Volume 3, Issue 11, November 2025 ISSN (E): 2938-3765

RISK FACTORS OF NEURAL TUBE DEFECTS IN NEONATAL CARE UNIT AT MATERNITY HOSPITAL IN ERBIL GOVERNORATE

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Abstract

Background and objectives: Fetal and newborn mortality are causes of concern when it comes to neural tube abnormalities. The exact cause of neural tube abnormalities is still not fully understood; however, it involves both hereditary and environmental variables. Antenatal diagnosis, multivitamin supplementation, and folic acid supplementation have all contributed to a drop in the prevalence of neural tube abnormalities in the past 30 years, yet some of the decrease remains unexplained.
The aim of this study neural tube abnormalities in the Erbil Governorate is the main goal of this research.

Methods: From February 1, 2017, until July 31, 2017, researchers in Iraq's maternity teaching hospital's infant care unit conducted a case-control study. After giving birth, all 53 instances' mothers were questioned. As a control group, 106 infants from the same hospital were chosen at random. They appeared to be developing normally. Results: show that there are several factors that increase the risk of neural tube defects. These include having a family history of the condition, not taking folic acid in the past, living in a rural area, being illiterate compared to mothers with a college degree, and a negative history of folic acid intake.

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Conclusion: Administering folic acid before pregnancy can avert the most significant risk factors, including a negative history of folic acid intake.

Keywords: Erbil, risk factors, neural tube abnormalities newborn.

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Introduction

A major cause of stillbirth and infant mortality, neural tube defects (NTDs) are among the most frequent congenital malformations of the central nervous system; nevertheless, their prevalence varies across countries and races. Antenatal diagnosis, multivitamin supplementation, and folic acid supplementation have all contributed to a drop in the prevalence of NTDs during the past 30 years, yet some of the decrease remains unexplained. (1) Abnormal neural tube closure during the third and fourth weeks of gestational age is the underlying cause of neural tube defects. two (2) Some of the most common neural tube defects (NTDs) are spina bifida occulta, conus medullary lipoma, syringomyelia, diastematomyelia, encephalocele, anencephaly, dermal sinus, tethered cord, and meningocele and myelomeningocele. (2) The origin of most cases of NTDs is still unclear, and their prevalence makes them one of the most prevalent devastating birth defects, despite the significant advances in understanding them. The idea that NTDs are caused by a combination of genetic and environmental factors is widely acknowledged. Those with a history of NTDs, a mother's age, a low or high parity, a low socioeconomic position, severe nutritional deficiencies, and insufficient prenatal care are all considered high-risk groups, according to genetic and epidemiological research. Sunlight, heat exposure, hypo- or hypervitaminosis A, maternal virus infections, zinc insufficiency, and medications like anticonvulsants are among the teratogens that have been identified in several clinical and epidemiological investigations as causing neural tube defects in the offspring. Some teratogens cause neural tube defects (NTDs) by blocking the effects of folic acid or by preventing the embryo from getting enough folic acid. (3) There is evidence that certain occupations, like farming, welding, and painting, can raise the incidence of neural tube defects (NTDs) in children. (4) Folic acid has a crucial function in the fight against NTDs and protects against their recurrence, according to the research. All women of childbearing age should ingest a minimum of 0.4 mg of folic acid daily, according to a 1992 recommendation from the United States Public Health Services (5).

TYPES OF NEURAL TUBE DEFECTS:

Most neural tube defects (NTDs) develop during the first few weeks of pregnancy, most commonly in the form of spina bifida, which damages the spinal cord and neurons because the spine does not heal correctly. Spina bifida is most frequently found in the lumbar and lumbosacral areas. Spina bifida manifests in two main ways:

1-The mildest form of spina bifida is known as spina bifida occulta (closed NTDs). This condition is marked by a small gap or deformity in one or more vertebrae. There is no rear entrance, the skin around the lesion could be normal, hair could be coming out of it, a dimple could be visible, or there could be a birthmark. (2) Incontinence, difficulties walking, numbness, odd gait, peculiar back discomfort, hyperreflexia, painless sores, and deformities of the hips, knees, and feet are all possible

symptoms of this kind. Capillary hemangiomatosis, caudal appendage, dermal sinus, and hypertrichosis are the skin stigmata. two (2)

2-Spina bifida cystica (open neural tube defects): the most severe type, known as myelomeningocele, occurs when a sac or cyst is formed and the meningeal membrane that covers the spinal cord and some of its components protrudes through a fissure. Because the sac or cyst comprises nerves, spinal cord, cerebrospinal fluid, and other tissues, it is common for patients to experience paralysis and a loss of sensation below the affected vertebrae (19). Disabilities caused by myelomeningocele are highly conditional on the location and severity of nerve injury. (19)

