International Journal of Contemporary Pediatrics
*Shams N et al. Int J Contemp Pediatr. 2023 Aug;10(8):1171-1175*
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20232165

**Original Research Article**

# Effect of maternal food habits in periconceptional life with the occurrence of birth defects

**Nusrat Shams[1]*, Alif Laila[2], Jobaida Parvin[1], Mohammad Mohsin[3], Ahmed Hosain[1]**

[1]Department of Pediatric Neurology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh
[2]Dhaka Medical College Hospital, Dhaka, Bangladesh
[3]Department of Pediatrics, Kuwait Bangladesh Friendship Government Hospital, Dhaka, Bangladesh

**Received:** 11 May 2023
**Accepted:** 11 July 2023

***Correspondence:**
Dr. Nusrat Shams,
E-mail: nusratshams99@gmail.com



## ABSTRACT

**Background:** Maternal periconceptional period can be defined as the critical window surrounding the period of conception. The periconceptional period consists of preconception, conception, implantation, placentation and embryo or organogenesis stages, and specific cellular events that occur during the distinct stages of embryogenesis. On the other hand, birth defects are structural changes present at birth that can affect almost any part of the body. They may affect how the body looks, works, or both. This study aimed to find maternal food habits in periconceptional life with the occurrence of birth defects.
**Methods:** This case-control study was conducted in both the Pediatric Surgery and Medicine Department of Dhaka Shishu (children) Hospital, Dhaka, Bangladesh during the period from January 2012 to December 2013. In total 280 '0-364 days old infants' were included as the study subjects and divided into two equal groups in number, cases having a structural birth defect and controls without any birth defect. A pretested questionnaire was introduced after getting informed written consent from the mothers. Data were analyzed by statistical package for the social sciences (SPSS) 16.0 version, by univariate, bivariate and multivariate analyses and were presented by tables and graphs.
**Results:** In this study, most of the defects were distributed to the gastrointestinal system (18%), genito urinary system (16%), CVS (14%), NTD (13%), defect of the face (13%) and skull (11%). The isolated defect was in 80% of patients, multiple defects in 17% of patients and 3% syndromes were present. In this study, mothers 'who took no meat/week', 'who took no fish/week', 'who took no egg/week', 'who took no milk/week', experienced BD more and the difference was statistically significant ($p<0.05$) between the groups. However, mothers who took vegetables less than once/week experienced BD more frequently, but the difference between the groups was not statistically significant ($p>0.05$).
**Conclusions:** In maternal food habits; less intake of meat, fish, milk and egg is significantly correlated with the occurrence of birth defects but there is not any significant correlation with vegetable intake.

**Keywords:** Maternal, Food habit, Periconceptional, Birth defects

## INTRODUCTION

The periconceptional period includes the stages of preconception, conception, implantation, placentation, and embryo or organogenesis, as well as specific cellular events that occur during the distinct stages of embryogenesis.[1] The prefix "peri" means "surrounding," and "conception" refers to the onset of pregnancy, marked by the implantation of the blastocyst in the endometrium and the formation of a visible zygote. Birth defects are structural changes present at birth that can affect almost any part of the body, such as the heart, foot, or brain, and may affect how the body looks, works, or both. They affect about 3-5% of all infants.[1] Preconception nutrition is hereditary affecting health, reproduction, and disease in current and future generations. From a nutritional

perspective, periconceptional nutrition first affects the overall health of childbearing-age women and, therefore, their reproductive potential. Subsequently, peri-conceptional maternal nutrition influences both the onset and the early stages of pregnancy, affecting maternal health and the concepts developed throughout the pregnancy.[1] In particular, diet during the first trimester may be more important for the development and differentiation of various organs. Unfortunately, the nutritional intake of childbearing-age women appears to be inadequate during the periconceptional period.[1] Periconceptional use of folic acid alone or in multivitamin supplements is effective for the primary prevention of neural tube defects (NTDs). Only multivitamins (containing 0.4-0.8 mg of folic acid) were able to reduce the prevalence at birth of obstructive defects of the urinary tract, limb deficiencies, congenital heart defects, multiple births, miscarriage, and congenital pyloric stenosis. However, a high dose of folic acid (5 mg) was effective in preventing some parts of rectal/anal stenosis/atresia and some orofacial clefts.[2,3] Nutritional factors affect birth defects differently. Several studies have observed increased risks associated with lower dietary intakes of linoleic acid, total carbohydrate, and fructose for dTGA, whereas decreased risks were observed for lower intakes of total protein and methionine for TOF.[1,2,4] Lower dietary intake of several micronutrients, namely folate, niacin, riboflavin, and vitamins B, A, and E, were associated with increased risks of dTGA, but not for TOF. Li et al found that consumption of six meals per week containing pickled vegetables during pregnancy is associated with NTDs, whereas a pregnancy diet lacking meat and fish appears to increase the risk of hypospadias in the offspring, which was also observed in another study.[5,6] The main objective of this study was to investigate maternal food habits during the periconceptional period and their association with the occurrence of birth defects.

