ISSN: 2091-2331 (Print) 2091-234X (Online)

Journal of Nobel Medical College

Volume 14, Number 02, Issue 27, July-December 2025, 10-16

Original Article

Relationship Between Dermatoglyphic Pattern and Dental Caries Among Pre-School Children of Kathmandu, Nepal

Sirjana Dahal [1]*, Anju Khapung [1], Prakash Poudel [2], Radha Baral [3], Samarika Dahal [3]

[1]Department of Community Dentistry, Maharajgunj Medical Campus, Maharajgunj, Kathmandu Nepal, [2] Department of Orthodontics and Dentofacial Orthopaedics, Kathmandu Medical College Teaching Hospital, Bhaktapur, Nepal, [3]Department of Oral Pathology, Maharajgunj Medical Campus, Maharajgunj, Kathmandu Nepal

Article Received: 12th October, 2025; Accepted: 20th December, 2025; Published: 31st December, 2025

DOI: https://doi.org/10.3126/jonmc.v14i2.87578

Abstract

Background

Development of dermal ridges and primary palate occurs at same time of intrauterine life. Also, epithelium of both enamel and finger buds have ectodermal origin due to which dermatoglyphics is considered as a genetic marker of dental caries. Therefore, this study was conducted to determine relationship between dermatoglyphic pattern and dental caries status among preschool children in Kathmandu, Nepal.

Materials and Methods

An analytical cross-sectional study was conducted among 236 schoolchildren of 2-6 years (Group 1, dmft=0, Group 2, dmft≥1). Dermatoglyphic pattern was assessed from all 10 fingers of two hands using inkpad and fingerprint cards and dmft index was recorded. Data collected were analyzed in statistical package for social sciences version 24. Mean, standard deviation, frequency and percentage were calculated for descriptive analysis. Chi-square test and Mann Whitney-U test were done to determine the relationship between dermatoglyphic pattern and caries experience.

Results

Arch pattern in left thumb was significantly associated with caries free children (p=0.023). Caries-free group had significantly higher counts of arches (p=0.007), while whorl patterns were prevalent in children with dmft≥1 (p=0.017) in right hand. Significantly more loops in caries-free group (p=0.030) were found in left hand. Overall observations showed significantly higher number of whorl patterns in children with dmft≥1 (p=0.017).

Conclusion

The findings of this study showed a potential relationship between dermatoglyphic patterns and dental caries experience in preschool children. Children with caries experience had a significantly higher number of whorl patterns whereas arch and loop patterns were more prevalent in caries-free children.

Keywords: *Child, Dental Caries, Dermatoglyphics, Hand, Preschool*

***Corresponding Author:**
Dr. Sirjana Dahal
Assistant Professor
Email: drsirjana@iom.edu.np
ORCID: https://orcid.org/0000-0002-0536-1230

Citation
Dahal S, Khapung A, Poudel P, Baral R, Dahal S, Relationship Between Dermatoglyphic Pattern and Dental Caries Among Pre-School Children of Kathmandu, Nepal, JoNMC. 14:2 (2025) 10-16. DOI: https://doi.org/10.3126/jonmc.v14i2.87578.

Introduction

Cummins and Midlo (1926) coined "Dermatoglyphic", “Dermato” meaning skin, “Glyphics” meaning carving, denoting study of naturally occurring patterns on surfaces of hand and feet [1,2]. These patterns are influenced by environmental and hereditary factors during fetal development [3]. Fingerprints that don't change throughout lifetime [4], is recognized as potential diagnostic tool for many disorders [5], including orofacial conditions [6].

Dermatoglyphics develops around 6-7th week and completes at 24th week of gestation period indicating that genetic code, whether normal or aberrant, interpreted at this time is mirrored in dermatoglyphics [7]. Dermatoglyphics is believed to represent a window of congenital anomalies [8]. Primary palate develops between 6-13 weeks of intrauterine life [9]. Thus, in the event of intrauterine dermal injury, it is plausible to expect tooth abnormalities [6]. Dental caries, a multifactorial disease, is prevalent worldwide [10]. Studies conducted in Nepal reported majority of children with primary dentition had dental caries [11,12]. Despite high prevalence of dental caries, there are various methods to detect but no method to predict it [13].

