Research Article

iMedPub Journals
www.imedpub.com

Journal of Birth Defects

2022
Vol.3 No.1:001

History of Substance Intake and Congenital Anomaly in Ethiopia: A Systematic Review and Meta-Analysis

Mesfin Wudu Kassaw[1*], Biruk Beletew Abate[1], Ayelign Mengesha Kassie[1], Alemu Birara Zemariam[1] and Ayele Mamo Abebe[2]

[1]Department of Nursing, Woldia University, Woldia, Ethiopia

[2]Department of Nursing, Debre Berhan Health Science College, Debre Berhan, Ethiopia

[*]**Corresponding author:** Mesfin Wudu Kassaw, Department of Nursing, Woldia University, Woldia, Ethiopia, E-mail: kassaw_mesfin@yahoo.com

Received: September 30, 2019, Manuscript No. IPJBD-19-2648; **Editor assigned:** October 03, 2019, PreQC No. IPJBD-19-2648; **Reviewed:** October 17, 2019, QC No. IPJBD-19-2648; **Revised:** August 22, 2022, QI No. IPJBD-19-2648, Manuscript No. IPJBD-19-2648;**Published:** September 19, 2022

Citation: Kassaw MW, Abate BB, Kassie AM, Zemariam AB, Abebe AM (2022) History of Substance Intake and Congenital Anomaly in Ethiopia: A Systematic Review and Meta-Analysis. J Birth Defects Vol.3 No.1:001

Abstract

Background: Congenital anomaly is a birth defect regardless of whether the anomaly is caused by a genetic factor or by events occurring before birth or at birth. Congenital malformations can involve many different organs including the brain, heart, lungs, liver, bones and intestinal tract. The causes of these defects include inherited genetic conditions, poor diet and toxic exposure to the fetus and birth injury. Since the causes of most congenital anomaly is unknown, all parents are at risk of having a baby with birth defects, regardless of age, race, income or residence.

Methods: The search strategy was performed in considering PEO mnemonics. The electronic database used was only PubMed and gray literatures like research and trials registers, organizations thesis and dissertations catalog, as well as organizational reports using the search logic grid. Ethics and dissemination the review was based on published data and an ethical approval were waived of health science institutional review board. This systematic review and meta-analysis are expected to indicate the association of substance intake and congenital anomaly for policy makers and for child bearing age women. The final report of this review will be published in a peer reviewed. Trial registration: The protocol for this review has been published in the PROSPERO, International Prospective Register of systematic reviews with a protocol identification number.

Results: A total of 5 researches were included based on inclusion criteria. Of these 5 researches, there were 16 factors reported in relation to congenital anomaly and substance utilization in Ethiopia. The odds of congenital anomaly among substance users was higher in relative to their counters, (OR, 95% CI), 1.80 (1.55-2.11). The heterogeneity of the studies was tested using visual techniques, Galbraith plot. The purpose of the plot was to indicated whether all the points lie within the 95% confidence bounds or not. The studies were out of the 95% confidence interval and are asymmetrical on visualization. The estimated magnitude of true heterogeneity (I2) was also 88.9 with a p-value of 0.00.

Conclusions: In this review, maternal substance utilization during pregnancy was associated with a higher risk of birth defects in children. Health education about the impact of substance intake on fetus should be delivered for all women and community in Ethiopia.

