# Prevalence of Oral Habits and its Association with Malocclusion in Primary Dentition among School Going Children of Nepal

Amita Rai*/ Bandana Koirala **/ Mamta Dali***/ Sneha Shrestha ****/ Ashish Shrestha*****/ Surya R Niraula *******



***Objectives:*** *The objectives of this study were to: (1) study the prevalence of oral habits among school going children with primary dentition; (2) determine the association of oral habits with malocclusion in primary dentition; and (3) compare the prevalence of oral habits based on gender, race, age and grade.* ***Study design****: A community based cross-sectional study was conducted among 625 school going children with a complete set of primary dentitions. A closed-ended questionnaire was developed to gather information about oral habits followed by clinical examination.* ***Results****: The prevalence of oral habits was 42.7%. Finger nail biting (19.5%) was the most prevalent oral habit, whereas self-destructive oral habits (0.7%) were the least prevalent. Multivariate logistic regression analysis revealed significant association of (P<0.05): digit sucking habit with distal step molar relationship, class II canine relationship and increased overjet; pacifier sucking habit with presence of distal step molar relationship, class II canine relationship, crossbite and increased overjet; and finger nail biting habit with absence of primate spaces.* ***Conclusions****: Nearly half of the participating children indulged in one or more oral habits. There was significant association between some oral habits and malocclusion traits, indicating the requirement of timely screening and interception.*

***Keywords:*** *Malocclusion, Oral habits, Primary dentition stage*

## INTRODUCTION

Habits are learned patterns of a highly complex nature. They start as a conditioned reflex during growth and maturation of a subject and are acquired through repetition of the same or similar actions creating instinctive tendencies. Oral habits could be functional or parafunctional[1]. Oral function consists of articulation, swallowing and chewing[2]. Parafunctional oral habits are acquired by practicing a non-functional or unnecessary action. The importance of diagnosing parafunctional habits lies in the fact that they interfere with the normal growth pattern of the jaws, the development of occlusion in secondary dentition and may therefore, cause malocclusion[1].

Malocclusion is frequently found irrespective of geographical area, ethnic group, gender, age, or social class[3]. The local factors responsible for malocclusion are muscle activity, posture and various deleterious oral habits. Other etiologic factors that are responsible for less than five percentage of malocclusion are congenital defects and trauma[2].

Forces from unilateral and habitual behaviors constantly acting on the maxillofacial and alveolar regions can cause the bony structures to generally deform, resulting in jaw deformity and malocclusion. Without a clear understanding of the etiology of any condition, there is a risk for treatment becoming empirical or symptomatic[2]. Since most of the oral habits like digit sucking, tongue thrust swallowing, mouth breathing etc. are modifiable, reliable data and

*Amita Rai, Assistant Professor, Department of Pediatric and Preventive Dentistry, People's Dental College and Hospital, Nayabazar, Kathmandu, Nepal.

**Bandana Koirala, Professor and Head, Department of Pedodontics and Preventive Dentistry, College of Dental Surgery, B.P. Koirala Institute of Health Sciences, Dharan, Nepal.

***Mamta Dali, Associate Professor, Department of Pedodontics and Preventive Dentistry, College of Dental Surgery, B.P. Koirala Institute of Health Sciences, Dharan, Nepal.

****Sneha Shrestha, Assistant Professor, Department of Pedodontics and Preventive Dentistry, College of Dental Surgery, B.P. Koirala Institute of Health Sciences, Dharan, Nepal.

***** Ashish Shrestha, Professor and Head, Department of Public Health Dentistry, College of Dental Surgery, B.P. Koirala Institute of Health Sciences, Dharan, Nepal.

******Surya R Niraula, Professor, School of Public Health and Community Medicine, B.P. Koirala Institute of Health Sciences, Dharan, Nepal.

**Corresponding author:**
Amita Rai
Department of Pediatric and Preventive Dentistry, People's Dental College and Hospital, Nayabazar, Kathmandu Nepal
Phone: 0977-9819203326
E-mail: amitarai2013@gmail.com

knowledge of how such behaviors contribute to malocclusion is important for its cessation and prevention[3].

The present study aimed to determine the prevalence of oral habits and its association with malocclusion among school going children with primary dentition in Dharan, Nepal. The study also aimed to compare the prevalence of oral habits based on gender, race, age, and grade.