Since the enamel, the primary palate's epithelium, and the finger buds' epithelium all have ectodermal origin and develop at the same time during intrauterine life, dermatoglyphic patterns are predicted as genetic marker for dental caries [5]. Thus, this study was designed to investigate relationship between dermatoglyphics and dental caries status among preschool children in Kathmandu, Nepal.

Materials and Methods

A community-based analytical cross-sectional study was conducted from April to July 2025 among 236 preschool children of age two to six years, studying in five different schools/preschools of Kathmandu. Ethical approval was obtained from the Ethical Review Board of Tribhuvan University [ERB-TU, Ref. no. 53/081/082] before data collection. Permission was received from respective schools along with informed consent from parents and verbal assent from the children who were the study participants in this study. Even after receiving informed consent from the parents and assent from the child, any participant who was uncooperative to provide fingerprint or oral examination was excluded from the study.

Schools/ pre-schools were selected by the convenience sampling method. The five schools/ pre-schools approached by the principal investigator for school oral health program from the Department of Community Dentistry, Maharajgunj Medical Campus, Maharajgunj, Kathmandu, Nepal were selected. The children of age two to six years with primary dentition were selected by quota sampling method by classifying them into two groups, each group comprising of 118 children. Differently abled children or those under anti-inflammatory drugs, antibiotics or immunosuppressant therapy were excluded.

Sample size was calculated based on the caries experience among arch and loop pattern from a published study [14] using formula, $n = 2sd^2(Z_{1-\alpha/2} + Z_{1-\beta})^2/(m_1-m_2)^2$, where n = sample size, $Z_{1-\alpha/2}$ =1.96 at 95% confidence interval, $Z_{1-\beta}$= 0.84 at 80% power, m_1 = mean caries experience of participants with arch pattern = 2.01, m_2 = mean caries experience of participants with loop pattern = 1.58, sd = standard deviation = $sd_1 + sd_2 / 2 = 1.27+1.03 / 2 = 1.15$. Placing these values in the formula provided above, total sample size= 112.15 ≈113 in each group. Adding 5% non-response rate, total sample = 117.75 ≈ 118 in each group (Final sample size = 118X2 = 236).

After the selection of study participants, an intraoral examination was done with the help of mouth mirror and explorer for assessing the dental caries status and dmft index was noted [15] which is a universally accepted index for recording the caries experience of primary dentition. Based on their caries experience, they were divided into two groups (Group 1: Children with dmft/dmfs = 0, with no caries experience and Group 2: Children with dmft/dmfs $\geq$1, with caries experience). Dermatoglyphic patterns were assessed from all 10 fingers of two hands using inkpad and fingerprint cards. The examiners who were involved in the oral examination and fingerprint collection were properly trained and calibrated in the department before final data collection to help gain precision and consistency of data. The fingerprint pads and oral diagnostic instruments used for data collection were regularly checked ensuring that they provide proper record. Fingerprint recording was done using standardized ink and paper methods under proper lighting and supervision by the principal investigator.

The data obtained were entered into Microsoft Excel Sheet and analyzed in SPSS (Statistical Package for Social Sciences) software version 24. Mean, standard deviation, median, interquartile range frequency and percentage were calculated for descriptive analysis of data. The Shapiro-Wilk test was used to check the normal-

ity of data. Due to the skewed nature of data, Mann Whitney U test was used to find out the difference in between dental caries experience and dermatoglyphic pattern. Chi-square test was done to determine the association between dermatoglyphic pattern and dental caries status.

Results

The study included a total of 236 preschool children aged between two to six years, with a male predominance (137, 58.0%). The age distribution showed the highest number of participants of age 3-year (83, 35.2%) and 5-year (65, 27.5%) age groups (Table 1).

Table 1: Age and sex distribution of study participants (n=236)

Among the total preschool children examined,

Age in years	Sex distribution		Total n (%)
	Male n (%)	Female n (%)	
2	4 (57.1)	3 (42.9)	7 (3.0)
3	50 (60.2)	33 (39.8)	83 (35.2)
4	34 (53.1)	30 (46.9)	64 (27.1)
5	40 (61.5)	25 (38.5)	65 (27.5)
6	9 (52.9)	8 (47.1)	17 (7.2)
Overall 2-6 years	137 (58.0)	99 (42.0)	236 (100)

118 children with no caries experience (dmft=0) and 118 with caries-experience (dmft≥1) were considered. The highest mean dmft score was observed in 2-year-olds (4.86±4.30), though this age group constituted only a small proportion of the total sample. The mean dmft scores decreased progressively with increasing age, with the lowest mean observed in 5-year-olds (1.72±3.11).

