Original Article

Prevalence of areca nut chewing habit among high school children of Parsa district of Nepal

Sartaj Singh Wazir^a, Pallak Arora^b, Shalini Kapoor^{c,*}, Raviraj Jayam^d, Sugandha Sharma^b, Trisha Rastogi^b^a Department of Oral Medicine & Radiology, MB Kedia Dental College, Birgunj, Nepal^b Department of Oral Medicine & Radiology, Divya Jyoti Institute of Dental Sciences, Modinagar, India^c Department of Periodontics, SGT Dental College, Gurgaon, India^d Department of Oral Medicine & Radiology, CKS Theja Institute of Dental Sciences, Tirupati, India

ARTICLE INFO

Article history:

Received 4 October 2016

Accepted 26 October 2016

Available online 5 November 2016

Keywords:

Areca nut

Prevalence

Pan masala

Gutkha

School going children

ABSTRACT

Aim: Consumption of areca nut products among school going children has become very common social evil in some areas of Nepal especially adjoining the Indian subcontinent. The aim of this study was to assess the prevalence of areca nut chewing habit among high school children in Terai belt of Nepal. The use of areca nut has become indigenous in this part and is being used by itself and in various formulations. The regular use of areca nut has been recognized as being carcinogenic to humans.

Materials and methods: Data on areca nut chewing habit among high school children was collected from 1359 students of age group 14–18 years from 13 schools of Parsa district of Nepal by random selection and the information was obtained from self administered questionnaire.

Results: The results from this study shows that the areca nut chewing habit is significant among the students of Parsa district (30.4%) and the frequency of chewing plain Supari was reported to be high (81.6%) followed by pan masala (10.4%) and gutkha (08.0%) and the habit increased with age.

Conclusion: It is mandatory to motivate the children not to initiate the habit and to enable the adolescent children to realize the potential health risk of areca nut products.

© 2017 Craniofacial Research Foundation. All rights reserved.

1. Introduction

Areca nut is the fruit of areca catechu palm tree mainly grown in South East Asia and Pacific islands.¹ Areca nut is the fourth most commonly used psychoactive substance in the world after nicotine, alcohol and caffeine.² Areca nut chewing habit is common in Nepal especially in the Terai region adjoining India. Areca nut is one of the two main basic constituents of betel quid (wrapped areca nut, catechu paste and slaked lime in a betel leaf).³ It is chewed in various forms; plain supari, sweet supari, pan masala and in the form of gutkha. Gutkha is the preparation of crushed tobacco, areca nut, lime, catechu and flavouring agents. The independent role of areca nut in oral cancer is well documented in the literature.^{4–6} The International Agency for Research on Cancer (IARC) in 2004 has classified areca nut as group I carcinogen.⁷ The adverse health effects of areca nut and tobacco include oral and

oro-pharyngeal carcinoma, oral premalignant lesions and conditions, gum diseases and addiction.^{8,9}

It is estimated that around 600 million people (10–25% of world's total population) chew areca nut in this or the other form and most of the chewers are concentrated in the Asian continent.¹⁰ Recent survey has shown that since last two decades, almost 20% population from Pakistan, India and Nepal has been using areca nut habitually.¹¹

Chewing betel quid and areca nut is considered as a part of custom and tradition in some of the communities throughout the Indian subcontinent including Nepal and Pakistan.¹²

Nowadays, areca nut is getting popularity in the younger generation in the form of processed areca products.¹³

Aggressive advertising and too much marketing in small attractive and inexpensive sachets since early 1980s has greatly enhanced the sales of these products.¹⁴

High proportions of school going children are being attracted and have started using areca in some form.

Since, not so much data is available about the indulgence and prevalence of areca nut chewing habits in this area, the current

* Corresponding author at: Department of Periodontics, SGT Dental College, Gurgaon, Haryana, India.

E-mail address: dr_shalinibasur@yahoo.co.in (S. Kapoor).

study was undertaken to assess the prevalence of the habit especially in the Terai belt of Nepal.

