REVIEW ARTICLE

Prevalence and Patterns of Orofacial Clefts among Children from Different Regions of Saudi Arabia: A Systematic Review

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Abstract

Aim and objective: To report on the prevalence and patterns of orofacial clefts (OFC) among Saudi Arabian children by analyzing the results of the studies that have been reported in the literature.

Materials and methods: A data search was carried out for the articles that had reported on the prevalence of OFC among the Saudi Arabian population in databases like Web of Science, PubMed, Google Scholar, Scopus, and Saudi Digital Library. Articles that were published over the last 15 years were included in this study, following which 13 studies were assessed for qualitative data. Newcastle–Ottawa Quality Assessment Scales for cross-sectional studies were used for analyzing the methodological quality of these studies.

Results: The prevalence of OFC was within the range of 0.65–1.9/1,000 live births. The highest was witnessed in the Medina region. Parent's consanguinity was the most common risk factor in OFC cases in the included studies. OFC was found to be higher among the male population in comparison with the female.

Conclusion: The prevalence of OFC in Saudi Arabian children follows the global patterns of OFC. Isolated cleft lip (CL) and cleft palate (CP) are the most common forms of OFC. The prevalence of orofacial anomalies was reported more among children born to parents who had consanguineous marriages. Considering the higher rate of consanguinity among this population, there is an urgent need of developing educational and counseling programs to address the genetic consequences.

Keywords: Cleft lip, Cleft palate, Facial clefts, Oral clefts, Orofacial clefts.

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Introduction

Orofacial clefts (OFC) are considered one of the most commonly affecting congenital deformities of the orofacial region in humans across the world. OFC comprises the partial to complete fissuring of the upper lip, with or without the involvement of the palate [cleft lip and palate (CLP)] or fissuring of the palate alone.[1]

Orofacial clefts (OFC) are classified as nonsyndromic when they are isolated, and when they are associated with other signs, they are classified as syndromic.[2] The global prevalence of OFC is seen at 1.7/1,000 live-born children, and the birth prevalence may vary among different people with different ethnic groups and geographical regions.[3,4] The prevalence of these OFC is reportedly higher in Asian countries in comparison with South Africa and Southern Europe.[4] The prevalence of these OFC is higher among females from different ethnic groups in comparison with males.[5]

There are multiple and complex etiological factors responsible for the OFC, which mainly include genetic and environmental factors. A higher rate of these congenital anomalies is seen among consanguineous marriages.[6] The epidemiological data reports on several environmental factors that might be considered as the risk factors for the occurrence of OFC. The most reported factors are maternal exposure to tobacco smoke and alcoholism, inadequate nutrition during pregnancy, exposure to viral infection, maternal obesity, and exposure to teratogens.[7–10]

Children born with CL and CP face several serious problems which eventually affect their quality of life.[11,12] The biggest challenges with these cases include feeding, articulation, development of speech, hearing disorders, nutritional deficiencies, and mental and social integration.[13–15] Children with OFC also suffer dental abnormalities, which include the number, size, and shape of the teeth.[16] Children born with OFC and their families suffer psychological distress along with major economic burdens.[10,17,18]

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Addressing these problems needs multidisciplinary care as these children have high morbidity and mortality.[3,19,20] This multidisciplinary approach includes various disciplines, including nursing care, maxillofacial surgery, speech therapy, counseling, psychology, pedodontics, orthodontics, prosthodontics, and general dentistry.[2] Most of the countries do not maintain surveillance systems monitoring birth defects and OFC clefts. Likewise, there is no national database reporting on the birth prevalence rates of OFC in Saudi Arabia; hence this systematic review (SR) intends to report on the prevalence and patterns of OFC among Saudi Arabian children by analyzing the results of the studies that have reported in the literature.

Materials and Methods

This SR is in accordance with the guidelines set by Preferred Reporting Items for Systematic Reviews and Meta-analyses.[21]

Search Strategy

Data search was carried out for the articles that had reported on the prevalence of OFC among the Saudi Arabian population in databases like Web of Science, PubMed, Google Scholar, Scopus, and Saudi Digital Library. Articles that were published over the last 15 years were included in this study.

Search terms comprised of keywords like "prevalence, incidence, CL, CP, dentofacial anomalies, craniofacial anomalies, OFC, oral clefts, facial clefts, and Saudi Arabia. In the advanced search stage, Boolean operators AND/OR were used to develop several combinations of key terms. Articles available in the English language were extracted using language filters. A manual search for the articles was also performed in the college central library after screening the articles from the electronic search.

