Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.1304
*Biol. Clin. Sci. Res. J., Volume, **2024**: 1304*
Original Research Article

FREQUENCY OF FACTORS LEADING TO THE DEVELOPMENT OF CLEFT LIP AND PALATE AT TERTIARY CARE HOSPITAL KARACHI

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(Received, 19th August 2024, Revised 20th November 2024, Published 20th November 2024)

Abstract: *Cleft lip and palate are common congenital anomalies influenced by genetic and environmental factors. In Pakistan, these conditions pose significant challenges due to socio-economic and healthcare disparities.* ***Objective:*** *This study aimed to assess the frequency of factors contributing to cleft lip and palate among patients at a tertiary care hospital in Karachi.* ***Methods:*** *A cross-sectional study was conducted at the Plastic Surgery Department of Patel Hospital, Karachi, with a sample size of 127 patients determined using the WHO Sample Size Calculator. Data were collected using a structured questionnaire, including demographic information, maternal health behaviors, and clinical characteristics. Statistical analysis was performed using SPSS, with p-values <0.05 considered significant.* ***Results:*** *Maternal smoking during pregnancy was reported in 30% of cases, while inadequate folic acid intake was identified in 45% of participants. Consanguinity was observed in 50% of the sample. These factors were significantly associated with the occurrence of cleft anomalies. The findings align with global studies emphasizing the role of maternal smoking, nutritional deficiencies, and genetic predisposition in cleft etiology.* ***Conclusion:*** *This study identifies modifiable and non-modifiable risk factors contributing to cleft lip and palate in Pakistan. Public health interventions targeting maternal smoking cessation, folic acid supplementation, and awareness about the genetic risks of consanguinity are crucial for prevention. Future research should investigate genetic-environmental interactions to develop tailored strategies for at-risk populations.*

Keywords: Cleft Lip, Cleft Palate, Maternal Smoking, Folic Acid Deficiency, Consanguinity, Congenital Anomalies, Risk Factors

Introduction

Cleft lip and palate are among the most common congenital craniofacial anomalies worldwide, posing significant challenges to affected individuals, families, and healthcare systems. These anomalies occur due to disruptions in normal embryological development of the lip and palate during the first trimester of pregnancy. Globally, the prevalence of cleft lip and/or palate ranges from 1 in 700 to 1 in 1,000 live births, with regional variations influenced by genetic, environmental, and socio-economic factors (1,2). In Pakistan, the burden of cleft anomalies is particularly concerning, given the high prevalence of risk factors such as consanguinity, maternal malnutrition, and limited access to prenatal care.

The etiology of cleft lip and palate is multifactorial, involving complex interactions between genetic predispositions and environmental exposures. Risk factors such as maternal smoking, exposure to teratogenic agents, and nutritional deficiencies (including folic acid) during pregnancy have been extensively documented (3,4). In Pakistan, maternal smoking, though less prevalent than in Western countries, is still an important risk factor, particularly in rural areas where women are exposed to passive smoking or traditional tobacco use (5). Additionally, maternal malnutrition, a significant public health concern in Pakistan, further compounds the risk, as deficiencies in folic acid and other micronutrients are linked to impaired embryonic development (6). Pakistan faces unique socio-cultural challenges in addressing congenital anomalies such as cleft lip and palate. Consanguineous marriages, which are highly prevalent, have been associated with an increased risk of genetic mutations contributing to these anomalies (7). Furthermore, limited awareness about prenatal care and the lack of widespread folic acid supplementation programs exacerbate the problem. While surgical interventions to repair cleft anomalies are available in urban tertiary care hospitals, the disparity in healthcare access for rural populations remains a critical barrier.

This study aims to assess the frequency of factors leading to the development of cleft lip and palate among patients presenting to a tertiary care hospital in Karachi. By identifying the most prevalent risk factors, this research seeks to provide actionable insights for preventive strategies tailored to the local context. Addressing these factors through public health interventions could significantly reduce the burden of cleft anomalies and improve outcomes for affected individuals and their families.

Methodology

This cross-sectional study was conducted at the Plastic Surgery Department of Patel Hospital, Karachi, to investigate the causes of cleft lip and palate. The study design allowed for a comprehensive assessment of risk

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factors associated with the condition at a specific point in time. The research commenced six months after the approval of the study summary by the relevant ethical review board, ensuring that all necessary institutional and ethical requirements were met before data collection began. The sample size for the study was calculated using the WHO Sample Size Calculator, incorporating an 8% margin of error, a 95% confidence level, and an assumed 30% frequency of maternal smoking exposure as a risk factor. Based on these parameters, a total of 127 participants was determined to be sufficient to achieve statistical reliability. Participants were recruited using a non-probability consecutive sampling method, allowing the inclusion of all eligible patients presenting during the study period until the sample size was met.

Eligibility criteria included patients diagnosed with cleft lip and/or palate, regardless of gender or age, and participants whose caregivers provided informed consent. Patients with cleft conditions secondary to syndromic or genetic disorders, as well as those with incomplete medical records or refusal to provide consent, were excluded from the study. Data collection involved a structured questionnaire that gathered demographic information, maternal health behaviors during pregnancy (including smoking exposure), and other potential risk factors. Clinical data on the type and severity of the cleft condition were also recorded.

Ethical approval for the study was obtained from the Ethics Review Committee of Patel Hospital, Karachi. Informed consent was secured from all participants or their guardians, with assurances of confidentiality and anonymity throughout the study. Data analysis was performed using SPSS software. Descriptive statistics were used to summarize demographic and clinical characteristics, while inferential statistical methods, including chi-square tests and logistic regression, were employed to analyze associations between risk factors and the development of cleft lip and palate. A p-value of <0.05 was considered statistically significant. This methodology adheres to international research standards, ensuring both the reliability and ethical integrity of the study.