## METHODS

This case-control study was conducted in both the Pediatric Surgery and Medicine Department of Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh during the period from January 2012 to December 2013. In total 280 '0-364 days old infants' were included as the study subjects and divided into two equal groups in number, cases having a structural birth defect and controls without any birth defect. As per the inclusion criteria of this study, babies of the age range of 0-364 days with birth defects admitted to Dhaka Shishu (Children) Hospital were enrolled in the case group and without birth defects were enrolled in the control group. On the other hand, according to the exclusion criteria of this study, patients' mothers who were non-respondents were excluded. Cases and controls were equal in number. The study was approved by the ethical committee of the mentioned hospital. A pretested questionnaire was introduced after getting informed written consent from the mothers. Each infant included was exposed to full examination to identify the defect and relevant investigations as per unit protocol were done. Data were analyzed by statistical package for the social sciences (SPSS) 16.0 version, by univariate, bivariate, and multivariate analyses were presented by tables and graphs.

## RESULTS

In this study, the mean age of the patient in the case group was 87.17±105.61 days and the mean age of the patient in the control group was 67.50±92.42 days. The mean age was not significantly different between the groups; the p value was >0.05. Mean maternal age was significantly different between the groups, p value <0.05. Birth defects were more common in elderly mothers. The mean paternal age of the case group was 32.10±5.39 years and the mean paternal age of the control group was 29.85±6.38 years. Mean paternal age was significantly higher among the cases, p value was <0.05. Birth defects were more common in mothers with low BMI and low monthly income group.

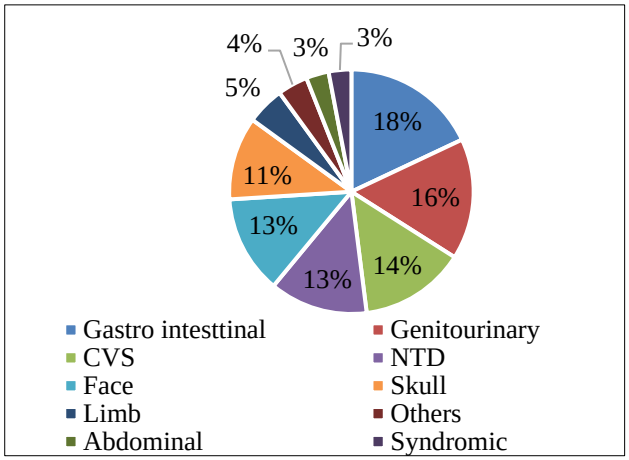


**Figure 1: Distribution of the birth defects according to the system.**

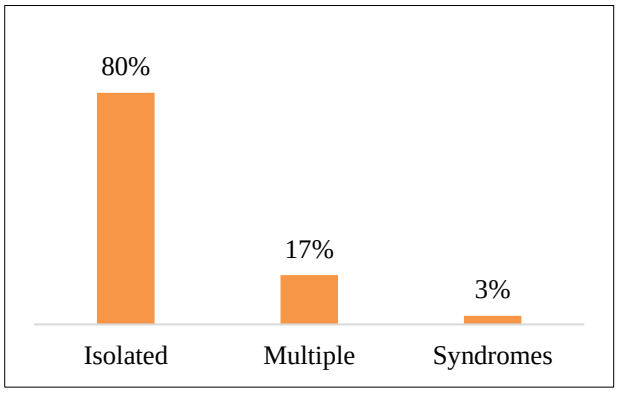


**Figure 2: Distribution of birth defects by the number of organs involved.**

In this study, mothers who took fish once or less than once a week experienced BD more and the difference was statistically significant (p<0.05) between the groups. OR [95% CI] for fish consumption ≤once/week was 11.88 [6.44-21.90]. Mothers who took no meat/wk. experienced

BD more frequently and the difference was statistically significant (p<0.05) between the groups. OR [95% CI] for no meat consumption was 9.37 [5.10-17.20]. Mothers who took no egg/week. experienced BD more frequently and the difference was statistically significant (p<0.05) between the groups. OR [95% CI] for egg consumption Less than once/week was 5.22 [3.10-8.77]. Mothers who took no milk/wk. experienced BD more frequently and the difference was statistically significant (p<0.05) between the groups. OR [95% CI] for milk consumption less than once/week was 32.3 [9.80-106.42]. Mothers who took vegetables less than once/week experienced BD more frequently, but the difference between the groups was not statistically significant (p>0.05). OR [95%Cl] for vegetable consumption less than once/week was 2.01 [1.79-2.27]. Most of the defects were distributed to the gastrointestinal system (18%), genito urinary system (16%), CVS (14%), NTD (13%), defect of the face (13%) and skull (11%). In addition, limb defects (5%), others defects (eye, ear, skin and chest) in 4%, abdominal defects in 3%, and syndromic defects in 3% of patients were observed. The isolated defect was in 80% of patients, multiple defects in 17% of patients and 3% syndromes were present.