## MATERIALS AND METHOD

A community based cross-sectional study was conducted among children studying in nursery to class one, in randomly selected nine different schools of Dharan sub-metropolitan city, within a period of 15th March to 31st December 2017. Ethical clearance was obtained from the Institutional Review Committee of B.P. Koirala Institute of Health Sciences, Dharan, Nepal (IRC/0821/016). Informed consent was obtained from parents/legal guardian and assent was obtained from the children involved in the study.

Mongolian and Caucasian children with a complete set of primary dentitions were included in the study. Children with fractured, anomalous, grossly decayed tooth/teeth, cleft of lip/palate, history of orthodontic treatment and parents/children not willing to participate in the study were excluded. The study population was categorized as Mongolian and Caucasian race according to ethnicity[4,5]. The sample size consisted of 625 children (95 percent confidence interval=1.96, permissible error of 14% and 10% for non-response), which was estimated based on the prevalence of developmental spaces in the mandibular arch (25.7%) from the study conducted by Bhayya and Shyagali[6].

Examination was carried out by a single examiner. Before commencing the examination, training and calibration was conducted for the examiner by an expert. An intra-examiner reliability test was performed by examining a group of 25 children at two different time periods of one week apart. Cohen's Kappa statistical analysis revealed that the Kappa coefficient for extraoral and intraoral parameters ranged from 0.80 to 0.82.

### Examination

A questionnaire addressing demographic data to characterize the sample, presence or absence of oral habits and history of orthodontic treatment was sent to parents/legal guardians. Each child was asked to sit on a chair under natural daylight and extraoral examination was performed, which was then followed by intraoral examination using a mouth mirror (no. 4) and straight probe.

Different types of oral habits recorded were digit sucking, pacifier sucking, finger nail biting, lip habits, mouth breathing, bruxism, tongue thrusting and self-destructive oral habits. Digit sucking habit was confirmed by positive parental history, and the presence of redness, clean digits, short finger nails and fibrous callus[1,7]. Pacifier sucking habit was diagnosed based on parental history alone. Finger nail biting habit was confirmed by positive parental history, and on examination with findings of inflammation on nail beds and bite marks on nails. Confirmation of lip habits (lip wetting, lip sucking) was done by positive parental history, and the presence of reddened chapped area below vermilion border along with accentuated mento-labial sulcus on examination[1,7]. Mouth breathing habit was again confirmed by positive parental history, inclusive of examination findings such as, long face, drooping eyes, thin upper lip, inverted lower lip, dry hypotonic lips, narrow nostrils, inadequate lip seal at rest, high arched palate and water holding test[1,2]. The water holding test involved the child holding water in his/her mouth with the lips closed without swallowing for three minutes. The lip commissures were observed for signs of effort and children who were unable to keep their lips closed over the three minutes period were considered mouth breathers[2]. Bruxism was confirmed by positive parental history, and presence of attrition of the dentition, sometimes even leading to the pulpal exposure and unusual mobility of teeth on examination[8]. Tongue thrust was considered as the forward movement of the tongue tip between the teeth to meet the lower lip during deglutition and in sounds of speech, so that the tongue becomes interdental[9]. The fingers of both the hands of the examiner were used to palpate the masseter muscle, while both the thumbs were used simultaneously to retract the lower lip lightly so that the tongue thrust if present could be seen. With the hands in this position, the subjects were asked to swallow the saliva. Subjects in whom there was diminution or absence of palpable contraction of masseter muscle but forward thrust of tongue causing it to protrude between the incisors were considered as tongue thrust swallowers[2]. Self-destructive oral habits (lip biting, cheek biting, tongue biting, picking of gingiva, frenum thrusting) was confirmed by positive parental history, and the presence of unexplained injury to the oral tissues on examination.

### Statistical analysis

Collected data was then entered into Microsoft Excel 2008 and converted into Statistical Package for the Social Sciences (SPSS) 11.0 version for statistical analysis. For descriptive statistics, mean, standard deviation and percentage were calculated. The comparison of categorical data was done using Chi square or Fisher's Exact test wherever applicable. Probability of significance which was set at 95% confidence interval, where $p \leq 0.05$.