Table 2: Distribution of study population according to their caries experience (n=236)

Age in years	Sex distribution	Group 1 (dmft=0) n (%)	Group 1 (dmft≥1) n (%)	dmft score (mean±SD)
2	Male	1 (25.0)	3 (75.0)	6.0±5.48
	Female	-	3 (100)	3.33±2.08
	Total	1 (14.3)	6 (85.7)	4.86±4.30
3	Male	23 (46.0)	27 (54.0)	3.38±4.33
	Female	17 (51.5)	16 (48.5)	2.24±3.10
	Total	40 (48.2)	43 (51.8)	2.93±3.91
4	Male	11 (32.4)	23 (67.6)	2.74±3.21
	Female	11 (36.7)	19 (63.3)	3.30±3.93
	Total	22 (34.4)	42 (65.6)	3.0±3.55
5	Male	25 (62.5)	15 (37.5)	1.83±3.0
	Female	18 (72.0)	7 (28.0)	1.56±3.33
	Total	43 (66.2)	22 (33.8)	1.72±3.11
6	Male	6 (66.7)	3 (33.3)	2.78±4.24
	Female	6 (75.0)	2 (25.0)	2.63±4.93
	Total	12 (70.6)	5 (29.4)	2.71±4.43
Overall 2-6 years	Male	66 (48.2)	71 (51.8)	2.80±3.78
	Female	52 (52.5)	47 (47.5)	2.45±3.57
	Total	118 (50.0)	118 (50.0)	2.66±3.69

Figures 1 and 2 illustrate the distribution of dermatoglyphic patterns in the right and left hands, respectively. Loops were the most prevalent pattern across thumb, middle and little fingers of both hands followed by whorl and arch pattern. The whole pattern was prevalent in index and ring fingers of both hands followed by loop and arch. Arch pattern was least prevalent in all ten fingers.

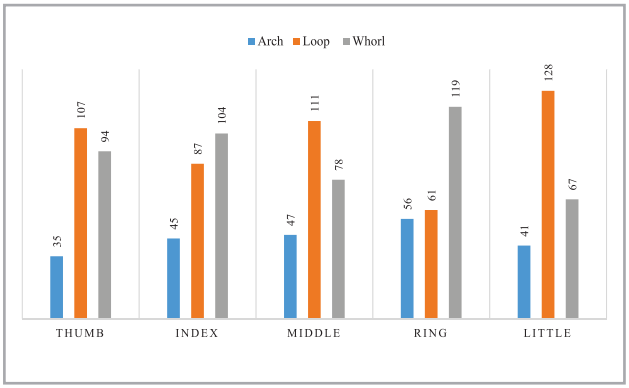

Figure 1: Distribution of dermatoglyphic patterns in fingers of right hand (n= 236)

Figure 2: Distribution of dermatoglyphic patterns in fingers of left hand (n= 236)

The distribution of dermatoglyphic patterns (arch, loop, whorl) in each finger of the right hand showed no statistically significant association with dental caries status ($p > 0.05$ for all fingers, Table 3). In the left hand, a statistically significant association was observed in the thumb ($p = 0.023$), where children without caries experience had a higher frequency of arch patterns as compared to those with caries experience. For the other fingers of the left hand, no significant association was found between dermatoglyphic pattern and caries experience ($P>0.05$, in all fingers except thumb, Table 4).

Table 3: Association between dermatoglyphic pattern and dental caries experience in right hand (n=118 in each group).