2. Aims and objectives

To assess the prevalence of areca nut chewing habit among high school children in Parsa district of Nepal.

To evaluate the reasons for areca nut chewing in various forms in children so that in future proper preventive measures can be taken to reduce this monstrous habit.

3. Materials and methods

The school based cross-sectional study was carried out in various urban and rural educational zones of Parsa district of Nepal as per convenience. Study sample consisted of 1359 students from 13 high schools by random selection in Parsa district of Nepal. Children of both sexes were included in this study. Permission to conduct the study in these schools was obtained from the school authorities. The parents of the students regarding the examination were informed through the concerned class teachers. Data on consumption of areca nut was obtained by a self-administered questionnaire based upon demographic characteristics, areca nut use, daily frequency of areca nut chewing, other ingredients mixed with nut (e.g. leaf and lime), tobacco use (smoking and/or chewing), age of initiation of nut chewing, reasons for use, social influence factors and risk perceptions. The data was compiled and Chi-square test (χ^2) was applied.

4. Results

Out of 13 schools included in the study, 06 schools were selected from urban areas and 07 schools from the rural areas. Data were collected from 1359 students who participated in the study.

Out of these, 654 (48.12%) were boys out of which 111 (16.97%) boys were in the age group of 14–15 years, 136 (20.79%) were in the age group of 15–16 years, 193 (29.52%) were in the age group of 16–17 years and 214 (32.72%) were in the age group of 17–18 years. 705 (51.88%) subjects were girls out of which 112 (15.88%) girls were in the age group of 14–15 years, 139 (19.72%) were in the

age group of 15–16 years, 193 (27.38%) were in the age group of 16–17 years and 261 (37.02%) were in the age group of 17–18 years (Table 1).

In the urban areas between the age group of 14–15 years, total number of subjects were 129 out of which 42 were habituated and 87 were non-habituated with $\chi^2 = 5.36$ and p value 0.02056 (significant <0.05). In the age group of 15–16 years, total number of subjects were 152 out of which 37 were habituated and 115 were non-habituated with $\chi^2 = 0.97$ and p value 0.32352 (non-significant). In the age group of 16–17 years, total number of subjects were 162 out of which 50 were habituated and 112 were non-habituated with $\chi^2 = 8.39$ and p value 0.00376 (significant <0.01). In the age group of 17–18 years, total number of subjects were 171 out of which 45 were habituated and 126 were non-habituated with $\chi^2 = 4.43$ and p value 0.03515 (significant <0.05) (Table 2).

In rural areas in the age group of 14–15 years, total number of subjects were 94 out of which 29 were habituated and 65 were non-habituated with $\chi^2 = 9.25$ and p value 0.00235 (significant <0.01), in the age group of 15–16 years, total number of subjects were 123 out of which 39 were habituated and 84 were non-habituated with $\chi^2 = 9.55$ and p value 0.00199 (significant <0.01), in the age group of 16–17 years, total number of subjects were 224 out of which 77 were habituated and 147 were non-habituated with $\chi^2 = 12.91$ and p value 0.00032 (significant <0.01) and in the age group of 17–18 years, total number of subjects were 304 out of which 94 were habituated and 210 were non-habituated with $\chi^2 = 12.47$ and p value 0.00041 (significant <0.01) (Table 3).

In urban areas out of 107 habituated boys, 80 (74.77%) were in the habit of taking plain supari, 14 (13.08%) of them were taking pan masala and 13 (12.14%) were in the habit of taking gutkha with $\chi^2 = 12.14$ and p value 0.0487 (significant <0.05). In rural areas out of 142 habituated boys, 106 (74.64%) were in the habit of taking plain supari, 18 (12.68%) of them were taking pan masala and 18 (12.68%) were in the habit of taking gutkha with $\chi^2 = 27.87$ and p value 0.00009 (significant <0.01) (Table 4).