At this stage, the articles were selected based on the title and abstract, and during this stage, 268 were found relevant to the research topic. In the later stage, we excluded 120 articles that were found to be duplicates. In the further stage, 148 articles were screened for the eligibility criteria set for this SR.

Eligibility Criteria

- Inclusion criteria: Original articles reporting on OFC prevalence in Saudi Arabia. There was no limit on the age of the study population and the type of study designs for inclusion.
- Exclusion criteria: Articles with only abstracts, review articles, opinion letters, letter to editors, case reports, and short communications were excluded.

Study Selection

At this stage, 14 articles that satisfied the selection criteria were distributed among two researchers for analyzing the quantity of the reported studies. Following this, there was confusion regarding the inclusion of one article in this SR, which was resolved after seeking an opinion from another researcher who was experienced in the field of literature. Followed by which the article was excluded from the SR. Finally, 13 original research articles underwent qualitative synthesis, as shown in Flowchart 1.

Results

A total of 13 studies that met the eligibility criteria were assessed for qualitative data.[22–34] The prevalence of OFC was within the range of 0.65–1.9/1,000 live births. The highest was witnessed in the Medina region, as reported by Sabbagh et al.[27]

Sabbagh et al.,[27] Ravichandran et al.,[24] Sabbagh et al.,[28] Aziza et al.,[23] and Alamoudi et al.[26] reported that parent's consanguinity was a common risk factor in most OFC cases included in the studies. Aljohar et al.,[22] Aziza et al.,[23] Sabbagh et al.,[27] Moshref et al.,[30] and Alyami et al.[32] reported that the prevalence of OFC was found higher among the male population in comparison with the female. Qualitative details extracted from the included articles are presented in Table 1.

Risk of Bias (ROB) Assessment

Analysis of the articles' methodological quality was performed using Newcastle–Ottawa Quality Assessment Scales for cross-sectional studies. Among the 13 studies, three studies were reported to have high ROB, one with low ROB, and the remaining reported with medium ROB as shown in Table 2.

Flowchart 1: Flowchart for screening and selection of articles

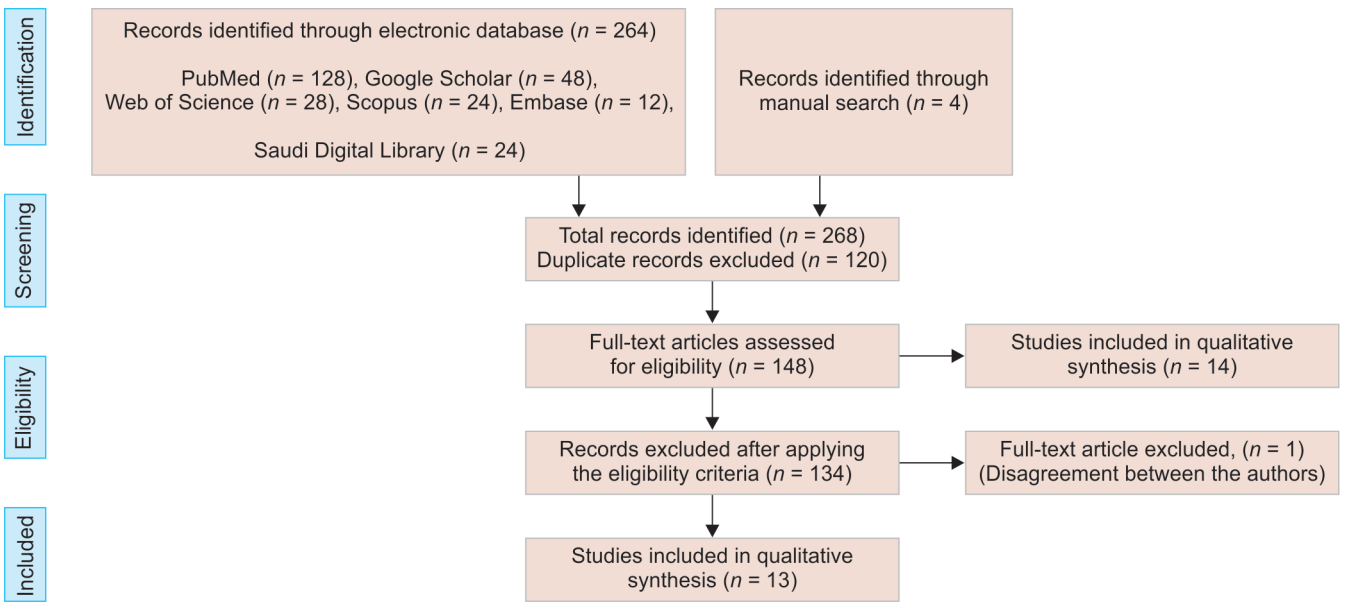

Table 1: Birth prevalence of OFC among children in Saudi Arabia [CL, CLP, CP CL with or without CP (CL ± P)]