**Table 1: Demographic status of participants (n=280).**

| Variables | Cases | Control | P value |
|---|---|---|---|
| | Mean±SD (n=140) | | |
| **Age of the patient (day)** | 87.17±105.61 | 67.50±92.42 | 0.102 |
| **Maternal age (years)** | 25.86±5.196 | 23.41±4.65 | 0.0001* |
| **Paternal age (years)** | 32.10±5.39 | 29.85±6.38 | 0.002* |
| **Maternal BMI (kg/m$^2$)** | 22.7±3.003 | 23.35±2.54 | 0.0001* |

**Table 2: Distribution of respondents by food consumption (n=280).**

| Charact-eristics | Case (%) | Control (%) | OR [95% CI] | P value |
|---|---|---|---|---|
| **Meat consumption (<1 time per week)** | | | | |
| Yes | 123 (87.9) | 61 (43.6) | 9.37 [5.10-17.20] | 0.0001* |
| No | 17 (12.1) | 79 (56.4) | | |
| **Fish consumption (<1 time per week)** | | | | |
| Yes | 87 (62.1) | 17 (12.1) | 11.88 [6.44-21.90] | 0.0001* |
| No | 53 (37.9) | 123 (87.9) | | |
| **Egg consumption (<1 time per week)** | | | | |
| Yes | 85 (60.7) | 32 (22.9) | 5.22 [3.10-8.77] | 0.0001* |
| No | 55 (39.3) | 108 (77.1) | | |
| **Milk consumption (<1 time per week)** | | | | |
| Yes | 58 (41.4) | 3 (2.1) | 32.3 [9.80-106.42] | 0.0001* |
| No | 82 (58.6) | 137 (97.9) | | |
| **Vegetable consumption (<1 time per week)** | | | | |
| Yes | 2 (1.4) | 0 (0) | 2.01 [1.79-2.27] | 0.5 |
| No | 138 (98.6) | 140 (100) | | |

**Table 3: Multivariable regression analysis of maternal food habits.**

| Variables in multivariate analysis | B | Std. error | sig. | Exp (B) | 95% confidence interval for exp (B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower bound | Upper bound |
| **Meat consumption < once** | 1.572 | 0.557 | 0.005 | 4.814 | 1.616 | 14.3418* |
| **Egg consumption < once** | -0.779 | 0.524 | 0.005 | 0.459 | 0.164 | 1.283* |
| **Milk consumption < once** | 3.524 | 0.817 | 0.001 | 33.92 | 6.846 | 168.074* |
| **Pulse consumption < once** | 0.843 | 0.947 | 0.373 | 2.323 | 0.363 | 14.869 |
| **Vegetable consumption < once** | 1.558 | 1.046 | 0.136 | 4.749 | 0.612 | 36.875 |
| **Folic acid used** | 0.239 | 0.428 | 0.577 | 1.270 | 0.549 | 2.937 |
| **Folic acid used before two months** | -1.785 | 1.23 | 0.147 | 0.168 | 0.015 | 1.872 |

## DISCUSSION

This study aimed to investigate maternal food habits during the periconceptional period and their association with the occurrence of birth defects. The preventive role of folic acid, either in isolated form or combination, is well known, but it is effective only when given during the peri-conceptional period.[2,7] However, only 5.7% of mothers in cases and 5.0% of mothers in controls used folic acid before 2 months, and the difference was not statistically

