02, 95% CI: 1.271, 7.177, P value = 0.012), and neonates born with birth weights ≤2.5 kg were 2.7 times more likely to develop or to be born with congenital anomalies than infants whose birth weights were ≥2.5 kg (AOR = 2.698, 95% CI: 1.265, 5.759, P value = 0.01) (Table 3).

Table 3: Bivariate and multivariate logistic regression analyses of factors associated with congenital anomalies among newborns delivered at public hospitals in Dire Dawa, Ethiopia, 2022.

Variable	Category	Congenital Anomaly		COR(95%CI)	AOR(95%CI)	P value
		Yes	No			
Maternal age	≤20	5	286	0.2(0.09, 0.7	0.20(0.06, 0.63)	0.006*
	21-34	32	1564	0.85(0.3, 2.2)	0.50(0.18, 1.36)	0.173
	≥35	16	222	1	1	
ANC visit	Yes	40	1977	0.2(0.08, 0.3)	0.56(0.20, 1.70)	0.295
	No	13	96	1	1	
History of still birth or Abortion	Yes	11	151	3.3(1.7, 6.6)	1.41(0.62, 3.17)	0.411
	No	42	1920	1	1	
Iron/Foliate supplementation	Yes	34	1915	0.1(0.08, 0.3)	0.32(0.12, 0.86)	0.024*
	No	19	157	1	1	
Chronic Medical illness	Yes	5	89	2.3(0.9, 6.0)	1.552(0.54, 4.46)	0.415
	No	48	1984	1	1	
Gestational age	Preterm	13	104	0.1(0.02, 0.9)	3.02(1.30, 7.18)	0.012*
	Term	39	1902	0.7(0.1, 5.4)	4.07(0.47, 35.4)	0.204
	Post-term	1	68	1	1	
Neonatal sex	Male	32	1005	1.6(0.9, 2.8)	1.58(0.88, 2.85)	0.125
	Female	21	1068	1		
Birth Weight	<2.5 kg	18	225	4.2(2.4, 7.6)	2.70(1.27, 5.76)	0.01*
	≥2.5 kg	35	1848	1		

***Note:** *P value <0.05 was considered significant, AOR, adjusted odds ratio, CI, confidence interval, 1, reference category. Hosmer and Lemeshow test 0.58*

4. Discussion

This study tried to assess the magnitude of congenital anomalies and associated factors among newborns delivered at public hospitals in Dire Dawa, Eastern Ethiopia. The overall magnitude of congenital anomalies among newborns during the study period was found to be 53 (2.5%) [95% CI: 1.8%–3.2%]. The result of this research is comparable with a study conducted in Nigeria, which had a prevalence of 2.8%, even though the study was conducted on newborns who were admitted to the neonatal intensive care unit [19], the prevalence of congenital anomalies observed in the present study was also comparable in another prevalence study conducted in the Philippines (2.74%) [20]. and in northern Ethiopia (1.96%) [3].

The magnitude of congenital anomalies in the present study is lower than in studies performed in Jimma, Ethiopia (5.95%) [13], Tanzania (29%) [21], Nigeria (6.3%) [20] and Korea (5.48%) [22].

This might be due to sample size differences; in Tanzania, the study was conducted among 445 admitted infants who were less than 2 months of age. However, in this study, 2126 delivery summaries and birth records were reviewed, and a study in Jimma was conducted in NICU-admitted infants and included recently diagnosed congenital anomalies such as CHD [13].

The current research finding is higher than in a study of newborn infants conducted in the city of São Paulo, Brazil, which showed a congenital anomaly prevalence of 1.6% [23]. The current study prevalence is also higher than studies conducted in Bishoftu, Ethiopia (1%) [16], Gojjam, Ethiopia (1.61%) [24]. These variations could be due to the increasing trend of prevalence of congenital anomalies among newborns from time to time [13].

The findings of this study show that maternal use of iron/foliate supplementation during pregnancy is a protective factor [AOR = 0.321, 95% CI: 0.120, 0.859, P value = 0.024)]. This study is similar to a study conducted in Tanzania of CAs [21]. showed that maternal use of folic acid during pregnancy is a protective factor for the occurrence of congenital anomalies in newborns. Another study conducted in central and southern parts of Ethiopia showed that folic acid intake during pregnancy is protective against the occurrence of congenital anomalies [9]. In the present study, neonates born to mothers aged ≤20 years were nearly 80% less likely to develop congenital anomalies than neonates born to mothers aged ≥35 years [AOR = 0.2, 95% CI: 0.06, 0.63, p value; 0.006]. This is in line with a study performed in Bishoftu, Ethiopia, which showed that mothers aged above 35 years had a 6.5 times greater chance of having congenitally deformed babies than mothers aged below 35 years [16].