Issues in controlling one's bowel and bladder movements are common in youngsters affected by this illness. Myelomeningocele patients also often experience hydrocephalus, which affects over 90% of them. (19)

Detection of NTDs:

There are three distinct prenatal tests that can detect NTDs, and the majority of them are:

1- Maternal serum alpha fetoprotein (AFP), a blood test that is commonly administered to pregnant women between the sixteenth and eighteenth weeks of their pregnancies. Ninety percent of a fetus's serum globulin is AFP, making it the most abundant serum protein throughout the early stages of embryonic development. (22) Below 500 ng/ml is the typical concentration of AFP in maternal serum. Fetuses with NTDs have an elevated maternal serum AFP, but there are other reasons why the maternal AFP might be elevated, such as (number of 22):

One lymphocele.

4-Turner disease.

Three, gastroschisis.

Polycystic disease affects the kidneys in four cases.

5-Fatal mortality.

6—Twins that are conjoined...

6-Urinary tract infection (UTI).

When measuring maternal blood AFP levels, the accuracy of detecting an open NTD is around 75% at 15 weeks of gestation. As the gestational age increases to 20 weeks, the accuracy of AFP reaches over 98% of all open NTDs. (22 items)

2-After about 18 weeks of pregnancy, a high-resolution ultrasound may be able to visually detect a non-targeted fetal death. Anencephaly and other severe NTDs can sometimes be identified before the 16-week mark. In most cases, a trained ultrasonographer can detect NTDs with fetal ultrasound with a 98 percent success rate. Incorrect fetal dates or several pregnancies might lead to false positive results. However, closed NTDs can occasionally stay undiscovered, especially in situations with skin covered, like meningoceles, in which the AFP also may be normal.

These closed NTDs comprise roughly 10% or more of total NTDs found. A trained ultrasonographer can detect these lesions with about 95% accuracy. (23)

3- Amniocentesis involves sampling the amniotic fluid after 15 weeks of pregnancy. (24)

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Prevention of NTDs:

Neural tube defects are multifactorial; hence, there is no known approach to prevent them totally. However, many studies have demonstrated that dietary supplementation with folic acid (folate) has been useful in reducing NTDs. (26, 27, 28, 29)

Sources of folic acid include leafy vegetables such as spinach and turnip greens, dried beans and peas, sunflower seeds, and certain other fruits and vegetables, which are excellent sources of folate, as is liver. (26) Pregnant women and those who are trying to conceive should take 0.4 milligrams of folic acid daily beginning one month before they want to become pregnant and continuing for the first twelve weeks. numbers 26–30

A larger dosage of 4-5 mg daily is recommended for women who have previously given birth to a child with spina bifida or other neural tube defects (NTDs), as well as those who are taking anticonvulsant medication. numbers 27, 30, and 31

Patients and Methods

During the period from February 1, 2017, to July 31, 2017, a case-control research was conducted in the neonatal care unit of the maternity teaching hospital in Erbil, Kurdistan region, Iraq. After giving birth, all 53 moms whose babies had NTDs were interviewed. As a control group, 106 infants from the same hospital were chosen because they seemed to be developing normally. Ultrasound during pregnancy confirmed NTD in 38 cases, while the author made the diagnosis in 15 cases immediately following birth. Two subsequent healthy infants served as a control group for the research. The International Classification of Diseases, tenth revision (ICD-10), was used to define NTDs.The study's mothers gave their verbal approval. Mothers' age, residence, parity, occupation, education, history of maternal illness during the last trimester of pregnancy, exposure to drugs or radiation during that time, folic acid intake before conception and during that time, antenatal visits, ultrasounds, family history of neural tube defects, consanguinity, father's occupation, gestational age, birth weight, baby's gender, and delivery method were all factors in the data collected from interviews with mothers.

Statistical analysis:

Analyses were conducted using SPSS, version 22, which is a statistical package for the social sciences.To evaluate exposure proportions between cases and controls, the Chi-square test of association was utilized. When the predicted count of more than 20% of the table cells was less than 5, Fisher's exact test was utilized instead of the chi-square test. To compare the means of the cases and controls, we utilized Student's t test of two independent samples. A binary logistic regression model was employed, with neural tube defect as the dependent variable, to incorporate variables that were determined to have a significant association with NTD (via a chi-square test). For statistical purposes, a 'p' value less than or equal to 0.05 was deemed significant.