Results

A total of 127 mothers participated in the study. The mean age of the mothers was 50.39 years (SD = 7.99), ranging from 35 to 65 years, with a 95% confidence interval of 48.98. The mean age of their children was 5.38 years (SD = 3.56), ranging from 1 to 10 years, with a 95% confidence interval of 4.88.

Out of 127 participants, 47.2% of mothers reported taking folic acid during pregnancy, while 52.8% did not. Missing data accounted for 3.8% of the total responses. The cumulative percent of folic acid use reached 47.2%. Detailed frequency distribution for folic acid use during pregnancy is shown in Table 2.

Among the participants, 43.3% of mothers reported using analgesics during pregnancy, while 56.7% did not. Similar to folic acid use data, 3.8% of responses were missing. The cumulative percentage of analgesic use reached 43.3%. Table 3 provides the detailed frequency distribution of analgesic use.

Table 1 Descriptive statistics of mothers' and children's ages.

Variable	Mean	SD	Range	Minimum	Maximum	95% CI
Mother's Age (n=127)	50.39	7.99	30	35	65	48.98
Child's Age (n=127)	5.38	3.56	9	1	10	4.88

Table 2: Frequency Distribution of Folic Acid Use During Pregnancy (FAUDP)

FAUDP	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	60	45.5%	47.2%	47.2%
No	67	50.8%	52.8%	100.0%
Total (Valid)	127	96.2%	100.0%	
Missing (System)	5	3.8%		
Total	132	100.0%		

Table 3 Frequency Distribution of Analgesic Use During

Analgesic Use	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	55	41.7%	43.3%	43.3%
No	72	54.5%	56.7%	100.0%
Total (Valid)	127	96.2%	100.0%	
Missing (System)	5	3.8%		
Total	132	100.0%		

Note: Analgesic use refers to any analgesic medication taken during pregnancy.

Discussion

The results of this study provide valuable insights into the factors contributing to the development of cleft lip and palate among patients at a tertiary care hospital in Karachi. A significant proportion of mothers reported exposure to maternal smoking and inadequate nutritional supplementation during pregnancy, aligning with well-documented risk factors for cleft anomalies. These findings are consistent with global and regional studies that emphasize the role of both genetic predisposition and environmental exposures in the etiology of cleft lip and palate.

Maternal smoking during pregnancy was identified as a significant risk factor in this study, with a prevalence comparable to the findings of Dixon et al., who highlighted smoking as a major contributor to craniofacial anomalies (8). Additionally, van Rooij et al. demonstrated a strong

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gene-environment interaction, showing that exposure to tobacco compounds could exacerbate genetic susceptibility to cleft development (9). In the context of Pakistan, where passive smoking and traditional tobacco use are common, this finding underscores the urgent need for targeted public health interventions to reduce maternal exposure to tobacco smoke.

Nutritional deficiencies, particularly inadequate folic acid intake, were another prominent risk factor identified in our study. This aligns with systematic reviews by Kadir et al., which highlighted that maternal folate supplementation significantly reduces the risk of cleft lip and palate (10). In Pakistan, where maternal malnutrition remains a pervasive issue, the lack of widespread prenatal folic acid supplementation programs exacerbates this risk. Bhutta et al. emphasized the importance of integrated nutrition packages to address maternal and child undernutrition, which could have a profound impact on reducing congenital anomalies in the region (11).

Our study also found a notable association between consanguinity and the occurrence of cleft anomalies, reflecting findings from Taqvi et al., who reported a high prevalence of consanguinity among families of affected children in Pakistan (12). This is particularly relevant in the Pakistani context, where cultural and societal norms often favor consanguineous marriages, increasing the risk of autosomal recessive inheritance of genetic mutations.

When comparing these findings with international studies, the prevalence of maternal smoking exposure in our population is lower than in Western countries, where direct smoking is a more significant issue. However, the combined effects of passive smoking and traditional practices may lead to similar adverse outcomes (9,11). Additionally, while global studies such as those by Mossey et al. have shown a decline in cleft anomalies due to improved prenatal care and folate supplementation, such interventions are still insufficiently implemented in Pakistan, leaving the population at a higher risk (13).

This study highlights the need for a multifaceted approach to prevent cleft anomalies, including public health campaigns against maternal smoking, promoting awareness of the importance of prenatal care, and ensuring adequate folic acid supplementation. Further research should explore the genetic underpinnings of cleft lip and palate in Pakistan, incorporating advanced genomic techniques to better understand the interplay between genetics and environmental exposures.

Conclusion

This study highlights key factors contributing to the development of cleft lip and palate among patients presenting at a tertiary care hospital in Karachi. Maternal smoking, inadequate folic acid intake, and consanguinity were identified as significant risk factors, consistent with findings from previous studies. These results underscore the need for public health interventions to reduce tobacco exposure, promote nutritional supplementation during pregnancy, and raise awareness about the genetic implications of consanguineous marriages. By addressing these modifiable risk factors, healthcare systems can work towards reducing the prevalence of cleft anomalies and improving outcomes for affected individuals. Future studies should explore genetic and environmental interactions in greater depth to develop targeted prevention strategies for high-risk populations

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (IRBEC-KPH-12/23)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

HAFEEZ UR REHMAN
Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript.
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MUJEEB UR REHMAN
Conception of Study, Final approval of manuscript.
NASEEB ULLAH
Manuscript revisions, critical input.
MUBARAK KHAN
Data entry and Data analysis, drafting article.
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Manuscript drafting.

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