Keywords: Congenital anomaly; Ethiopia; Substance intake; Meta-analysis

Introduction

For this review, substance is defined as any traditional or medicinal chemicals that have impact on the fetus or newborn child. It includes chat chewing, cigarette smoking, therapeutic or diagnostic drugs, contraceptive utilization, alcoholic ingestion and any other locally made substances ingested by mothers during pregnancy. Thus, substance intake is use of any of the traditional or medicinal chemicals for therapeutic, diagnostic or recreational purpose either prescribed by physician or traditional healers. Congenital anomaly is a physical irregularity regardless of whether the anomaly is caused by a genetic factor or by events occurring before or at birth. Congenital malformations can involve many different organs including the brain, heart, lungs, liver, bones and intestinal tract. The causes of these defects include inherited genetic conditions, poor diet and toxic exposure of the fetus to alcohol or to birth injury [1]. Since the causes of most congenital anomaly is unknown, all parents are at risk of having a baby with birth defect, regardless of age, race, income or residence [2]. But advanced maternal age increases the risk of chromosomal abnormalities such as down syndrome, trisomy 13 and trisomy 18. [3-5]. Maternal exposure to certain pesticides and other chemicals, certain medications, alcohol, tobacco, psychoactive drugs and radiation exposure during pregnancy increases the risk of giving birth to a newborn with congenital anomalies [6]. Prescription of iatrogenic drugs, especially in the first trimester during pregnancy is associated with causation of several types of congenital limb anomalies [7-10]. Women who smoke during pregnancy are more likely to have infants with congenital anomalies such as congenital heart defects, musculoskeletal

defects, orofacial defects and gastrointestinal defects. Working or living near or in, waste sites, smelters or mines may also be a risk factor especially if the mother is exposed to other environmental risk factors or nutrition deficiencies [11]. Furthermore, congenital anomalies are a global problem and every year an estimated 7.9 million children were born with a serious birth defect. Of these 3.3 million children under five years of age die from birth defects and 3.2 million who survive may be disabled for life. In Africa, some of the rare studies on congenital anomalies have reported an incidence between 1.5% and 2.5% in Egypt and East Africa (Kenya and Uganda) respectively [12]. Literature showed that congenital anomaly contributes to prenatal mortality and postnatal physical defects [13-15]. and congenital anomalies contribute for one of every three babies that die in the world. The long-term disabilities caused by congenital anomalies not only have significant effects on the child's wellbeing and development, but also on families, societies and health systems. Because of such socio-economical impact of congenital anomaly, reviewing the association of congenital anomaly and substance utilization in Ethiopia may be imperative to act early.

The purpose of this review was to assess the association of congenital anomaly and history of substance intake from 2010 to 2019 in Ethiopia.

For this review and meta-analysis, the question was developed using PEO mnemonics in considering the context of Ethiopia. Thus, the question is; "Is there an association between congenital anomaly and substance intake history in Ethiopia"

Materials and Methods

Search strategy: The PubMed search was performed using PEO mnemonics by four investigators. They were search the database for published studies independently. The other one investigator search gray literatures like research and trials registers, thesis and dissertations and organizational reports using the following logic grid [16]. A manual search for additional relevant studies using references from retrieved articles were performed by all of the 5 investigators. The searches were restricted to human studies with English language only [17]. The literatures were downloaded to Endnote version 7 to maintain and manage citations, duplications and to facilitate the review process [18].

Type of studies, participants and exposure: Studies with cross-sectional, cohort and case control design conducted among children in Ethiopia were included. All studies that focused on mother-child pairs, parents, relatives or genetics and child in relative to congenital anomaly were included. Studies on *in vivo* or studies that assess environmental risks independent of human subjects were excluded [19].

Inclusion and exclusion criteria

Similar researches done on animals, done in none-English language or done in None-Ethiopian countries and researches that was not used cross-sectional or cohort or case control design were excluded from this review and meta-analysis. In addition, researches with poor quality based on JBI criteria were excluded when the reviewers agree to reject the paper with clear reason. Moreover, PRISMA flowchart were used in including and excluding papers for review and meta-analysis [20].

Outcome measures: The primary outcome was congenital anomaly. The anomaly might be physical birth defects like club foot, spinal bifida or vital organ anomalies like kidney, heart or stomach abnormalities.

Data abstraction and extraction: Titles and abstracts were retrieved using the search strategy. Additional sources were screened by all of the five authors to identify studies that were included. The titles then abstract and at the end the full text of all the potentially eligible studies were assessed for eligibility by four reviewers independently [21]. Two reviewers assess a single study at the same time. If two of the reviewers agreed to include or exclude the paper, it will be treated as it is. But if the two reviewers have discordant review result, a third reviewer were invited to evaluate the paper [22]. The decision to include or exclude the paper was also determined by the third reviewer. Information about the authors, year of publication, journals, design, area or place of study, sample size, response rate, time of data collection, type of participants that were significantly related to congenital anomaly were extracted [23]. Electronic mails were sent to the corresponding or first authors of the studies or abstracts for missing information and waited 3-4 weeks for their responses. When there were no responses, the studies were excluded with not available reason. A standardized data extraction forms were used to assure the consistency, to reducing bias and improving validity and reliability of the systematic review and meta-analysis of this paper [24].