Results

Fifty three infants (cases) with neural tube defect (NTD) were included in the study, in addition to 106 infants with no NTD.

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Table1. Socio-demographic characteristics of the studied samples.

Table 1 shows no significant association between NTD and gender (p = 0.734). Around two thirds (64.2%) of cases were residing in rural areas compared with 33% of the control group (p < 0.001). It is evident in the same table that 39.6% of the mothers of the cases were illiterate compared with 14.2% of the controls. On the other hand, 20.8% of the mothers of the control group were college graduates compared with 9.4% of the mothers in the cases group (p = 0.003). Table 1 shows that consanguinity was present in a considerable proportion (40.9%) of the whole sample, but no significant association was detected between NTD and consanguinity (p = 0.425).

	Cases		Controls		Total		
	No.	**%**	**No.**	**%**	**No.**	**%**	**P**
Gender							
Male	31	58.5	59	55.7	90	56.6	0.734
Female	22	41.5	47	44.3	69	43.4	
Residency							
Urban	19	35.8	71	67.0	90	56.6	< 0.001
Rural	34	64.2	35	33.0	69	43.4	
Mother education							
Illiterate/Read and write	21	39.6	15	14.2	36	22.6	0.003
Primary	20	37.7	48	45.3	68	42.8	
Secondary	7	13.2	21	19.8	28	17.6	
College	5	9.4	22	20.8	27	17.0	
Consanguinity							
Yes	24	45.3	41	38.7	65	40.9	0.425
No	29	54.7	65	61.3	94	59.1	
Total	53	100.0	106	100.0	159	100.0	

Table 2. Past history in mother and family history of NTD in the two study groups.

Significant association was detected between past history of NTD with development of this abnormality (p = 0.016) where it is evident in **Table 2** that 13.2% of cases had such a history compared with 2.8% of the controls. The same table shows that 20.8% of cases had family history of NTD which was significantly higher than the proportion (3.8%) in the control group (p = 0.001).

	Cases		Controls		Total		
	No.	**%**	**No.**	**%**	**No.**	**%**	**P**
Past history of NTD							
Yes	7	13.2	3	2.8	10	6.3	0.016*
No	46	86.8	103	97.2	149	93.7	
Family history of NTD							
Yes	11	20.8	4	3.8	15	9.4	0.001
No	42	79.2	102	96.2	144	90.6	
Total	53	100.0	106	100.0	159	100.0	

*By Fisher's exact test.

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Table 3. Association between folic acid intake and NTD.

Table 3 shows that only 20.8% of the cases' mothers had history of folic acid intake during pregnancy, compared with 54.7% of the control group ($p < 0.001$).

	Cases		Controls		Total		
Folic acid intake	**No.**	**%**	**No.**	**%**	**No.**	**%**	**P**
Yes	11	20.8	58	54.7	69	43.4	< 0.001
No	42	79.2	48	45.3	90	56.6	
Total	53	100.0	106	100.0	159	100.0	

Table 4. Association between NTD with some obstetrical problems.

Table 4 shows that 24.5% of the controls had history of diabetes compared with 11.3% among the cases ($p = 0.050$). The table shows no significant association between hypertension ($p = 0.687$) and bleeding ($p = 1$) with the development of NTD. Regarding urinary tract infections (UTI), the table shows that 19.8% of mothers of the control group had history of UTI compared with 5.7% of the cases ($p = 0.019$). No significant association was detected between history of febrile diseases with the development of NTD ($p = 0.425$).

	Cases		Controls		Total		
	No.	**%**	**No.**	**%**	**No.**	**%**	**P**
Diabetes							
Yes	6	11.3	26	24.5	32	20.1	0.050
No	47	88.7	80	75.5	127	79.9	
Hypertension							
Yes	3	5.7	4	3.8	7	4.4	0.687*
No	50	94.3	102	96.2	152	95.6	
Bleeding							
Yes	2	3.8	4	3.8	6	3.8	1*
No	51	96.2	102	96.2	153	96.2	
UTI							
Yes	3	5.7	21	19.8	24	15.1	0.019
No	50	94.3	85	80.2	135	84.9	
Febrile illness							
Yes	6	11.3	17	16.0	23	14.5	0.425
No	47	88.7	89	84.0	136	85.5	
Total	53	100.0	106	100.0	159	100.0	

*By Fisher's exact test.

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Table 5. Association between NTD with gestation age and birth weight.