In urban areas out of 67 habituated girls, 63 (94.03%) were in the habit of taking plain supari and 04 (05.97%) of them were taking pan masala with $\chi^2 = 5.73$ and p value 0.45355 (non-significant). In rural areas out of 97 habituated girls, 88 (90.72%)

Table 1
Distribution of subjects according to sex.

Age (years)	Boys			Girls			Total
	Habit	Non-habit	Total	Habit	Non-habit	Total	
14–15	36	75	111	35	77	112	223
15–16	47	89	136	29	110	139	275
16–17	84	109	193	43	150	193	386
17–18	82	132	214	57	204	261	475
Total	249	405	654	164	541	705	1359

Table 2
Association of chewing habit according to sex in urban areas.

Age (years)	Habit present			Habit absent			χ^2	p
	Boys	Girls	Total	Boys	Girls	Total		
14–15	15	27	42	50	37	87	5.3637	0.02056
15–16	24	13	37	64	51	115	0.9747	<0.05
16–17	38	12	50	58	54	112	8.3952	0.323521 (NS)
17–18	30	15	45	61	65	126	0.003762	<0.01
Total	107	67	174	233	207	440	4.4377	0.035153

Table 3

Association of chewing habit according to sex in rural areas.

Age (years)	Habit present			Habit absent			χ^2	p
	Boys	Girls	Total	Boys	Girls	Total		
14–15	21	08	29	25	40	65	9.2508	0.002354 <0.01
15–16	23	16	39	25	59	84	9.5517	0.001998 <0.01
16–17	46	31	77	51	96	147	12.9113	0.000327 <0.01
17–18	52	42	94	71	139	210	12.471	0.000413 <0.01
Total	142	97	239	172	334	506		

Table 4

Habit details of boys in urban and rural areas.

Age (years)	Urban				Rural				n = 249
	Plain supari	Pan masala	Gutkha	Total	Plain supari	Pan masala	Gutkha	Total	
14–15	15	00	00	15	17	04	00	21	36
15–16	18	05	01	24	19	01	03	23	47
16–17	27	03	08	38	43	01	02	46	84
17–18	20	06	04	30	27	12	13	52	82
Total	80	14	13	107	106	18	18	142	249
$\chi^2 = 12.1489, p = 0.04872 (<0.05)$					$\chi^2 = 27.8726, p = 0.000099 (<0.01)$				

Table 5

Habit details of girls in urban and rural areas.

Age (years)	Urban				Rural				n = 164
	Plain supari	Pan masala	Gutkha	Total	Plain supari	Pan masala	Gutkha	Total	
14–15	27	00	00	27	08	00	00	08	35
15–16	12	01	00	13	15	01	00	16	29
16–17	11	01	00	12	28	02	01	31	43
17–18	13	02	00	15	37	04	01	42	57
Total	63	04	00	67	88	07	02	97	164
$\chi^2 = 5.737, p = 0.453558 (NS)$					$\chi^2 = 1.7768, p = 0.939036 (NS)$				

were in the habit of taking plain supari, 07 (07.22%) of them taking pan masala and 02 (02.06%) were in the habit of taking gutkha with $\chi^2 = 1.77$ and p value 0.93903 (non-significant) (Table 5).

The odd ratio of chewing habits is slightly higher for those who live in rural areas. Among 614 urban subjects, habits were seen in 174 subjects (28.34%), whereas among 745 rural subjects, habits were seen in 239 subjects (32.08%) (Tables 2 and 3).

In urban areas out of 107 boys, 35 boys (32.71%) were in the habit of taking areca nut once daily, followed by 33 boys (30.84%) who used to take areca nut occasionally whereas, 05 boys (04.67%) were in the habit of taking areca nut 2–3 times per day. Among 67 urban girls, 28 girls (41.79%) used to take areca nut once daily, followed by 23 girls (34.32%) who were in the habit of taking areca

nut occasionally whereas 04 girls (05.97%) used to take it 1–2 times daily (Table 6).