Assessment of risk of bias: All authors in two pairs were piloted studies independently for possible bias using JBI and Glasgow university critical appraisal checklist. Research with poor quality in both assessment tools were excluded from this review [25].

Assessment of heterogeneity and data synthesis: The heterogeneity of studies was assessed using graphic aid particularly forest plot. The overlapping of confidence intervals was considered to appreciate it, if there is heterogeneity. The other statistical tests, chi-squared test and I square statistic (I2) were also used [26].

Statistical methods: Statistical analysis were carried out using the statistical software package Stata version 14 with build in meta-analysis commands. Using the command sensitivity analysis, subgroup analysis, funnel plot and Egger test were performed.

Results

A total of 5 researches were included based on inclusion criteria. Of these 5 researches, there were 16 factors reported in relation to congenital anomaly and substance utilization in Ethiopia [27]. The odds of congenital anomaly among substance

users was higher in relative to their counters, (OR, 95% CI), 1.80 (1.55-2.11). The result indicated the presence of association between substance intake history and congenital anomaly in Ethiopia in the last 10 years. But the studies have significant heterogeneity **(Figure 1)**.

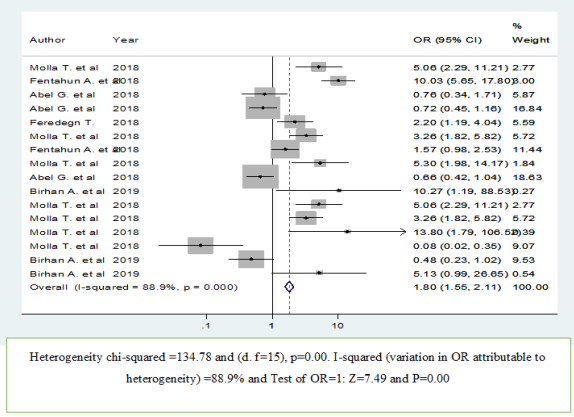

Figure 1: The association of substance intake history and congenital anomaly in Ethiopia, 2010-2019.

Test of heterogeneity: The heterogeneity of studies was tested using visual (subjective) technique mainly Galbraith plot; that checked whether all the points lied within the 95% confidence bounds or not [28]. The studies were out of the 95% confidence interval and were asymmetrical on visualization. The estimated magnitude of true heterogeneity was also 88.9 with a p-value of 0.00. Both the subjective and objective methods assure the presence of considerable heterogeneity [29].

Assessing presence of biases

Funnel plot subjective test: The presence of publication bias in meta-analysis was examined by visually checking for asymmetry in funnel plots [30]. The plot shows that studies were distributed unevenly, which concentrated more to the right side, to the top and to the bottom of the plot. The studies were also clustered asymmetrically from the mean effect size. The graph indicated the presence of biases in publishing researches **(Figure 2)**.

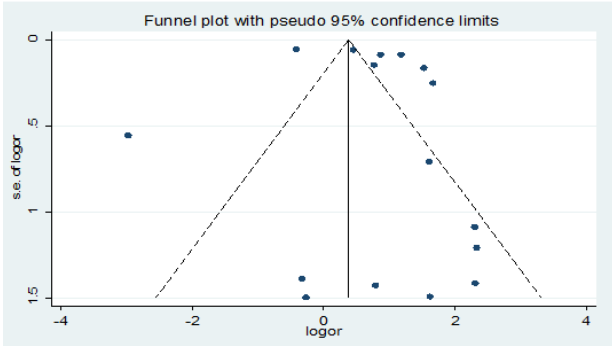

Figure 2: The test of publication bias using the subjective technique, funnel plot for studies done from 2010-2019.