Sl. no	*Authors*	*Year of publication*	*Study location*	*Type of study design*	*Objective of the study*	*Data extraction period*	*Total number of OFC cases*	*Main findings*	*Prevalence of OFC (per 1,000 live births)*	*Other findings*
1	Aljohar et al.[22]	2008	Riyadh	Observational study	To report the patterns of cleft lip and/or cleft palate in Saudi Arabia	June 1999–December 2005	807 cases (451—male) (356—female)	CL = 122 CLP = 387 CP = 294	Not mentioned	Parents of 439 cases had consanguineous marriages 224 cases had a familial history of cleft
2	Aziza et al.[23]	2011	Riyadh	Observational study	To report the patterns of craniofacial anomalies in Saudi Arabia	2002–2009	447 cases (242—male; 205—female)	CP = 23 (7.6%) CP = 171 (56.8%) CLP = 99 (32.9%)	Not mentioned	Anomalies were reported more among children born to parents who had consanguineous marriage
3	Ravichandran et al.[24]	2012	Riyadh	Observational study	To report on the possible effects of consanguinity on the occurrence of OFC	June 1999–December 2009	1,171 cases	(64.0%) CL±P) Females had more of CL ($p < 0.0001$)	Not mentioned	51.4% of patients with a family history of clefts had more of cleft ($p < 0.0001$). 56.8% of patients' parents had consanguineous marriage ($p < 0.003$).
4	Togoo et al.[25]	2012	Abha	Observational study	To report on the pattern of cleft lip/palate and associated anomalies	2005–2011	44 cases (32 male, 22 female)	CL = 09 (59%) CLP = 13 (17%) CP = 32 (24%)	Not mentioned	The prevalence of isolated cleft palate cases is higher than the other variants OFC
5	Alamoudi et al.[26]	2014	Jeddah	Observational study	To report on the prevalence of nonsyndromic orofacial cleft (NSOFC) in Jeddah	1st January 2010–31st December 2011	37 cases	CL = 16 CLP = 15 CP = 6 Males had more of OFC ($p < 0.0001$)	NSOFC was 0.80/1,000 live births CL/P was 0.68/1,000 births and CP was 0.13/1,000 births	Consanguinity among parents of CP cases was statistically higher than that among CL with or without CP (CL/P) patients ($p = 0.039$).
6	Sabbagh et al.[27]	2014	Medina	Observational study	To report on the prevalence of NSOFC and their relationship to consanguinity	1st January 2010–31st December 2011	78 cases (50 male, 28 female)	CL = 34 (43%) CLP = 26 (33.3%) CP = 18 (23%)	1.9/1,000 live births, CL was 0.89/ 1,000 live births, CLP was 0.68/1,000 live births, CP was 0.36/1,000 live births	Prevalence of CL was greater than CLP and CP 52 (66.7%) of the children born with OFC had consanguineous parents
7	Sabbagh et al.[28]	2015	Riyadh, Jeddah, and Madinah	Observational study	To report on the prevalence of NSOFC	January 2010–December 2011	133 cases	CL = 53 CLP = 48 CP = 32	1.17/1,000 live births CL was 0.47/1,000 births, CLP was 0.42/1,000 births, and CP was 0.28/1,000 births.	CP was significantly associated with consanguinity ($p = 0.047$, odds ratio—2.50)
8	AlShammari et al.[29]	2017	Hail	Observational study	To report on the prevalence of orofacial cleft	2011–2017	30 cases	CL = 4 (13.3%) CLP = 12 (40%) CP = 14 (46.7%)	1.08/1,000 births.	CP was the most common type of orofacial cleft