## RESULTS

A total of 625 children were examined among which 353 (56.5%) were males and 272 (43.5%) were females. Race wise, 382 (61.1%) were Mongolians and 243 (38.9%) were Caucasians. Age wise, 113 (18.1%) were 3- to 4-year-old, 223 (35.7%) were 4- to 5-year-old, 177 (28.3%) were 5- to 6-year-old and 112 (17.9%) were 6- to 7-year-old. Grade wise, 221 (35.4%) were studying in nursery, 196 (31.4%) in Lower Kindergarten (LKG), 124 (19.8%) in Upper Kindergarten (UKG) and 84 (13.4%) in Class one.

### Oral habits

Based on parental history and examination, oral habit was present in 267 (42.7%) children among which finger nail biting habit was the commonest (Figure 1). Oral habit was more common in males (54.3%) as compared to females (45.7%) (Table 1). Among 267 children having oral habits, 160 (59.9%) were Mongolian and 107 (40.1%) were Caucasian (Table 1). Oral habit was commonest among the age group of 4-5 years (39.7%) (Table 2). Grade wise, highest prevalence was seen among children studying in nursery (35.2%) (Table 3).

### Association of oral habits and malocclusion

Multivariate logistic regression analysis was performed to find out the relationship between oral habits and malocclusion, which were considered as the malocclusion traits after adjusting gender,

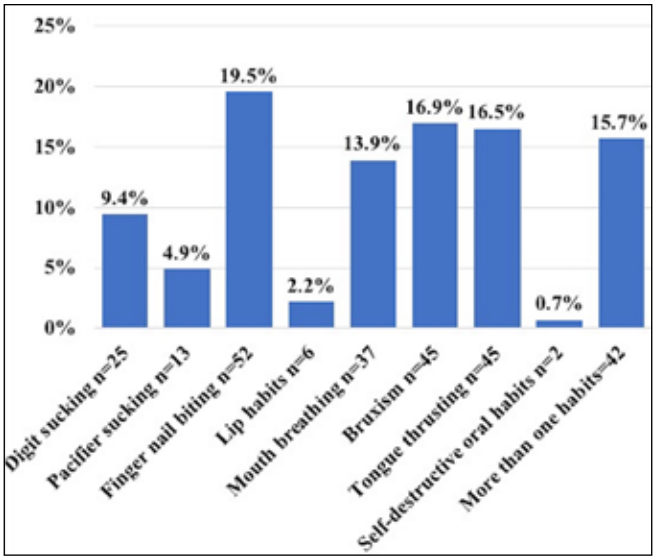


**Figure 1: Prevalence of oral habits, n=267**

**Table 1: Gender and race wise distribution of oral habits**

| Oral habits | Frequency (%) | Gender | | Significance | Race | | Significance |
|---|---|---|---|---|---|---|---|
| | | Male (%) | Female (%) | | Mongolian (%) | Caucasian (%) | |
| Digit sucking | 25 (9.4) | 17 (11.7) | 8 (6.6) | $\chi^2$=2.084, P=0.149 | 16 (10.0) | 9 (8.4) | $\chi^2$=0.191, P=0.662 |
| Pacifier sucking | 13 (4.9) | 8 (5.5) | 5 (4.1) | $\chi^2$=0.288, P=0.592 | 4 (2.5) | 9 (8.4) | $\chi^2$=3.645, P=0.056 |
| Finger nail biting | 52 (19.5) | 23 (15.9) | 29 (23.8) | $\chi^2$=2.642, P=0.104 | 28 (17.5) | 24 (22.4) | $\chi^2$=0.994, P=0.319 |
| Lip habits | 6 (2.2) | 2 (1.4) | 4 (3.3) | P=0.417 (f) | 6 (3.8) | 0 (0.0) | P=Not applicable |
| Mouth breathing | 37 (13.9) | 19 (13.1) | 18 (14.8) | $\chi^2$=0.151, P=0.697 | 21 (13.1) | 16 (15.0) | $\chi^2$=0.180, P=0.672 |
| Bruxism | 45 (16.9) | 27 (18.6) | 18 (14.8) | $\chi^2$=0.707, P=0.400 | 28 (17.5) | 17 (15.9) | $\chi^2$=0.119, P=0.730 |
| Tongue thrusting | 45 (16.9) | 22 (15.2) | 23 (18.9) | $\chi^2$=0.640, P=0.424 | 30 (18.8) | 15 (14.0) | $\chi^2$=1.024, P=0.312 |
| Self-destructive oral habits | 2 (0.7) | 1 (0.7) | 1 (0.8) | P=1.000 (f) | 1 (0.6) | 1 (0.9) | P=1.000 (f) |
| More than one habits | 42 (15.7) | 26 (17.9) | 16 (13.1) | $\chi^2$=1.159, P=0.282 | 26 (16.3) | 16 (15.0) | $\chi^2$=0.081, P=0.775 |
| **Total** | **267** | **145 (54.3)** | **122 (45.7)** | | 160 (59.9) | 107 (40.1) | |