Objective testing using Egger's technique: The presence of publication bias in meta-analysis were also examined by Egger's technique objectively [31]. The plot showed the presence of bias, since the line modeled in the Egger plot passed above the origin with a p-value of 0.33, bias coefficient (intercept) of 1.86, a standard error of 1.84 and a p-value of 0.03. The test thus provided strong evidence for the presence of a small studies effect **(Figure 3)**.

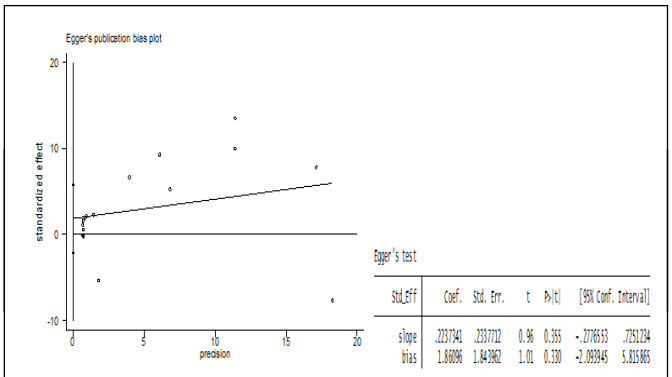

Figure 3: The test of publication bias using the objective technique, Egger's plot for studies done from 2010-2019.

Subgroup analysis

Since both the subjective and objective assessment of risk of bias confirm the presence of actual bias, a subgroup and sensitivity analysis were computed [32]. A subgroup analysis by study design was computed but the analysis was showed as heterogeneous with (I2) of 86.5% and p-value of 0.00 for case-control study design and (I2) of 94.4% and P-value of 0.00 for cross-sectional design **(Figure 4)**.

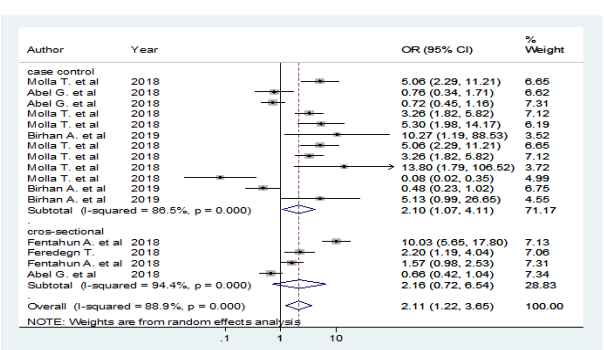

Figure 4: The subgroup analysis by study design for case control and cross-sectional studies done from 2010-2019.

Sensitivity analysis

The influence of each single studies on the overall meta-analysis was also estimated. All estimates fall within the 95% CI. But the study done by which is the second research, inclined to the left of estimate and which is the 14th research, fall to the right of the estimate. The heterogeneity of this review might be because of these two researches data **(Figure 5)**.

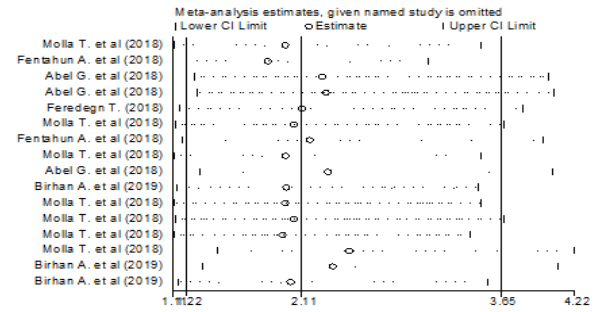

Figure 5: The sensitivity analysis on the study of congenital anomaly and substance intake history in considering researches done from 2010-2019.

Meta trim and ill analysis

The trim and fill technique also used as an iterative procedure to remove the most extremely small studies from one side of the funnel plot. The small studies were omitted until a funnel plot gets symmetrical [33-45]. When the plot gets symmetrical, the original studies were added back into the analysis and impute a mirror image for each. The 4 imputed studies are shown as squares but the observed 16 studies are shown as open circles **(Figure 6)**.