Table 5 shows that 22.6% of infants in the cases group born before 37 weeks gestation which was significantly higher than the proportion (9.4%) among the controls (p = 0.023). Regarding birth weight, 26.9% of cases were of low birth weight (< 2.5 Kg) compared with 9.4% of the control group (p = 0.004).

	Cases		Controls		Total		
	No.	%	No.	%	No.	%	P
Gestational age (weeks)							
< 37	12	22.6	10	9.4	22	13.8	0.023
≥ 37	41	77.4	96	90.6	137	86.2	
Birth weight (Kg)							
< 2.5	14	26.9	10	9.4	24	15.2	0.004
≥ 2.5	38	73.1	96	90.6	134	84.8	

Table 6. Means of some numerical variables of cases and controls.

Table 6 shows that the mean of mother age of cases was 28.22 years, and that of the controls was 27.24 years (p = 0.403). The mean gestational age of cases (36.92) was significantly (p < 0.001) less than that of the controls (38.23). Regarding parity, the differences were not significant (p = 0.149). The table shows that the mean birth weight of cases (2.960 Kg) was significantly (p = 0.038) less than that of the controls (3.153).

	Cases		Controls		
	Mean	SD	Mean	SD	P
Mother's age (years)	28.226	7.490	27.245	6.669	0.403
Gestational age (weeks)	36.925	2.226	38.236	1.945	< 0.001
Parity	3.245	2.336	2.698	2.192	0.149
Birth weight (Kg)	2.960	0.603	3.153	0.515	0.038

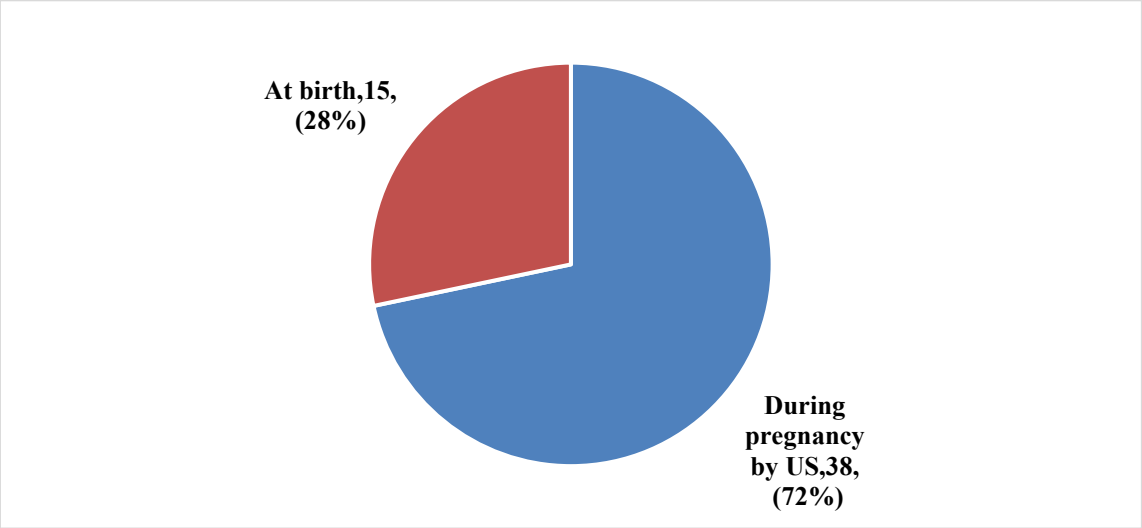

Figure 1. Time of diagnosis of NTD

The time of diagnosis of NTD was by ultrasound, during pregnancy, in the majority (72%) of cases, as presented in figure1.

Table 7. SPSS output of logistic regression analysis between NTD as a dependent variable with several covariates

Binary logistic regression analysis showed that some factors were significantly associated with NTD like family history of NTD (OR = 9.3; 95% CI = 2.1 – 39.8), no history of folic acid intake (OR = 4.0; 95% CI = 1.6 – 9.9), residency in a rural area (OR = 2.3; 95% CI = 1.008 – 5.435), and illiterate mothers compared with college graduates (OR = 4.5; 95% CI = 1.1 – 18.1).

Covariates	B	P	OR†	95% CI* for OR	
				Lower	Upper
Past history of NTD	0.821	0.359	2.272	.394	13.102
Family history of NTD	2.232	**0.003**	9.315	2.177	39.850
No intake of folic acid	1.400	**0.002**	4.057	1.656	9.937
Gestational age	-.760	0.501	0.468	0.051	4.274
Birth weight	1.420	0.190	4.139	0.496	34.566
Residency (rural)	0.850	**.048**	2.340	1.008	5.435
Urban (reference)					
Mother education		0.144			
Illiterate	1.513	**0.032**	4.540	1.135	18.157
Primary	0.809	0.219	2.245	0.618	8.159
Secondary	0.462	0.539	1.587	0.364	6.911
College (reference)					
Constant	-3.221	< 0.001	0.040		

*CI = confidence interval. †OR = Odds ratio.