**(f) Fisher's exact test**

**Table 2: Age wise distribution of oral habits, n=267**

| Oral habits | Frequency (%) | Age (Years) | | | | Significance |
|---|---|---|---|---|---|---|
| | | 3-4 (%) | 4-5 (%) | 5-6 (%) | 6-7 (%) | |
| Digit sucking+ | 25 (9.4) | 5 (11.9) | 12 (11.3) | 5 (6.8) | 3 (6.7) | $\chi^2$=1.764, P=0.184 |
| Pacifier sucking+ | 13 (4.9) | 1 (2.4) | 6 (5.7) | 4 (5.4) | 2 (4.4) | $\chi^2$=0.014, P=0.906 |
| Finger nail biting | 52 (19.5) | 9 (21.4) | 19 (17.9) | 13 (17.6) | 11 (24.4) | $\chi^2$=1.145, P=0.766 |
| Lip habits+ | 6 (2.2) | 1 (2.4) | 2 (1.9) | 2 (2.7) | 1 (2.2) | P=1.000 (f) |
| Mouth breathing+ | 37 (13.9) | 4 (9.5) | 18 (17.0) | 12 (16.2) | 3 (6.7) | $\chi^2$=0.282, P=0.595 |
| Bruxism | 45 (16.9) | 7 (16.7) | 14 (13.2) | 13 (17.6) | 11 (24.4) | $\chi^2$=2.884, P=0.410 |
| Tongue thrusting | 45 (16.9) | 10 (23.8) | 14 (13.2) | 14 (18.9) | 7 (15.6) | $\chi^2$=2.735, P=0.434 |
| Self-destructive habits+ | 2 (0.7) | 0 (0.0) | 1 (0.9) | 1 (1.4) | 0 (0.0) | P=1.000 (f) |
| More than one habits | 42 (15.7) | 5 (11.9) | 20 (18.9) | 10 (13.5) | 7 (15.6) | $\chi^2$=1.526, P=0.676 |
| **Total** | **267** | **42 (15.7)** | **106 (39.7)** | **74 (27.7)** | **45 (16.9)** | |

**(f) Fisher's exact test; + $\chi^2$ test based on below 5 years versus above 5 years for digit sucking, pacifier sucking, lip habits, mouth breathing and self-destructive oral habits**

race, age and grade. The malocclusion traits were absence of developmental spaces, absence of primate spaces, presence of crowding, distal step molar relationship, class II canine relationship, presence of midline discrepancy, presence of crossbite, presence of scissor bite, overjet of >4mm, overbite of >4 mm and presence of open bite. There was significant association of digit sucking habit with distal step molar relationship (P=<0.001), class II canine relationship (P=<0.001) and increased overjet (P=0.001); pacifier sucking habit with presence of distal step molar relationship (P=0.004), class II canine relationship (P=0.003), crossbite (P=0.010) and increased overjet (P=<0.001); and finger nail biting habit with absence of primate spaces (P=0.006) (Table 4).