Finger	Caries experience	Dermatoglyphic pattern Arch	Loop	Whorl	P value*
Thumb	No	16 (13.6)	59 (50.0)	43 (36.4)	0.355
	Yes	19 (16.1)	48 (40.7)	51 (43.2)	
	Total	35 (14.8)	107 (45.3)	94 (39.8)	
Index finger	No	21 (17.8)	44 (37.3)	53 (44.9)	0.882
	Yes	24 (20.3)	43 (36.4)	51 (43.2)	
	Total	45 (19.1)	87 (36.9)	104 (44.1)	
Middle finger	No	24 (20.3)	57 (48.3)	37 (31.4)	0.857
	Yes	23 (19.5)	54 (45.8)	41 (34.7)	
	Total	47 (19.9)	111 (47.0)	78 (33.1)	
Ring finger	No	31 (26.3)	34 (28.8)	53 (44.9)	0.239
	Yes	25 (21.2)	27 (22.9)	66 (55.9)	
	Total	56 (23.7)	61 (25.8)	119 (50.4)	
Little finger	No	23 (19.5)	64 (54.2)	31 (26.3)	0.612
	Yes	18 (15.3)	64 (54.2)	36 (30.5)	
	Total	41 (17.4)	128 (54.2)	67 (28.4)	

*Chi-square test

Table 4: Association between dermatoglyphic pattern and dental caries experience in left hand (n=118 in each group).

Finger	Caries experience	Dermatoglyphic pattern Arch	Loop	Whorl	P value*
Thumb	No	24 (20.3)	44 (37.3)	50 (42.4)	**0.023**
	Yes	11 (9.3)	60 (50.8)	47 (39.8)	
	Total	35 (14.8)	104 (44.1)	97 (41.1)	
Index finger	No	20 (16.9)	52 (44.1)	46 (39.0)	0.606
	Yes	20 (16.9)	45 (38.1)	53 (44.9)	
	Total	40 (16.9)	97 (41.1)	99 (41.9)	
Middle finger	No	20 (16.9)	63 (53.4)	35 (29.7)	0.450
	Yes	19 (16.1)	55 (46.6)	44 (37.3)	
	Total	39 (16.5)	118 (50.0)	79 (33.5)	
Ring finger	No	24 (20.3)	36 (30.5)	58 (49.2)	0.234
	Yes	15 (12.7)	35 (29.7)	68 (57.6)	
	Total	39 (16.5)	71 (30.1)	126 (53.4)	
Little finger	No	31 (26.3)	53 (44.9)	34 (28.8)	0.110
	Yes	18 (15.3)	62 (52.5)	38 (32.2)	
	Total	49 (20.8)	115 (48.7)	72 (30.5)	

*Chi-square test

Table 5 presents the comparisons of overall dermatoglyphic patterns between caries-free and caries-experienced children. Children in the caries-free group had significantly higher arch patterns in the right hand compared to those with caries experience (p = 0.007). In contrast, the whorl pattern was significantly higher in the right hand among those with caries experience (p = 0.017). No significant difference was found in the median number of loop patterns in the right hand among those with and without caries experience (p = 0.520). In the left hand, there was a significant difference in the loop pattern, where children without caries had higher loop counts (p = 0.030). When the dermatoglyphic pattern of all ten fingers of both hands were assessed, children with caries experience showed significantly higher median number of whorl pattern (p = 0.017) as compared to caries free group.

Table 5: Comparison of dermatoglyphic patterns among preschool children with and without caries experience (n=118 in each group).

Dermatoglyphic pattern	Group	Mean±SD	Median (IQR)	Mean rank	P value*
Fingers of right hand					
Arch	dmft=0	1.13±1.14	1 (0-2)	129.81	**0.007**
	dmft≥1	0.77±1.02	0 (0-1)	107.19	
Loop	dmft=0	2.14±1.21	2 (1-3)	121.28	0.520
	dmft≥1	2.04±1.32	2 (1-3)	115.72	
Whorl	dmft=0	1.73±1.27	2 (1-3)	108.17	**0.017**
	dmft≥1	2.19±1.40	2 (1-3)	128.83	
Fingers of left hand					
Arch	dmft=0	0.86±1.15	0 (0-1)	118.48	0.997
	dmft≥1	0.85±1.11	0 (0-1)	118.52	
Loop	dmft=0	2.33±1.39	2 (1-3)	127.94	**0.030**
	dmft≥1	1.95±1.49	2 (1-3)	109.06	
Whorl	dmft=0	1.81±1.40	2 (1-3)	110.16	0.056
	dmft≥1	2.20±1.56	2 (1-4)	126.84	
Fingers of both hands					
Arch	dmft=0	1.99±1.91	1 (1-3)	125.87	0.089
	dmft≥1	1.62±1.78	1 (0-3)	111.13	
Loop	dmft=0	4.47±2.13	4 (3-5)	125.33	0.121
	dmft≥1	3.99±2.34	4 (2-6)	111.67	
Whorl	dmft=0	3.53±2.33	4 (1-5)	107.98	**0.017**
	dmft≥1	4.39±2.54	0 (0-1)	129.02	