In rural areas out of 142 boys, 44 boys (30.98%) were in the habit of taking areca nut occasionally, followed by 39 boys (27.46%) who used to take areca nut once daily whereas 13 boys (09.15%) used to take areca nut 2–3 times daily. Among 97 rural girls, 46 girls (47.42%) used to take areca nut occasionally, followed by 35 girls (36.08%) who used to take areca nut once daily whereas, 02 girls (02.06%) used to take it 1–2 times daily (Table 6).

Fig. 1 shows the duration of habits in the habituated boys of different age groups. Among 36 boys in the age group of 14–15 years, 28 were in the habit from 0 to 1 year and 08 boys were from 1 to 2 years. Among 47 boys in the age group of 15–16 years,

Table 6

Frequency of chewing areca nut.

Dose	Urban		Rural		Total
	Boys	Girls	Boys	Girls	
1 time/day	35	28	39	35	137
2 times/day	15	11	16	14	56
3 times/day	05	00	13	00	18
1–2 times/day	11	04	17	02	34
2–3 times/day	05	00	13	00	18
Occasional	33	23	44	46	146
No reply	03	01	00	00	04
Total	107	67	142	97	413

Fig. 1. Duration of habits in the habituated boys of different age groups.

Fig. 2. Duration of habits in the habituated girls of different age groups.

Fig. 3. Distribution of subjects regarding awareness.

Table 7
Reasons for chewing areca nut.

Reasons	Number	% age
Craving	94	22.76
Pleasure	79	19.13
Boredom	00	00.00
For aiding concentration	02	00.48
Do something with mouth	24	05.82
Custom	59	14.28
Taste	103	24.94
Refresh breath	42	10.17
No reply	10	02.42
Total	413	100.00

34 were in the habit from 0 to 1 year, 09 were from 1 to 2 years and 04 were from 2 to 3 years. Among 84 boys in the age group of 16–17 years, 54 boys were in the habit from 0 to 1 year, 17 boys were from 1 to 2 years, 08 boys were from 2 to 3 years, 03 were from 3 to 4 years and 02 were with no reply. Among 82 boys in the age group of 17–18 years, 40 were in the habit from 0 to 1 year, 17 were from 1 to 2 years, 11 were from 2 to 3 years, 10 were from 3 to 4 years and 04 were with no reply. Fig. 2 shows the duration of habits in the habituated girls of different age groups. Among 35 girls in the age group of 14–15 years, all were in the habit from 0 to 1 year. Among 29 girls in the age group of 15–16 years, 20 girls were in the habit from 0 to 1 year, 08 were from 1 to 2 years and 1 girl was from 2 to 3 years. Among 43 girls in the age group of 16–17 years, 30 were in the habit from 0 to 1 year and 13 were from 1 to 2 years. Among 57 girls in the age group of 17–18 years, 40 were in the habit from 0 to 1 year, 14 were from 1 to 2 years and 03 were from 2 to 3 years.

The most prevalent reason for chewing areca nut was taste (24.94%), followed by for craving (22.76%), for pleasure (19.13%), as a custom (14.28%), to refresh their breath (10.17%) and in the last followed by the subjects who chewed it just because of doing something with the mouth (05.82%) (Table 7).

Among the urban areas, out of 174 subjects, awareness was present in 70 subjects and absent in 104 and among the rural areas, out of 239 subjects, awareness was found to be present in 68 and absent in 171 (Fig. 3).

5. Discussion

Areca nut is an important agricultural product that is believed to be native to Sri Lanka, West Malaysia and Melanesia.¹⁵

It has been estimated that, worldwide, six hundred million people chew areca nut. In this belt of Nepal, areca nut is commonly known as “supari”. It is the basic ingredient of a variety of widely used chewed products. Areca nut products are easily available even in small shops and in every nook and corner. In this belt, areca nut is being used in various religious, social and cultural functions. Areca nut is available in processed and unprocessed forms.¹⁶