**Table 3: Grade wise distribution of oral habits, n=267**

| Oral habits | Frequency (%) | Grade | | | | Significant |
|---|---|---|---|---|---|---|
| | | Nursery (%) | LKG (%) | UKG (%) | Class 1 (%) | |
| Digit sucking+ | 25 (9.4) | 9 (9.6) | 8 (8.9) | 7 (13.5) | 1 (3.2) | $\chi^2$=0.011, P=0.917 |
| Pacifier sucking+ | 13 (4.9) | 5 (5.3) | 3 (3.3) | 5 (9.6) | 0 (0.0) | $\chi^2$=0.347, P=0.556 |
| Finger nail biting | 52 (19.5) | 15 (16.0) | 22 (24.4) | 7 (13.5) | 8 (25.8) | $\chi^2$=4.150, P=0.246 |
| Lip habits+ | 6 (2.2) | 2 (2.1) | 2 (2.2) | 0 (0.0) | 2 (6.5) | P=1.000 (f) |
| Mouth breathing+ | 37 (13.9) | 13 (13.8) | 15 (16.7) | 8 (15.4) | 1 (3.2) | $\chi^2$=0.917, P=0.338 |
| Bruxism | 45 (16.9) | 16 (17.0) | 7 (7.8) | 15 (28.8) | 7 (22.6) | $\chi^2$=11.354, **P=0.010*** |
| Tongue thrusting | 45 (16.9) | 18 (19.1) | 14 (15.6) | 8 (15.4) | 5 (16.1) | $\chi^2$=0.553, P=0.907 |
| Self-destructive habits+ | 2 (0.7) | 2 (2.1) | 0 (0.0) | 0 (0.0) | 0 (0.0) | P=Not applicable |
| More than one habits | 42 (15.7) | 14 (14.9) | 19 (21.1) | 2 (3.8) | 7 (22.6) | $\chi^2$=2.170, P=0.141 |
| **Total** | **267** | **94 (35.2)** | **90 (33.7)** | **52 (19.5)** | **31 (11.6)** | |

**(f) Fisher's exact test; + $\chi^2$ test based on below 5 years versus above 5 years for digit sucking, pacifier sucking, lip habits, mouth breathing and self-destructive oral habits**

**Table 4: Association between oral habits and malocclusion**

| Oral habits | Developmental spaces | | | Primate spaces | | |
|---|---|---|---|---|---|---|
| | β | Odds Ratio** (95% CI) | P-value | β | Odds Ratio** (95% CI) | P-value |
| **Digit sucking** | 0.155 | 1.168 (0.529, 2.581) | 0.701 | 0.206 | 1.229 (0.514, 2.935) | 0.643 |
| **Pacifier sucking** | -0.786 | 0.455 (0.102, 2.043) | 0.304 | -1.148 | 0.317 (0.41, 2.459) | 0.272 |
| **Finger nail biting** | 0.469 | 1.598 (0.913, 2.795) | 0.100 | 0.812 | 2.253 (1.261, 4.024) | **0.006*** |
| **Lip habits** | -0.876 | 0.417 (0.051, 3.422) | 0.415 | -0.509 | 0.601 (0.072, 5.044) | 0.639 |
| **Mouth breathing** | -0.038 | 0.963 (0.474, 1.953) | 0.916 | 0.263 | 1.301 (0.618, 2.735) | 0.488 |
| **Bruxism** | 0.168 | 1.182 (0.653, 2.141) | 0.580 | -0.623 | 0.536 (0.235, 1.223) | 0.139 |
| **Tongue thrusting** | 0.104 | 1.110 (0.593, 2.078) | 0.745 | -0.319 | 0.727 (0.331, 1.598) | 0.428 |

| Oral habits | Crowding | | | Molar relationship | | |
|---|---|---|---|---|---|---|
| | β | Odds Ratio** (95% CI) | P-value | β | Odds Ratio** (95% CI) | P-value |
| **Digit sucking** | 0.296 | 0.437 (0.057, 3.381) | 0.428 | 2.026 | 7.581 (2.465, 23.312) | **<0.001*** |
| **Pacifier sucking** | -0.827 | 2.63 (0.73, 9.46) | 0.139 | 2.058 | 7.826 (1.965, 31.178) | **0.004*** |
| **Finger nail biting** | 0.532 | 1.703 (0.884, 3.279) | 0.111 | | Not applicable | |
| **Lip habits** | -0.163 | 0.850 (0.103, 7.037) | 0.880 | 1.143 | 3.135 (0.356, 27.638) | 0.303 |
| **Mouth breathing** | 0.434 | 1.543 (0.710, 3.352) | 0.273 | 0.032 | 1.033 (0.227, 4.693) | 0.966 |
| **Bruxism** | -0.274 | 0.760 (0.332, 1.739) | 0.516 | 0.688 | 1.989 (0.637, 6.209) | 0.236 |
| **Tongue thrusting** | -0.394 | 0.674 (0.278, 1.636) | 0.384 | -0.050 | 0.951 (0.212, 4.261) | 0.947 |