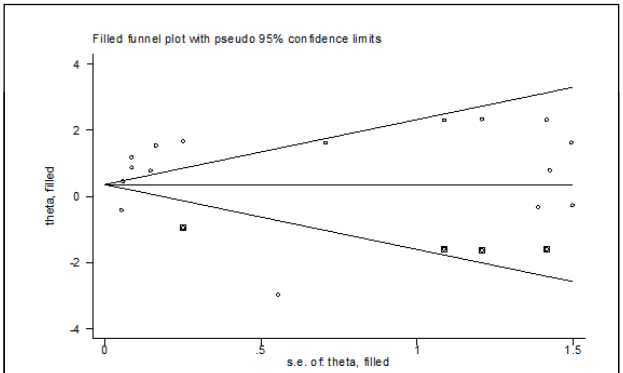

Figure 6: The meta trim and fill analysis on the study of congenital anomaly and substance intake history in considering researches done from 2010-2019.

Discussion

Congenital anomalies are not prioritized as public health problems in low income countries as they are considered to be rare conditions that are self-limiting due to the high mortality of affected infants. But time to time the prevalence of congenital anomaly is increasing either because of improved diagnostic tools or increase incidence of congenital anomaly [46]. Whatever if identifying the factors and take measurement on those factors is significant in low income countries. To our knowledge, this is the first review and meta-analysis to estimate the pooled effect of substance use on congenital malformations in Ethiopia [47]. Thus, this review is intended to assess the impact of substance utilization during pregnancy on fetus. The review with meta-analysis has shown that children of mothers who had history of substance intake during pregnancy are at a higher risk of presenting birth defects of any type. The odds of congenital anomaly among substance users in relative to their counters [48].

Conclusion

This review is congruent with the findings of other primary studies that reports maternal exposure to nitrate from drinking water and diet are risk factors for congenital anomaly. In addition, consumption of both prescribed and self-administered drugs during pregnancy have adverse effects on the development of the fetus. Other studies also indicated that pregnant mothers drinking any amount of alcohol during early pregnancy had direct effects on the growth and morphogenesis of fetuses. Those researches showed that infants born from mothers who consumed alcohol during pregnancy were found to be 2.02 times more likely to have congenital anomaly compared to infants born from mothers. We conclude, from this systematic review with meta-analysis, that maternal substance utilization during pregnancy is associated with a higher risk of birth defects in children.

References

1. Lee KS, Khoshnood B, Chen L, Wall SN, Cromie WJ, et al. (2001) Infant mortality from congenital malformations in the United States, 1970-1997. Obstet Gynecol 98: 620-627.
2. Schempf AH, Branum AM, Lukacs SL, Schoendorf KC (2007) The contribution of preterm birth to the black-white infant mortality gap, 1990 and 2000. Am J Public Health 97: 1255-1260.
3. Materna-Kiryluk A, Wiśniewska K, Badura-Stronka M, Mejnartowicz J, Więckowska B, et al. (2009) Parental age as a risk factor for isolated congenital malformations in a Polish population. Paediatr Perinat epidemiol 23: 29-40.
4. Muga R, Mumah SC, Juma PA (2009) Congenital malformations among newborns in Kenya. African J Food Agric Nutr Dev 9.
5. Corneg Blokland E, Jansen HE, de Jong de Vos van Steenwijk CC, Poenaru D (2011) Quality of life of children with spina bifida in Kenya is not related to the degree of the spinal defects. Trop Med Int Health 16: 30-36.
6. Carmona RH (2005) The global challenges of birth defects and disabilities. Lancet 366: 1142-1144.
7. Mashuda F, Zuechner A, Chalya PL, Kidenya BR, Manyama M (2014) Pattern and factors associated with congenital anomalies among young infants admitted at Bugando medical centre, Mwanza, Tanzania. BMC Res Notes 7: 1-7.
8. McIntosh R, Merritt KK, Richards MR, Samuels MH, Bellows MT (1954) The incidence of congenital malformations: A study of 5,964 pregnancies. Pediatrics 14: 505-522.
9. Gustavson KH, Jorulf H (1976) Recurrence risks in a consecutive series of congenitally malformed children dying in the perinatal period. Clin Genet 9: 307-314.
10. Khoshnood B, De Vigan C, Vodovar V, Goujard J, Lhomme A, et al. (2005) Trends in prenatal diagnosis, pregnancy termination and perinatal mortality of newborns with congenital heart disease in France, 1983-2000: A population-based evaluation. Pediatrics 115: 95-101.