The major chemical constituents of the areca nut are carbohydrates, fats, proteins, polyphenols (flavonoids and tannins), alkaloids and mineral matter (lysyl oxidase dependent copper).¹⁷ The polyphenols are responsible for the astringent taste of the nut. The main alkaloids of areca nut include arecoline, arecaidine, guvaine and guvacoline which induce the proliferation of the fibroblasts. The flavonoids are responsible for decrease in the secretion of the enzyme collagenase which indirectly is responsible for increase in the number of collagen fibres. Lysyl oxidase dependent copper is responsible for the cross linkage and stabilization of the collagen fibres forming tight fibrous bands.^{18–20}

Areca nut chewing is strongly associated with Oral sub mucous fibrosis (OSMF) which is an established pre-cancerous condition.^{21–23} Areca nut is implicated in causing oral cancer and heavy

users have significantly increased mortality rate.^{24,25} Areca nut has been found to be a common cause of broncho-constriction aggravating asthma and a potential cause of airway obstruction in children leading to potential fatal complications.^{26,27} It has been found in the studies that areca nut chewing is an addictive practice like nicotine.²⁸ The euphoric effects of areca nut is due to arecoline, a cholinergic agent and central nervous system stimulant that increases the amount of acetylcholine in the brain and arecaidine, a hydrolyzed product of arecoline.²⁹

The number of cases of OSMF has risen rapidly in this area adjoining Indian border. The reasons for the rapid increase of the disease are reported to be due to an upsurge in the popularity of commercially prepared areca nut preparations (pan masala) and an increased uptake of this habit by young people are seen due to easy access, effective price changes and marketing strategies.³⁰

So many studies have been conducted among school going children in India but very less, may be even negligible data is available regarding the areca nut chewing habit in this belt of Nepal. Hence, the study was designed to assess the prevalence of areca nut chewing habit.

In this study, the rate of prevalence of chewing areca nut among the students was seen to be 30.4%. Similar prevalence rate of 27% was found in a study conducted by Khandelwal et al.³¹ In comparison, very high prevalence rates were seen in the studies conducted by Sarfaraz et al., Dere et al., Qureshi et al., Oakleu et al. and by Leghari et al. ranging from 41% to 77.9%.^{32–36}

In this study, more boys were seen to be indulged in chewing areca nut than the girls (60.3% vs 39.7%). Similar results were seen in the studies being conducted by Khandelwal et al. (67% vs 33%), Sarfaraz et al. (47.6% vs 34.3%), Dere et al. (55% vs 31%), Oakleu et al. (73% vs 54%), Leghari et al. and Shah et al. (70% vs 30%).^{31–33,35–37}

The habit of areca nut chewing in our study was seen to be more prevalent in rural areas than the urban areas (32.1% vs 28.3%). Similar results were seen in the studies being conducted by Khandelwal et al. in 2012 (45% vs 20%).³¹

The frequency of chewing areca nut was reported to increase with age in this study as was seen in the previous studies.^{36,37}

The most prevalent reasons for chewing the areca nut in this study was taste (24.94%) followed by craving (22.76%) and pleasure (19.13%). Almost similar results were seen in the study conducted by Dere et al. and Oakley et al. where the prevalent reason for chewing the areca nut was craving followed by taste.^{33,35}

The highest period of risk for catching the habit of taking areca nut for both the boys and the girls was between the ages of 14 and 15 years which was in accordance with the results of the previous studies.^{33,35,36}

The majority of the areca nut chewers in the current study were not aware of the fact that the use of areca nut might be harmful for their health. Similar results were seen in the previous studies.^{11,33,36}

6. Conclusion

Areca nut chewing is common and significant among school going children in the Terai belt of Nepal. Areca nut use by the parents as well as the friends, lack of knowledge on their harmful effects and the elders being indifferent towards this habit encourages the younger generation towards the habit. The early age of initiation reflects the urgent need to intervene and protect this vulnerable group from falling prey to this addiction. If not stopped at present, these children may indulge in other addictive habits including tobacco use and cigarette smoking. Urgent regulatory actions are therefore warranted to restrain the trade, control the manufacture, marketing and the consumption of the products containing areca nut/tobacco. The young generation, should therefore be motivated and made to realize the potential

health risks of areca nut. School health education programmes should be carried out that may emphasize on the ill effects of areca nut chewing and tobacco use to bring an end to this social evil in conjunction with various interactive programmes between the children, parents and the teachers.