significant between the groups. There might be other associated factors that played a protective role in addition to folic acid, which was considered in this study. Similar findings were reported by Shawky and Sadik and Li et al, although their study did not consider the period of folic acid intake.[8,9] Sutton et al found similarities to our study and concluded that folic acid supplementation at the beginning of pregnancy was inadequate even in a relatively well-educated population.[4] Therefore, greater publicity for folic acid recommendations is needed during the peri-conceptional period. However, as many pregnancies are unplanned, improved nutrition and lifestyles of women of childbearing age are also required. In addition, dietary supplementation such as iodination of salt can be considered for folic acid. Nowadays, many advanced countries ensure folic acid supplementation by fortification of flour and oral contraceptive pills.[10] We have attempted to explore maternal dietary habits in detail, and we found that mothers who consumed fish, meat, egg, and milk less than once a week were significantly associated with birth defects. To the best of our knowledge, no study was conducted in our country to explore the detailed dietary habits of mothers. This was a baseline information, and further evaluation should be considered. In this study, only the frequency of the diet was considered, and the quantitative measure was not taken. According to the findings of Li et al, consuming meat one to three times per week and legumes six or more times per week may have a protective effect against NTD.[5] Additionally, Akre et al found that a diet during pregnancy that lacks meat and fish may increase the risk of hypospadias in the offspring. This finding is supported by a few other studies as well.[6,11,12] Although obesity is a well-recognized problem in many developed countries due to adverse pregnancy outcomes, including birth defects, most mothers are undernourished in our country.[13] In the present study, the mean BMI of most mothers in the case group was significantly lower than that of the controls. Zwink et al concluded that there is a relationship between birth defects, especially anorectal malformation (ARM), and maternal overweight and obesity.[14] No study showed a relationship between birth defects and low BMI. This difference may be due to a lack of adequate nutrients required during the period of organogenesis. However, all the findings of this study may be helpful in further similar studies.

### *Limitations*

This was a single-centered study with small-sized samples. Moreover, the study was conducted over a very short period. So, the findings of this study may not reflect the exact scenario of the whole country.

## CONCLUSION

In maternal food habits; less intake of meat, fish, milk and egg is significantly correlated with the occurrence of birth defects but there is not any significant correlation with vegetable intake. Maternal proper feeding may reduce the frequency of the occurrence of birth defects. For getting more specific results, we would like to recommend conducting similar studies in several places.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Shaw GM, Carmichael SL, Yang W and Lammer EJ.Periconceptional nutrient intakes and risks of conotruncal heart defects. Birth Defects Res A Clin Moi Teraioi. 2010;88(3):144-51.
2. Czeizel AE.The primary prevention of birth defects: Multivitamins or folic acid? Int J Med Sci. 2004;1(1):50-61.
3. Zwink N, Jenetzky E and Brenner H. Parental risk factors and anorectal malformations: systematic review and meta-analysis. Orphanet J Rare Dis. 2011;6:25-41.
4. Sutton M, Mills JL, Troendle AM, James F, Brody LC, Conley M. MaternalI vitamin levels in pregnancies affected by congenital malformations other than neural tube defects. Birth Defects Res A Clin Moi Teratol. 2011;91(7):610-5.
5. Li Z, Zhang L, Ye R, Pei L, Liu J, Zheng X. Indoor Air Pollution From Coal Combustion and the Risk of Neural Tube Defects in a Rural Population in Shanxi Province, China. Am J Epidemiol. 2011;1-8.
6. Akre O, Boyd HA, Ahlgren M, Wilbrand K, Westergaard T, Hjalgrim H. Maternal and Gestational Risk Factors for Hypospadias. Environ Health Perspect. 2008;116:1071-6.
7. Smithells RW, Sheppard S and Schorah CJ. Vitamin deficiencies and neural tube defects. Arch Dis Childhood. 1976;51:944-50.
8. Shawky RM, Sadik DI. Congenital malformations are prevalent among Egyptian children and associated risk factors. Egypt J Med Human Genet. 2011;12:69-78.
9. Committee on Genetics. Folic acid for the Prevention of Neural Tube Defect. Pediatrics. 1999;104(2):325-7.
10. Li Z, Ren A, Zhang L, Guo Z, Li Z. A population-based case-control study of risk factors for neural tube defects in four high-prevalence areas of Shanxi province, China. Pediatric Perinatal Epidemiol. 2006;20:43-53.
11. Slickers JE, Olshan AF, Siega-Riz AM, Honein MA, Aylsworth AS. Maternal body mass index and lifestyle exposures and the risk of bilateral renal agenesis or Hypoplasia. Am J Epidemiol. 2008;168:1259-67.
12. Yazdy MM, Liu S, Mitchell AA, Werler MM. Maternal Dietary Glycemic Intake and the Risk of Neural Tube Defects. Am J Epidemiol. 2010;171:407-14.

13. Waller DK, Shaw GM, Rasmussen SA, Hobbs CA, Canfield MA, Siega-Riz AM. Prepregnancy Obesity as a Risk Factor for Structural Birth Defects. Arch Pediatr Adolesc Med. 2007;161(8):745-50.
14. Zwink N, Jenetzky E, Brenner H. Parental risk factors and anorectal malformations: systematic review and meta-analysis. Orphanet J Rare Dis. 2011;6:25-41.

**Cite this article as:** Shams N, Laila A, Parvin J, Mohsin M, Hosain A. Effect of maternal food habits in periconceptional life with the occurrence of birth defects. Int J Contemp Pediatr 2023;10:1171-5.