11. Hernández-Díaz S, Werler MM, Walker AM, Mitchell AA (2000) Folic acid antagonists during pregnancy and the risk of birth defects. New Engl J Med 343: 1608-1614.

12. Christianson A, Modell B (2004) Medical genetics in developing countries. Annu Rev Genomics Hum Genet 5: 219-265.

13. Moore KL, Persaud TV, Torchia MG (2018) The developing human-e-book: Clinically oriented embryology. Elsevier Health Sci 23.

14. Croen LA, Todoroff K, Shaw GM (2001) Maternal exposure to nitrate from drinking water and diet and risk for neural tube defects. Am J Epidemiol 153: 325-331.

15. Nelson MM, Forfar JO (1971) Associations between drugs administered during pregnancy and congenital abnormalities of the fetus. Br Med J 1: 523-527

16. Hanson JW, Streissguth AP, Smith DW (1978) The effects of moderate alcohol consumption during pregnancy on fetal growth and morphogenesis. J pediatr 92: 457-460.

17. Druse MJ, Hofteig J (1977) The effect of chronic maternal alcohol consumption on the development of central nervous system myelin subfractions in rat offspring. Drug Alcohol Dependence 2: 421-429.

18. Guerri C (1998). Neuroanatomical and neurophysiological mechanisms involved in central nervous system dysfunctions induced by prenatal alcohol exposure. Alcoholism Clin Exper Res 22: 304-312.

19. Delport SD, Christianson AL, Van den Berg HJ, Wolmarans L, Gericke GS (1995) Congenital anomalies in black South African liveborn neonates at an urban academic hospital. S Afr Med J 85: 11-15.

20. Rozendaal AM, van Essen AJ, Te Meerman GJ, Bakker MK, van der Biezen JJ, et al. (2013) Periconceptional folic acid associated with an increased risk of oral clefts relative to non-folate related malformations in the Northern Netherlands: A population based case-control study. Europ J Epidemiol 28: 875-887.

21. Mobasheri E, Keshtkar A, Golalipour MJ (2010) Maternal folate and vitamin B12 status and neural tube defects in Northern Iran: A case control study. Iran J Pediatrs 20: 167.

22. Prajapati VJ, Kacha AR, Kakkad KM, Damor PB, Nandaniya AM (2015) Study of congenital malformation in neonates born at tertiary care hospital. Natl J Community Med 6: 30-34.

23. van Gelder MM, Bos JH, Roeleveld N, de Jong-van den Berg LT (2014) Drugs associated with teratogenic mechanisms. Part I: Dispensing rates among pregnant women in the Netherlands, 1998-2009. Hum Reprod 29: 161-167.

24. Van Gelder MM, Van Rooij IA, Miller RK, Zielhuis GA, de Jong-van den Berg LT, et al. (2010) Teratogenic mechanisms of medical drugs. Hum Reprod Update 16: 378-394.

25. Mohammed MA, Ahmed JH, Bushra AW, Aljadhey HS (2013) Medications use among pregnant women in Ethiopia: A cross sectional study. J Appl Pharma Sci 3: 116-123.

26. Admasie C, Wasie B, Abeje G (2014) Determinants of prescribed drug use among pregnant women in Bahir Dar city administration, Northwest Ethiopia: A cross sectional study. Pregnancy Childbirth 14: 1-7.

27. Abeje G, Admasie C, Wasie B (2015) Factors associated with self-medication practice among pregnant mothers attending antenatal care at governmental health centers in Bahir Dar city administration, Northwest Ethiopia, a cross sectional study. Pan Afr Med J 20.

28. Kebede B, Gedif T, Getachew A (2009) Assessment of drug use among pregnant women in Addis Ababa, Ethiopia. Pharmacoepidemiol Drug Saf 18: 462-468.

29. Grewal J, Carmichael SL, Ma C, Lammer EJ, Shaw GM (2008) Maternal periconceptional smoking and alcohol consumption and risk for select congenital anomalies. Birth Defects Research Part A: Clin Mol Teratol 82: 519-526.