*Mann-Whitney U test

Discussion

Dermatoglyphics is regarded as a window of intrauterine and congenital anomalies. The formation of ridge patterns is influenced by the maternal environment, gene abnormalities, and chromosomal aberrations during development. This is the reason for dermatoglyphic investigation being important in clinical practice [16]. Dental caries is considered as a multifactorial disease having many risk factors including host and environmental factors. Understanding that genes and environment are interdependent and that different contexts can affect appearance or degree of heritability is crucial [14]. Host factors

that may be associated with salivary composition, immune response to cariogenic bacteria, or dental enamel structure influence the occurrence of dental caries. Variations in the host factors' genetic makeup might increase the risk of dental caries [17]. Therefore, this study was conducted to determine the relationship between dermatoglyphic pattern and dental caries among preschool children of Kathmandu, Nepal.

In this study, mean dmft score of the study participants was 2.66±3.69 which was slightly lower than that of the study done in Kathmandu in 2017 where mean dft observed was 3.28±3.581 [18]. In the current study, males had slightly higher prevalence of dental caries experience (51.8%, mean dmft 2.80±3.78) than in females (47.5%, mean dmft 2.45±3.57). However, a study conducted in Northern Appalachia reported no significant sex differences for children aged 1–5 years [19]. This finding contrasts with study reporting higher caries in females, possibly due to earlier tooth eruption [18].

In the present study, statistically significant association ($p = 0.023$) was observed, with caries-free children showing a higher frequency of arch patterns in the thumb finger of left hand as compared to those with at least one caries experience. This finding aligns with studies suggesting that arch patterns may correlate with lower susceptibility to multifactorial conditions like caries, possibly due to shared ectodermal developmental pathways [20].

Children with caries experience in the current study had significantly more whorls in the right hand ($p = 0.017$) and across all fingers ($p = 0.017$). Similar to these findings, the whorl pattern of fingerprint was found to be more prevalent in published studies [14,21, 22].Whorls have been linked to increased susceptibility to oral potentially malignant disorder and oral squamous cell carcinoma [23, 24] and other systemic conditions [25, 26], possibly reflecting genetic predispositions affecting enamel formation or immune response. Loops were the most common pattern observed in this study with caries-free children having higher loop counts in the left hand ($p = 0.030$). Accordingly, a study conducted in Bihar, India showed higher number of loops seen in control group with no dental caries experience [22]. In contrast, a study revealed significant difference ($p=0.043$) in dermatoglyphic pattern with higher number of loops in the third digit of left hand [13]. This difference in finding suggests that handedness or asymmetrical genetic influences might play a role.

This study had some limitations. The cross-sectional nature of this study could only show potential associations; longitudinal studies are needed to further establish causality. Confounding factors like diet, oral hygiene, and fluoride exposure were not considered in this study that may have influenced the caries status. Generalizability of study findings is questionable as conventional sampling method was used for selection schools/preschools and study participants. This study provides preliminary evidence of a relationship between dermatoglyphic patterns, particularly arches and whorls and dental caries in preschoolers of Kathmandu. Dermatoglyphics could serve as a non-invasive, cost-effective tool for early caries risk assessment, especially in resource-limited settings like Nepal. While the findings suggest a genetic or developmental link, the potential associations and methodological limitations warrant cautious interpretation. Future research should incorporate genetic testing, larger diverse cohorts, and controlled confounders to validate these observations. Studies should be conducted using standardized caries diagnostic methods, and broader demographic representation to strengthen the evidence base. If confirmed, dermatoglyphics could enhance early caries prevention strategies, complementing traditional risk assessments.