Conflicts of interest

The authors have none to declare.

Acknowledgements

The authors would like to thank the Head masters of the schools of Parsa district, Nepal for permitting us to conduct this study in their schools. Our sincere thanks to all those school going children who participated in the study.

References

- Shah G, Chaturvedi P, Vaishampayan S. Areca nut as an emerging etiology of oral cancers in India. *Ind J Med Paediatr Oncol*. 2011;33:71–79.
- Auluck A, Hislop G, Poh C, Zhang L, Rosin MP. Areca nut and betel quid chewing among South Asian immigrants to Western countries and its implications for oral cancer screening. *Rural Remote Health*. 2009;9:1118.
- Nair U, Bartsch H, Nair J. Alert for an epidemic of oral cancer due to use of the betel quid substitutes gutkha and pan masala: a review of agents and causative mechanisms. *Mutagenesis*. 2004;19:251–262.
- Johnson NW, Warnakulasuriya S, Gupta PC, Dimba E, Chindia M, Otoh EC, et al. Global oral health inequalities in incidence and outcomes for oral cancer: causes and solutions. *Adv Dent Res*. 2011;23(2):237–246.
- Wen CP, Tsai MK, Chung WS, Hsu HL, Chang YC, Chan HT, et al. Cancer risks from betel quid chewing beyond oral cancer: a multiple-site carcinogen when acting with smoking. *Cancer Causes Control*. 2010;21:1427–1435.
- Chen YJ, Liao CT, Chen PJ, Lee LY, Li YC, Chen IH, et al. Downregulation of Ches1 and other novel genes in oral cancer cells chronically exposed to areca nut extract. *Head Neck*. 2010;33:257–266.
- IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Betel-quid and areca-nut chewing and some areca-nut derived nitrosamines. *IARC Monogr Eval Carcinog Risks Hum*. 2004;85:1–334.
- Trivedi CR, Craig G, Warnakulasuriya S. The oral health consequences of chewing areca nut. *Addict Biol*. 2002;7:115–125.
- Betel-Quid and Areca-Nut Chewing and Some Areca Nut Derived Nitrosamines IARC Monograph on the Evaluation of Carcinogenic. vol. 85. Lyon: International Agency for Research on Cancer; 2004.
- Gupta PC, Warnakulasuriya S. Global epidemiology of areca nut usage. *Addict Biol*. 2002;7:77–83.
- Narain R, Sardana S, Gupta S, Sehgal A. Age at initiation & prevalence of tobacco use among school children in Noida, India: a cross-sectional questionnaire based survey. *Indian J Med Res*. 2011;133:300–307.
- Verma S. Areca nut (betel nut) chewing: a popular Indian cultural practice and its mucosal implications. *Int J Dermatol*. 2011;50:229–232.
- Gandhi G, Kaur R, Sharma S. Chewing pan masala and/or betel quid-fashionable attributes and/or cancer menaces. *J Hum Ecol*. 2005;17:161–166.
- Betel Quid and Areca Nut Chewing. Available from: <http://monographs.iarc.fr/ENG/Monographs/vol85/mono85-6> [cited 12.01.10].
- Williams S, Malik A, Chaudhary S, Chauhan S. Socio-cultural aspects of areca nut use. *Addict Biol*. 2002;7:147–154.
- International Agency for Research on Cancer. *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Tobacco Habits Other Than Smoking; Betel Quid and Areca Nut Chewing and Some Related Nitrosamines*. Lyon: International Agency for Research on Cancer; 1984:37.
- Jayalaxmi A, Mathew AG. Chemical composition and processing. In: Bavappa KVA, Nair MK, Kumar, eds. In: *The Areca Nut Palm, Kerala*. Central Plantation Crops Research Institute; 1982:225–244.