**Table 4: Association between oral habits and malocclusion (continued)**

| Oral habits | Canine relationship | | | Midline discrepancy | | |
|---|---|---|---|---|---|---|
| | β | Odds Ratio** (95% CI) | P-value | β | Odds Ratio** (95% CI) | P-value |
| **Digit sucking** | 1.650 | 5.207 (2.155, 12.585) | **<0.001*** | -0.757 | 0.469 (0.110, 2.007) | 0.307 |
| **Pacifier sucking** | 1.727 | 5.624 (1.824, 17.341) | **0.003*** | -0.706 | 0.494 (0.064, 3.818) | 0.499 |
| **Finger nail biting** | -0.192 | 0.826 (0.280, 2.434) | 0.728 | 0.257 | 1.292 (0.620, 2.692) | 0.493 |
| **Lip habits** | 0.647 | 1.910 (0.228, 16.030) | 0.551 | 0.823 | 2.276 (0.457, 11.344) | 0.315 |
| **Mouth breathing** | -1.508 | 0.221 (0.029, 1.662) | 0.143 | 0.079 | 1.082 (0.440, 2.664) | 0.863 |
| **Bruxism** | -0.535 | 0.586 (0.175, 1.960) | 0.385 | -0.104 | 0.393 (0.393, 2.066) | 0.805 |
| **Tongue thrusting** | 0.306 | 1.359 (0.506, 3.644) | 0.543 | -0.907 | 0.404 (0.122, 1.330) | 0.136 |

| Oral habits | Crossbite | | | Open bite | | |
|---|---|---|---|---|---|---|
| | β | Odds Ratio** (95% CI) | P-value | β | Odds Ratio** (95% CI) | P-value |
| **Digit sucking** | -1.033 | 0.356 (0.047, 2.673) | 0.315 | 1.062 | 2.893 (0.602, 13.913) | 0.185 |
| **Pacifier sucking** | 1.567 | 4.794 (1.456, 15.782) | **0.010*** | | Not applicable+ | |
| **Finger nail biting** | -0.162 | 0.851 (0.291, 2.489) | 0.768 | 0.584 | 1.793 (0.364, 8.838) | 0.473 |
| **Lip habits** | 0.420 | 1.523 (1.182, 12.707) | 0.698 | | Not applicable | |
| **Mouth breathing** | 0.461 | 1.585 (0.586, 4.286) | 0.364 | -0.145 | 0.865 (0.108, 6.925) | 0.891 |
| **Bruxism** | 0.231 | 1.260 (0.510, 3.114) | 0.617 | 0.364 | 1.440 (0.306, 6.779) | 0.645 |
| **Tongue thrusting** | -0.903 | 0.405 (0.095, 1.727) | 0.222 | 0.647 | 1.910 (0.404, 9.023) | 0.414 |

| Oral habits | Overjet | | | Overbite | | |
|---|---|---|---|---|---|---|
| | β | Odds Ratio** (95% CI) | P-value | β | Odds Ratio** (95% CI) | P-value |
| **Digit sucking** | 1.645 | 5.182 (1.884, 14.253) | **0.001*** | 0.355 | 1.426 (0.528, 3.852) | 0.484 |
| **Pacifier sucking** | 2.541 | 12.687 (4.032, 39.921) | **<0.001*** | 0.869 | 2.384 (0.737, 7.710) | 0.147 |
| **Finger nail biting** | -0.447 | 0.640 (0.184, 2.221) | 0.482 | 0.043 | 1.044 (0.468, 2.331) | 0.916 |
| **Lip habits** | 1.051 | 2.862 (0.329, 24.904) | 0.341 | 0.156 | 1.169 (0.141, 9.709) | 0.885 |
| **Mouth breathing** | 0.019 | 1.019 (0.291, 3.566) | 0.976 | 0.051 | 1.052 (0.425, 2.603) | 0.912 |
| **Bruxism** | -1.317 | 0.268 (0.036, 2.018) | 0.201 | -0.037 | 0.964 (0.418, 2.221) | 0.932 |
| Tongue thrusting | -1.215 | 0.297 (0.039, 2.224) | 0.239 | -0.036 | 0.965 (0.395, 2.361) | 0.938 |

*Statistically Significant; **Adjusted Odds Ratio for gender, race, age, and grade

## DISCUSSION

To the best of the authors' knowledge, this study is the first to study the oral habits among Nepalese children in the primary dentition stage. So, this paper generates the baseline data for further studies.