Conclusion

The findings of this study revealed potential association of dental caries experience with dermatoglyphic patterns such that children with one or more caries experience presented with higher number of whorl patterns in their fingers than other two patterns. Furthermore, arch or loop pattern was associated with children with no caries experience. These findings imply that certain fingerprint patterns may be linked to a higher risk of caries, possibly due to shared genetic or developmental factors influencing both traits. Therefore, this study suggests that dermatoglyphic screening can be included as a non-invasive, low-cost tool in early childhood health assessments. In resource-limited settings like Nepal, identifying children with genetic susceptibility to dental caries through dermatog-lyphics can help optimize resource distribution. Prioritization of caries-preventive care and nutritional programs for genetically susceptible groups, especially in marginalized communities can be done.

Acknowledgement
The authors would like to thank the Principals schools / preschools of Kathmandu who agreed to allow their students to participate in this study and the faculties of school who showed co-operation during the data collection.

Conflict of interest: None

Funding
This study was funded by The Research Directorate, Rector Office, Tribhuvan University, Kirtipur, Kathmandu Nepal (Small Research Grant – 2080/81)

References

[1] Sengupta AB, Bazmi BA, Sarkar S, Kar S, Ghosh C, Mubtasum H, A cross sectional study of dermatoglyphics and dental caries in Bengalee children. J Indian Soc Pedod Prev Dent 31(2013) 245–8. DOI:10.4103/0970-4388.121823.

[2] Venkatesh E, Bagewadi A, Keluskar V, Shetti, A Palmar dermatoglyphics in oral leukoplakia and oral squamous cell carcinoma patients. Journal of Indian Academy of Oral Medicine and Radiology 20 (2008) 94 DOI: 10.4103/0972-1363.52774.

[3] Ho YY, Evans DM, Montgomery GW, Henders AK, Kemp JP, Timpson NJ, Pourcain BS, Heath AC, Madden PA, Loesch DZ, McNevin D. Common genetic variants influence whorls in fingerprint patterns. J Invest Dermatol. 136(4) (2016) 859-62. DOI: 10.1016/j.jid.2015.10.062.

[4] Anitha C, Konde S, Raj NS, Kumar NC, Peethamber P, Dermatoglyphics: a genetic marker of early childhood caries. J Indian Soc Pedod Prev Dent 32 (2014) 220–4. DOI:10.4103/0970-4388.135828.

[5] Abhilash PR, Divyashree R, Patil SG, Gupta M, Chandrasekar T, Karthikeyan R, Dermatoglyphics in patients with dental caries: A study on 1250 individuals. J Contemp Dent Pract. 13:3 (2012) 266-74. DOI: 10.5005/jp-journals-10024-1135

[6] Kapoor A, Shetty P, Shetty SS, Aggarwal N, Merchant Y, Riahi SM, Evaluation of the relationship between dermatoglyphics and mandibular third molar impaction: A cross-sectional study. F1000Research. 11 (2022) 1120-34. DOI: 10.12688/f1000res.123398. 1

[7] Jindal G, Pandey RK, Gupta S, Sandhu M, A comparative evaluation of dermatoglyphics in different classes of malocclusion. Saudi Dent J. 27:2 (2015) 88-92. DOI: 10.1016/j.sdentj.2014.11.012

[8] Natekar P, DeSouza F, Fluctuating asymmetry in dermatoglyphics of carcinoma of breast. Indian J Hum Genet 12 (2006) 76. DOI: 10.4103/0971-6866.27790

[9] Sharma A, Somani R, Dermatoglyphic interpretation of dental caries and its correlation to salivary bacteria interactions: An in vivo study. Journal of the Indian Society of Pedodontics and Preventive Dentistry 27 (2009) 17–21. DOI: 10.4103/0970-4388.50811

[10] Wang X, Willing MC, Marazita ML, Wendell S, Warren JJ, Broffitt B, Smith B, Busch T, Lidral AC, Levy SM, Genetic and Environmental Factors Associated with Dental Caries in Children: The Iowa Fluoride Study. Caries Res 46 (2012) 177–184. DOI: 10.1159/000337282

[11] Subedi B, Shakya PK, Kc U, Jnawali M, Paudyal BD, Acharya A, Koirala S, Singh A. Prevalence of dental caries in 5-6 years and 12-13 years age group of school children of Kathmandu valley. J Nepal Med Assoc. 51:184 (2011) 176-81. PMID: 22922897

[12] Tsang C, Sokal-Gutierrez K, Patel P, Lewis B, Huang D, Ronsin K, Baral A, Bhatta A, Khadka N, Barkan H, Gurung S. Early childhood oral health and nutrition in urban and rural Nepal. Int J Environ Res Public Health environmental research and public health. 16:14 (2019) 2456-67.DOI: 10.3390/ijerph16142456.