Contd…

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Sl. no	*Authors*	*Year of publication*	*Study location*	*Type of study design*	*Objective of the study*	*Data extraction period*	*Total number of OFC cases*	*Main findings*	*Prevalence of OFC (per 1,000 live births)*	*Other findings*
9	Moshref et al.[30]	2017	Jeddah	Observational study	To report on the demographic and clinical characteristics of pediatric patients with NSOFC	2005–2015	528 cases (318 male, 210 female)	286 (54.17%)) Saudi Nationals, CL = 71 (24.83%) CLP = 114 (39.86%), CP = 101 (35.32%	Not mentioned	The prevalence of CLP was more common in than isolated CP and CL
10	AlHammad et al.[31]	2019	Riyadh	Observational study	To report on the prevalence of congenital heart diseases (CHD) associated with NSOFC	January 2015–December 2018	168 cases (38/168) 23%syndromic OFC (SOFC) (130/168) 77% NSOFC	CL = 33 (25%) CLP = 72 (55%) CP = 19 (25%)	Not mentioned	An understanding of between the CHD and OFC cases is considerably important for the health and betterment of the patients
11	Alyami et al.[32]	2020	Najran	Observational study	To report on the prevalence of CL/P among syndromic or nonsyndromic infants	January 2013–December 2016	16 cases (10 male, five females, one not reported) 9 (56.25%) NSOFC, seven (43.75%) SOFC	CL = 2 (12.5%) CLP = 10 (62.5%) CP = 4 (25%)	0.65/1,000 live births	CL with or without palate was the common finding
12	Alrasheedi et al.[33]	2021	Northern Region	Observational study	Determining the prevalence of and risk factors for CL and/or CP	2016–2020	99 cases	CL = 28 (28.3%) CLP = 47 (47.5%) CP = 24 (24.2%)	1.6/1,000 live births	Prevalence of CL/CP in this population was relatively high
13	AlHayyan et al.[34]	2021	Riyadh	Observational study	To determine the birth prevalence of orofacial cleft patients	January 2014–December 2018	78 cases 12 (15.4%) SOFC	CL = 21 (26.9%) CLP = 19 (24%) CP = 30 (38.5%)	1.8/1,000 live births	Prevalence of CP was higher than the other orofacial cleft types

CL, cleft lip; CLP, cleft lip and palate; CP, cleft palate; CL±P, cleft lip with or without cleft palate

Table 2: Details of the ROB for the included studies using the Newcastle–Ottawa Quality Assessment Scale

Study		*Selection*			*Comparability*	*Outcome*		*Total score*	*ROB*
Sl. no	*Authors*	*Representativeness of the sample*	*Sample size*	*Nonincluded subjects*	*The subjects in different outcome groups are comparable based on the study design or analysis. Confounding factors are controlled*	*Assessment of the outcome*	*Statistical test*		
1	Aljohar et al.[22]	1	1	0	2	1	1	6	Medium
2	Aziza et al.[23]	1	1	0	2	1	1	6	Medium
3	Ravichandran et al.[24]	1	1	0	2	1	1	6	Medium
4	Togoo et al.[25]	1	1	0	1	1	1	5	High
5	Alamoudi et al.[26]	1	1	0	2	1	1	6	Medium
6	Sabbagh et al.[27]	1	1	0	2	1	1	6	Medium
7	Sabbagh et al.[28]	1	1	0	2	1	1	6	Medium
8	AlShammari et al.[29]	1	1	0	2	1	1	6	Medium
9	Moshref et al.[30]	1	1	0	2	1	1	6	Medium
10	AlHammad et al.[31]	1	1	1	2	1	1	7	Low
11	Alyami et al.[32]	1	1	0	1	1	1	5	High
12	Alrasheedi et al.[33]	1	1	0	2	1	1	6	Medium
13	AlHayyan et al.[34]	1	1	0	1	1	1	5	High

Discussion

World Health Organization (WHO) considers health as a state of complete physical, mental, and social well-being that necessarily has a significant influence on overall health and on the quality of life of an individual.[35] OFCs are common congenital deformities that affect the orofacial region in humans. CLP being the most prevalent among them, which occurs due to the failure in the fusion of the facial processes during the embryonic phase of development.[36] These clefts have a significant impact on the individuals' well-being both physically and psychologically, as the individual encounters numerous treatment modalities, which could be surgical or nonsurgical from birth.[37] Along with this, the children may also face other psychological issues like lowered self-esteem and shyness, which can affect their social interaction within society.[38] This could be a result of the facial appearance, satisfaction with the surgical treatment, lack of self-confidence, anxiety, and depression among the individuals.[39–42] Quality of life of these individuals is affected as they face tremendous psychosocial issues from the start of their schooling, which could be in the form of bullying, which can result in long-lasting sadness and depression due to the intimidation as a result of bullying.[43]