### Oral habits

In the present study, the prevalence of oral habits was 42.7%. In studies done by Bosnjak *et al* in 2002 (33.37%) in Croatian and Kasparaviciene et al. in 2014 (16.9%) in Luthiyanian children, the prevalence of oral habits was lesser as compared to present study, whereas study by Chour et al. in 2014 (47.2%) in Indian and Cavalcanti et al. in 2008 (73.4%) in Brazilian children had reported higher prevalence[10,3,2,11]. This difference might be due to the racial variation, variation in the selection of different types of oral habits and the methods used for examination of oral habits.

The present study showed the higher prevalence of oral habits in males (54.3%) as compared to females (45.7%) which is in agreement with the result of Jajoo *et al* (2015) in Indian children[12]. In the present study, bruxism was the most common oral habits among males and finger nail biting habit was the most common oral habits among female children. Male children often face stressful situations aggressively whereas females on the other hand are shy and submissive in nature and tend to deal with stressful situations accordingly. Among the Mongolian children, tongue thrusting was the most commonly indulged oral habit, whereas in case of Caucasians, it was finger nail biting habit. None of the Caucasian children indulged in the lip habits, whereas six among 382 Mongolian children indulged in lip habits. In Nepalese context, different ethnic groups have different cultures, practices, and social understandings. These differences can go a long way from having an entirely different upbringing leading to varied mindset and temperament, way of reaction and coping abilities of the younger ones[1,5].

The highest prevalence of oral habits was seen in 4- to 5-year-old children age wise and children studying in nursery grade wise. In the present study, 19.5% of the study population had finger nail biting habit, which was also the most frequently practiced oral habit. Prevalence of nail biting habit was comparable to the results of a study by Vishnoi *et al* in Indian children but higher compared to study done by Preethika in 2016 (2.1%) in Indian, and lower than the study done by Percival and others in 2017 (52.9%) in West Indies[13,14,15].

It is known that oral habits can manifest as a child's adjustment problems or inappropriate emotional expression. They evidence a deeply rooted emotional need and become a defense mechanism against the external environment which is hostile for the infant. The environment a child grows in becomes crucial for developing these habits since it could produce a state of well-being and satisfaction[1]. The age group 4- to 5-year coincides with the period during which the children start their schools in Nepal, sometimes even before that. These children are yet not ready either emotionally or cognitively to emerge out of their parental cocoon as they are still developing within the preoperational stage of Jean Piaget[7]. Hence, the pressure to cope in the school environment and adjust among friends is quite common and understandable. These children might have developed the finger nail biting habit as well as other habits like bruxism, lip habits, self-destructive oral habits as a defense or coping strategy against the external environment. Nonetheless, there are some who imitate their friends while others practice just to get peer acceptance. Over a period of time the children learn to survive in the new school among new friends, leading to the discontinuation of acquired oral habits and decrease in the prevalence of oral habits which coincides with increasing age groups and grades.

In present study, tongue thrusting habit was seen in 19.1%, which was lower as compared to study done by Chour in 2014 (29.5%) but higher as compared to the study done by Preethika in 2016 (9%) in Indian, and Omer and Abuaffan in 2016 (2.7%) in Sudanese children[2,14,16]. Comparing the prevalence of mouth breathing habit with the finding of Chour et al. in 2014 (26.2%) in Indian children, lower prevalence (16.1%) was observed in present study but higher as compared to the study reported by Preethika in 2016 (10.1%) in Indian children[2,14].

In the present study, prevalence of digit sucking habit was 9.4%, which was similar to that reported by Farsi, Salama 1997 (10.4%) in Saudi Arabian children, but higher as compared to the study done by Chour *et al*. 2014 (0.2%) in Indian children[17,2]. The prevalence of digit sucking habit in Mongolian children of present study population was comparable to the study of Vishnoi et al. (2017) which was done among Mewar ethnicity Indian children[13]. The prevalence of pacifier sucking and lip habits in present study was 4.9% and 2.2%, respectively which was lower than that reported by Percival, in 2017 (16.1% and 11%) in West Indies[15]. The prevalence of pacifier habit was found to be 8% and 43.4% in the studies done by Varas, in Spanish children and Santos *et al* in Brazilian children, respectively which was higher as compared to the present study result[19,20]. The prevalence of pacifier sucking habit has been observed to be higher in the developed countries as compared to the developing or underdeveloped countries whereas, the observation is vice versa in context to digit sucking habit[1,13,15,19,20].Whichever country the children belong to, their psychological build-up and desire for gratification is universal. In the developing or underdeveloped countries, the demand and supply of pacifiers are scarce, and expenditure in pacifiers may place added financial burden to the family.