[13] Shah P, Khanal S, Relationship of Dermatoglyphics with Dental Caries among Pre-School Children- A Hospital Based Study. J Coll Med Sci-Nepal 19(2023) 266–76. DOI: 10.3126/jcmsn.v19i3.49866

[14] Chinmaya B, Smitha B, Tandon S, Khurana C, Dermatoglyphics: An indicator of dental caries in humans. J Indian Assoc Public Health Dent 14(2016) 272. DOI: 10.4103/2319-5932.187175

[15] Gruebbel AO, A measurement of dental caries prevalence and treatment service for deciduous teeth. 23 (1944) 163–168. DOI: 10.1177/00220345440230030201

[16] Samudrawar R, Mazhar H, Wasekar R, Tamgadge P, Tiwari RVC, Bhowmick S, Evaluation of Digital Palmar Dermatoglyphics in Oral Submucous Fibrosis and Leukoplakia: A Prospective Comparative Clinical Study. Maxillofac Oral Surg. 21(2020) 219. DOI: 10.1007/s12663-020-01399-8

[17] Shuler CF, Inherited risks for susceptibility to dental caries. J Dent Educ 65 (2001) 1038–45. PMID: 11699975

[18] Limbu S, Dikshit P, Bhagat T, Evaluation of Dental Caries Among Preschool Children in Kathmandu-Using Significant Caries Index. Nepal Med Assoc 56 (2017) 341–345. DOI: 10.31729/jnma.3282

[19] Shaffer JR, Leslie EJ, Feingold E, Govil M, McNeil DW, Crout RJ, Weyant RJ, Marazita ML, Caries experience differs between females and males across age groups in Northern Appalachia. International journal of dentistry, 2015: 1 (2015) 938213. DOI: 10.1155/2015/938213

[20] Panwar P, Chaudhry K, Khanduri N, Rava D. Unravelling oral patterns: correlation of dactyloscopy and cheiloscopy with dental caries in 4-9 years old children: a pilot study. Int J Contemp Pediatr. 12:9 (2025) 1482-6. DOI: 10.18203/2349-3291.ijcp20252596

[21] Sharma R, Singh NN, Sreedhar G, Dermatoglyphic findings in dental caries and their correlation with salivary levels of Streptococcus mutans and Lactobacillus in school-going children in and around Moradabad. J Oral Maxillofac Pathol. 22:3 (2018) 360-6. DOI: 10.4103/jomfp.JOMFP_110_18

[22] Nezam S, Nishat R, Khan S, Singh P, Kumar A, Faraz S, Correlation of dental caries and dermatoglyphic patterns: A study in pediatric population. J Family Med Prim Care, 9(2020) 2980. DOI: 10.4103/jfmpc.jfmpc_208_20

[23] Subramanium A, Isaac TK, Sharma B, Gupta VV,

Kapoor S, Chitkara N. Evaluation of Prevalence of Fingerprint Patterns in Patients with Oral Potentially Malignant Disorders. Int J Health Sci. (I) (2022) 952-61. DOI: 10.53730/ijhs.v6nS1.4848

[24] Ganvir S, Gajbhiye N, Detection of genetic predisposition in oral squamous cell carcinoma (OSCC) and oral submucous fibrosis patients by qualitative analysis of finger and palm-print patterns: A dermatoglyphic study. Clin Cancer Investig J. 3(2014) 377–82. DOI: 10.4103/2278-0513.138054

[25] Pakhale SV, Borole BS, Doshi MA, More VP, Study of the Fingertip Pattern as a Tool for the Identification of the Dermatoglyphic Trait in Bronchial Asthma. J Clin Diagn Res 6(2012) 1397–1400. DOI: 10.7860/JCDR/2012/4734.2368

[26] Wijerathne BT, Meier RJ, Agampodi TC, Agampodi SB, Dermatoglyphics in hypertension: a review. J Physiol Anthropol 34(2015) 29. DOI: 10.1186/s40101-015-0065-3