Along with these, children with OFC also face problems related to oral health, which include the fear of toothbrushing as a limit with the accessibility in the cleft regions, crowding of the teeth, and also difficulty with self-cleansing by saliva. These conditions result in a higher incidence of dental caries among these children. A higher prevalence of dental caries is reported among children with OFC in both deciduous and permanent when compared with children without clefts.[44]

Like few other countries, there is no national database on the prevalence of OFC in Saudi Arabia. Considering these concerns, a need was felt on determining the prevalence and patterns of OFC among children in Saudi Arabia. In this SR article, only seven of the included studies mentioned the prevalence of OFC. According to WHO data, the global prevalence of OFC was reported as one in every 700 live births.[1] In the present review, the prevalence of OFC ranged between 0.65 and 1.9/1,000 live births. The highest was witnessed in the Medina region, as reported by Sabbagh et al.[27]

Parent's consanguinity was reported in most of the included studies, Sabbagh et al.[27] reported that parents of 66.7% of the children born with OFC had a history of marrying first cousins. These findings were similar to the earlier study reported by Ravichandran et al.,[24] where it was reported that 56.8% of patients' parents had consanguineous marriage ($p < 0.003$). Sabbagh et al.[28] also reported that the association between CP and consanguinity was significant ($p = 0.047$, odds ratio—2.50). Aziza et al.[23] had also reported that the prevalence of orofacial anomalies was reported more among children born to parents who had a consanguineous marriage. Alamoudi et al.[26] also reported that consanguinity among parents of CP cases was found to be significantly higher than that of parents of CL with or without CP ($p = 0.039$). These finds were similar to the other studies reported on consanguineous marriages from different

parts of the world, where there was a significant association between the consanguinity and OFC.[45–48]

In Middle East countries, consanguineous marriages are a common type of cultural practice and marrying their first cousins is very frequent. In Saudi Arabia, there is a higher rate of consanguineous marriages and is relatively common, with 56% constituting the marriage between first cousins, and this is considered one of the major risk factors for the occurrence of OFC.[45] These finds are higher in comparison with other countries having a similar tradition of consanguineous marriages, with Lebanon having 41% and Iraq having 45.8% of the marriages.[48,16] Considering the multiple risk factors for OFC, consanguineous marriages is one of the most commonly reported risk factors among this population; a reduction in the practice of consanguinity can produce significant benefits among the population.[49] Identifying this risk factor and controlling this would be the best approach at a primordial and primary level.[50] Other risk factors reported from the observational studies were parental smoking, vitamin deficiencies, and lack of intake of folic acid during pregnancy. Studies conducted by Aljohar et al.,[22] Aziza et al.,[23] Sabbagh et al.,[27] Moshref et al.,[30] and Alyami et al.[32] reported that the prevalence of OFC is higher among the male population in comparison with the female. These findings were contrary to the findings of the study reported by Ravichandran et al.,[24] where the prevalence was higher among females in comparison with males.

Considering the overall prevalence of OFC among children in Saudi Arabia, a multidisciplinary approach is needed in addressing this issue, and the team may comprise gynecologists, pediatricians, dentists, health counselors, and speech therapists, along with other stakeholders. Since there is an increase in the prevalence of dental caries in this population, pain and discomfort due to dental infections are higher.[51,52] General dental practitioners may not be familiar with the management of patients with OFC, and the majority of the time, may refer them to specialists. The specialists' team may include a pediatric dentist, oral and maxillofacial surgeons, orthodontists, and prosthodontists, and most of the time, the treatment may require hospital settings. However, general dental practitioners may be involved in regular dental checkups and oral hygiene maintenance.[53]

This SR has certain limitations with the number of included studies; even though a good number of studies have reported on the prevalence of OFC, only a few of the studies reported on the actual prevalence of OFC, which is the number of OFC/1,000 live births. The majority of the articles reported only on consanguineous marriages as the risk factors, and hence more risk factors have to be looked into through longitudinal studies.

Conclusion

The prevalence of OFC in Saudi Arabian children follows the global patterns of OFC. Isolated CL and CP are the most common forms of OFC, with males being affected more in comparison with females. The prevalence of orofacial anomalies was reported more among children born to parents who had consanguineous marriages. There is a need for the implementation of a national registry for monitoring the nationwide prevalence of OFC and for global comparison. Considering the higher rate of consanguinity among this population, there is an urgent need of developing educational and counseling programs to address the genetic consequences.

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