Among neonatal factors associated with congenital anomalies, according to the findings of this study, preterm neonates were 3.02 times more likely to be born with congenital anomalies [AOR = 3.02, 95% CI: 1.27, 7.2, P value=0.012)]. The findings of this study are also similar to those of a study conducted in the city of Sao Paolo and a study conducted in Mwanza, Tanzania, which reported that the majority of neonates born with congenital anomalies were premature [21, 23]. Neonates with birth weights ≤2.5 kg were 2.7 times more likely to develop or be born with congenital anomalies than infants whose birth weights were ≥2.5 kg [AOR = 2.7, 95% CI: 1.3, 5.8, P value = 0.01). This study is also similar to a study performed in Bishoftu, Ethiopia [16].

Maternal chronic diseases such as DM and hypertension showed no association with the existence of congenital anomalies in the present study; however, in contrast to these findings, several reports from other scientific studies have shown that maternal chronic illness is a wellestablished risk factor for congenital anomalies and adverse birth outcomes. A study performed in western Ethiopia revealed that mothers who had a chronic disease during pregnancy were significantly associated with infants having congenital anomalies [24]. The findings in a study performed in Arsi, southwest Ethiopia, showed that there was a significant association between maternal chronic medical illness (CMI) and congenital anomalies in newborns [17].

ANC visits and maternal residency had no association with the occurrence of congenital anomalies among newborns in the current study, but a study performed in Bishoftu, Ethiopia, showed that mothers who live in urban areas were less likely to be born neonates with congenital anomalies than mothers who live in rural areas, which could be due to increased ANC coverage and the higher urban population proportion in the study area [16, 25].

5. Strengths and Limitations of the Study

5.1. Strength of Study

The strength of this study is that it includes all birth records and delivery summaries, which avoids selection bias and omission of congenital anomalies. It addresses the positive and negative determinants of congenital anomalies in this region.

5.2. Limitations of the Study

This study is unable to determine congenital anomalies that were diagnosed later, such as congenital heart defects, Down syndrome and early terminations of pregnancy, since the study shows congenital anomalies diagnosed only at birth. It also fails to address the effect of some variables, such as alcohol drinking and smoking, medication use and chemical exposure, due to the study design.

6. Conclusion

Based on the findings of this study, the overall magnitude of congenital anomalies was low compared to that of other anomalies. The most common congenital anomalies in this study were anencephaly and spinal bifidia. Neonates who are born to mothers aged ≥35 are at higher risk of being born with congenital anomalies. The majority of neonates born with congenital anomalies were premature and had low birth weights. Maternal iron/foliate use during pregnancy protects neonates from congenital anomalies. Health Bureau should strengthen resources for managing congenital anomalies and promote folic acid use before and during pregnancy. Policymakers and communities should focus on prevention, expand surgical centers, encourage childbirth before 35, fortify foods with folate, and support further research on contributing factors and community burden.

Abbreviations

ANC: Antenatal Care, AOR: Adjusted Odd Ratio, CA: Congenital Anomaly, CHD: Chronic Heart Disease, COR: Crude Odds Ratio, EMDHS: Ethiopian Mini Demographic Health Survey, NICU: Neonatal Intensive Care Unit, NTD: Neural Tube Defects, SPSS: Statistical Package for Social Science, WHO: World Health Organization

Author Contributions

YA conceived the idea of the study, prepared the study proposal, collected data in the field, performed the data analysis, and drafted the manuscript. YS & YM assisted with the preparation of the proposal and the interpretation of data, participated in data analysis, critically reviewed the manuscript and participated in the critical comments of the proposal and manuscript preparation. All authors read and approved the final manuscript.

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Ethical Approval

Ethical clearance was obtained from the Dire Dawa University Institutional Review Board, (SOP/DDU-IRB/98/03) and a permission letter was received from the Dire Dawa Health Bureau and respected health institutions in the city. All the study participants were informed about the objective of the study, and their informed verbal consent was obtained. Additionally, the study subjects were informed that confidentiality and privacy of the information were maintained throughout the study.

Availability of Data and Materials

The data supporting this finding can be available at any time with a request. If someone wants to request the data you can communicate the corresponding Authors with email.

Competing Interests

The authors declare that they have no competing interests.

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