30. Zhang X, Li S, Wu S, Hao X, Guo S, et al. (2012) Prevalence of birth defects and risk-factor analysis from a population-based survey in Inner Mongolia, China. Pediatrics 12: 1-6.

31. O'Leary CM, Elliott EJ, Nassar N, Bower C (2013) Exploring the potential to use data linkage for investigating the relationship between birth defects and prenatal alcohol exposure. Birth Defects Research Part A: Clin Mol Teratol 97: 497-504.

32. O'Leary CM, Nassar N, Kurinczuk JJ, De Klerk N, Geelhoed E, Elliott EJ, et al. (2010) Prenatal alcohol exposure and risk of birth defects. Pediatr 126: 843-850.

33. Mitro SD, Johnson T, Zota AR (2015) Cumulative chemical exposures during pregnancy and early development. Curr Environ Health Rep 2: 367-378.

34. Bell EM, Hertz-Picciotto I, Beaumont JJ (2001) A case-control study of pesticides and fetal death due to congenital anomalies. Epidemiol 148-156.

35. G. Araneta MR, Schlangen KM, Edmonds LD, Destiche DA, Merz RD, et al. (2003) Prevalence of birth defects among infants of Gulf War veterans in Arkansas, Arizona, California, Georgia, Hawaii and Iowa, 1989-1993. Birth Defects Research Part A: Clin Mol Teratol 67: 246-260.

36. Dolk H, Vrijheid M, Armstrong B, Abramsky L, Bianchi F, et al. (1998) Risk of congenital anomalies near hazardous-waste landfill sites in Europe: the EUROHAZCON study. Lancet 352: 423-427.

37. Heeren GA, Tyler J, Mandeya A (2003) Agricultural chemical exposures and birth defects in the Eastern Cape Province, South Africa A case-control study. Environ Health 2: 1-8.

38. Alverson CJ, Strickland MJ, Gilboa SM, Correa A (2011) Maternal smoking and congenital heart defects in the Baltimore-Washington infant study. Pediatr 127: 647-653.

39. Little J, Cardy A, Arslan MT, Gilmour M, Mossey PA, et al. (2004) collaboration includes smoking and orofacial clefts: A united kingdom-based case-control study. Cleft Palate Craniofac J 41: 381-386.

40. Hackshaw A, Rodeck C, Boniface S (2011) Maternal smoking in pregnancy and birth defects: A systematic review based on 173 687 malformed cases and 11.7 million controls. Hum Reprod Update 17: 589-604.

41. Honein MA, Paulozzi LJ, Moore CA (2000) Family history, maternal smoking and clubfoot: An indication of a gene-environment interaction. Am J Epidemiol 152: 658-665.

42. Czeizel AE, Kodaj I (1995) A changing pattern in the association of oral contraceptives and the different groups of congenital limb deficiencies. Contraception 51: 19-24.

43. Li DK, Daling JR, Mueller BA, Hickok DE, Fantel AG, et al. (2012) Oral contraceptive use after conception in relation to the risk of congenital urinary tract anomalies. Teratology 51: 30-36.

44. Bracken MB, Holford TR, White C, Kelsey JL (1978) Role of oral contraception in congenital malformations of offspring. Intl J Epidemiol 7: 309-317.

45. Anteab K, Demtsu B, Megra M (2014) Assessment of prevalence and associated factors of alcohol use during pregnancy among the dwellers of Bahir-Dar City, Northwest Ethiopia, 2014. Int J Pharma Sci Res Assess 5: 939-946.

46. Gedefaw A, Teklu S, Tadesse BT (2018) Magnitude of neural tube defects and associated risk factors at three teaching hospitals in Addis Ababa, Ethiopia. BioMed Research Int.

47. Seyoum G, Adane F (2018) Prevalence and associated factors of birth defects among newborns at referral hospitals in Northwest Ethiopia. Ethiop J Health Dev 32.

48. Taye M, Afework M, Fantaye W, Diro E, Worku A(2018) Factors associated with congenital anomalies in Addis Ababa and the Amhara Region, Ethiopia: A case-control study. Pediatics 18: 1.