## Oral habits and malocclusion

Multivariate logistic regression analysis showed the significant association of digit sucking habit with distal step molar relationship, class II canine relationship and overjet of >4 mm (P<0.05) and this result is similar to the reports of Farsi, Salama & Pedo (1997) in Saudi Arabian children[17]. In a study done by Preethika (2016) in Indian children, there was significant association of thumb sucking habit with anterior open bite (P<0.05) unlike the present study which showed no significant association (P>0.05)[14].

Present study also revealed that pacifier sucking habit was significantly associated with distal step molar relationship, class II canine relationship and overjet of >4 mm (P<0.05) and this result is similar to the reports of Farsi, Salama (1997) in Saudi Arabian children[17]. Pacifier sucking habit was also significantly associated with crossbite (P=0.01), whereas de Vasconcelos *et* al (2011) in Brazilian children reported significant association of non-nutritive sucking habit with anterior open bite (P<0.05)[21]. The present study showed pacifier sucking habit to be significantly associated with various malocclusion traits, highlighting the need to investigate other factors that can be associated with the prevalence of pacifier sucking habits such as psychological aspects, mother-child relationship.

Association of oral habits and malocclusion traits was found to be varying among different studies, which might be explained due to the fact that the biological damages caused by oral habits depend on many factors like age of initiation, duration, intensity and type of oral habits, and, above all, individual biological and genetic features. Since no study till date has been carried out in Nepal regarding the oral habits in primary dentition stage, comparison of present study results could not be done with other Nepalese children residing in other regions or of other ethnicity. Nevertheless, the association of certain oral habits and malocclusion characteristics was observed in the study population. In Nepalese scenario as well as in other underdeveloped nations, where the first dental visit is often followed by painful teeth and sleepless nights, knowledge about such association is helpful in community education and to some extent diagnosis, which ultimately help in early intervention and prevention of malocclusion in the succeeding dentition.

There could be a chance of bias due to over or under reporting of oral habits if depended upon parental history alone or examination findings alone. Diagnosis of pacifier sucking habit could be questionable without parental confirmation. Similarly, diagnosis of tongue thrusting habit could be almost impossible without the examination by an expert. To avoid such misinterpretations, different strategies were followed such as: to confirm the presence of oral habits like digit sucking, finger nail biting, lip habits, mouth breathing, bruxism and self-destructive oral habits, the children required to have both the positive parental history and positive biological findings on examination; whereas presence of pacifier sucking habit was based solely on the parental history; and diagnosis of tongue thrusting habit was based on the examination findings alone.

While carrying out the multivariate analysis between different oral habits and malocclusion traits, some of the relationships were found to have an unexpected odds ratio which shows that the result of multivariate analysis might not be true in these situations as there were smaller number of cases or percentage for rare variables. So, most of these relationships are not included in the result and mentioned as 'Not applicable' (Tables 1,3,4). This highlights the requirement of further studies among the larger sample size covering larger study areas.

Different factors of oral habits like age of initiation, intensity, frequency of practicing and discontinued oral habits do have a role

to play in developing malocclusion; however, in the present study, there is no information to describe the relationship between these aspects and malocclusion owing to time constraint and limited resources thus highlighting on the requirement of further studies to address these aspects of oral habits as well.

## CONCLUSIONS

Nearly half of the children were indulged in one or more deleterious oral habits of some sort. Children indulged in finger nail biting habit most frequently whereas self-destructive oral habits was the least frequently practiced oral habit. Oral habits were more common in males than females and in Mongolians than Caucasian children. Prevalence of oral habit was commonest in the age group of 4- to 5-year-old children and for children studying in nursery. There were some malocclusion traits like distal step molar relationship, class II canine relationship, increased overjet, crossbite and absence of primate spaces which were significantly associated with certain oral habits. All these findings indicate the need for early recognition and elimination of deleterious oral habits, correction of the malocclusion traits to maintain normal occlusion, function of dentition and esthetics.

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