- Lord GA, Lim CK, Warnakulasuriya S, Peters TJ. Chemical and analytical aspects of areca nut. *Addict Biol*. 2002;7:99–102.
- Harvey W, Scut A, Harvey W, Canniff JP. Stimulation of human buccal mucosa fibroblasts from normal and oral submucous fibrosis. *Arch Oral Biol*. 1986;31:45–49.
- Murti PR, Bhonsle RB, Gupta PC. Etiology of oral submucous fibrosis with special reference to the role of areca nut chewing. *J Oral Pathol Med*. 1995;24:45–52.
- Maher R, Lee AJ, Warnakulasuriya KA. Role of areca nutin the causation of oral submucous fibrosis. A case-control study in Pakistan. *J Oral Pathol Med*. 1994;23:65–69.
- Prokopczyk B, Rivinson A, Hoffmann D. A study of betel quid carcinogenesis. *Cancer Lett*. 1991;60:153–157.
- Adhvariyu SG, Dave BJ, Trivedi AH. Cytogenic surveillance of tobacco-areca nut chewers, including patients with oral cancers and pre malignant conditions. *Mutat Res*. 1991;261:41–49.
- Thomas SJ, MacLennan R. Slaked lime and betel nut cancer in Papua New Guinea. *Lancet*. 1992;340:577–578.
- Gupta PC. Betel quid and oral cancer, prospects for prevention. *IARC*. 1991;105:466–470.
- Tariq P. Foreign body aspiration in children, a persistent problem. *J Pak Med Assoc*. 1999;49:33–36.
- Taylor RF, Al-Jarad N, John LM, Conroy DM, Barnes NC. Betel nut chewing and asthma. *Lancet*. 1992;339:1134–1136.
- Burton-Bradley BG. Papua and New Guinea transcultural psychiatry: some implications of betel chewing. *Med J Aust*. 1996;2:744–746.
- Holmstedt B, Lindgren G. Arecoline, nicotine and relate compounds. Tremorgenic activity and effect upon brain acetylcholine. *Ann NY Acad Sci*. 1967;142:126.
- Tilakaratne WM, Klinikowski MF, Saku T, Peters TJ, Warnakulasuriya S. Oral submucous fibrosis: review on aetiology and pathogenesis. *Oral Oncol*. 2006;42(6):561–568.
- Khandelwal A, Khandelwal V, Saha MK, Khandelwal S, Prasad S, Saha S.G.. Prevalence of areca nut chewing in the middle school-going children of Indore, India. *Contemp Clin Dent*. 2012;3(2):155–157.
- Sarfaraz M, Ali A, Mirza T. Prevalence and characteristics of areca nut chewing habit among school going children in Karachi. *J Dow Univ Health Sci*. 2014;8(3):111–116.
- Dere K, Choudhary P, Bhaskar V, Ganesh M, Venkataraghavan K, Shah S. Prevalence and characteristics of chewing habits of areca nut, gutka & tobacco among school children of rural areas in and around Gandhinagar District, Gujarat. *J Adv Oral Res*. 2014;5(2):20–26.
- Qureshi A, Dawani N, Shaikh AA. Areca nut consumption patterns among primary school children of Karachi. *J Dow Univ Health Sci*. 2013;7(1):25–29.
- Oakley E, Demaine L, Warnakulasuriya S. Areca (betel) nut chewing habit among high school children in the Commonwealth of the Northern Mariana Islands (Micronesia). *Bull World Health Organ*. 2005;83(9):656–660.
- Leghari MA, Ali S, Maqbool S. The prevalence of use of areca nut on its effect on oral health in school going children in Gadap town, Malir, Karachi, Pakistan. *World J Dent*. 2016;7(1):6–9.
- Shah SMA, Merchant AT, Luby SP, Chotani RA. Addicted school children: prevalence and characteristics of areca nut chewers among primary school children in Karachi, Pakistan. *J Paediatr Child Health*. 2002;38:507–510.