Discussion

In this study, we looked at the potential impact of certain risk variables on the origins of NTDs. When looking at gender differences, the study found no significant correlation between NTDs and either sex. Nili F. (2009) and Elwood JM. (2009) found that being a female increased the risk. 11 and 29

Coincident with Slattery ML (2009) and Carter CO (2004), our study found that 64.2% of parents whose newborns were affected lived in rural areas. It might be because of things like a lack of socioeconomic status (16, 32).

This study's findings that NTDs were significantly associated with mothers' lower levels of education are in line with those of Tillman F. (2002) (33). One possible reason could be that women with lower levels of education are less likely to follow their doctors' orders and use prenatal care services.

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Despite the fact that some researchers have shown that the rate of consanguineous marriage is high in NTD births (34, 35), this study found no significant association between NTDs and consanguineous marriage, even though 45.3% of parents with affected newborns had it.Additional study is needed to determine whether consanguinity is a risk factor for NTD in a community.

There is a correlation between the prevalence of NTDs in the population and the higher risk of NTD-affected births among mothers who have a history of NTD-affected children or who have close relatives with the disorder.According to Elwood JM (2009) and Nili F (2009), the recurrent risk of NTDs is around 3-4%. If the prior infant or fetus had anencephaly, the risk is slightly higher (11, 29). Eleven cases (20.8% of the total) had a positive family history of congenital defects, and seven cases (13.2%) had afflicted siblings in the past.

Research has shown that folic acid, when taken by mothers during their pregnancies, lowers the chances of NTDs and their recurrence.Iqbal MM (2013), Milunsky A (1989), Aubry MC (2013), Locksmith GJ (1998), Berry RJ (2010), and Aqrabawi H (2005) found that this lowering happens in both high- and low-NTDs rate locations. The most significant risk factor in this study was a history of poor maternal folate consumption.

Having a woman with D.M. and a UTI decreased the likelihood of NTD, according to the study.Despite the abundant evidence linking maternal D.M. to an increased risk, Loeken MR (2005) and Shaw GM (1998) found no such link (36, 37). Possible explanation: organogenesis can only take place in the first trimester of pregnancy, when diabetes is already present.

Consistent with Charney EB (2000) (38), the study found a significant connection between NTDs and gestational age at delivery (37 weeks) and birth weight (<2.5Kg). However, the logistic regression analysis failed to reveal the same significant association.

No correlation between parity and NTDs was found in this investigation.There have been conflicting findings from the several research that have looked at the correlation between maternal parity and NTDs. Women with low or high parity were more likely to be pregnant, according to one study (Elwood JM, 2009), whereas another (Nili F, 2009) found no correlation. (29)

According to certain studies, the risk of neonatal death syndrome is highest among the youngest (<20 years) and oldest (> 35 years) mothers (7), but according to other studies, the risk decreases or even reverses with age (39, 40). The majority of moms in this study who had NTDs in their infants were between the ages of 20 and 29, although there was no statistically significant difference between the case and control groups in terms of age distribution.

Conclusion:

NTDs are more likely to occur in families where the condition has previously occurred, in rural areas, among illiterate mothers as compared to college graduates, during the first 37 weeks of gestation, when the baby is born with a low weight, and in cases where the mother has a history of NTDS. One of the most significant epidemiological risk factors is a lack of folic acid consumption history.

Recommendations:

1- we recommend that antenatal clinics do a better job of registering pregnant women and providing them with folic acid at the beginning of their pregnancies, as well as following up with them properly throughout their pregnancies.

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2-The importance of folic acid in avoiding neural tube defects (NTDs) should be educated through public and professional health education programs.Folic acid should be taken by all pregnant and trying-to-conceive women at a dosage of 0.4 mg daily for the first 12 weeks of the pregnancy, and even higher at 4 mg daily for women with a high risk of pregnancy (history).

Thirdly, raising living standards and bettering overall health in rural areas.

Pregnant women should have access to diagnostic tests or prenatal screening (AFP) at teaching hospitals in order to detect fetal abnormalities.

5-Community-based research should be conducted with larger samples over longer periods of time because NTDs are frequent and significant congenital defects.

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