

Areca chewing among Sri Lankan adolescents

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Objective: To determine the prevalence of and characteristics associated with Sri Lankan adolescents' chewing of areca. **Basic research design:** Cross-sectional descriptive study based on a self-administered questionnaire. **Participants:** 633, 15-year-olds in the Bandarawela education zone of Sri Lanka. **Results:** Nearly 7% of the sample were current chewers of arecanut and 1% of commercially available areca products respectively. Furthermore 42% were past areca nut chewers while 3% of the sample had previously chewed commercially available areca products. According to the Poisson regression models, males were more likely than females to be past areca nut chewers as were those having an areca nut chewer at home compared to those who did not. Sinhalese students were more likely than Tamils to be past chewers. Also current areca nut chewing was independently associated with being male, having an areca nut chewer at home, Tamil ethnicity and father's occupation. **Conclusions:** The prevalence of current areca nut and commercially available areca product use was low among this group of adolescents.

Key words areca nut, betel quid, commercial areca products, adolescents,

Introduction

Areca nut for chewing is obtained from the tropical palm tree *Areca catechu*. According to reports, about 600 million people worldwide chew areca in some form and its usage is particularly high among Asian populations (Gupta and Warnakulasuriya, 2002). In many Asian countries and Western Pacific Islands it is chewed with slaked lime with or without tobacco, wrapped up in a betel leaf; a mixture commonly referred to as betel quid. Young people predominately chew it alone or use various commercially manufactured preparations available in the market (Farrand *et al.*, 2001; Shah *et al.*, 2002).

Chemical analysis indicates that areca contains several psychoactive alkaloids and of them arecoline is the most abundant. Alkaloids present in areca nut have carcinogenic properties (IARC, 2004). In addition, areca is known to be the fourth most commonly used psychoactive substance next to caffeine, alcohol and tobacco (Gupta and Ray, 2004). Use of areca nut has deleterious effects in the oral cavity. A systematic review has indicated that chewing areca products even without tobacco is associated with an increased risk of developing oral cancer and oral potentially malignant disorders such as oral leukoplakia and oral submucous fibrosis (Sharan *et al.*, 2012). Areca chewing is not only linked to the development of oral cancer, but also to medical conditions such as metabolic syndrome, coronary artery disease and dependency syndrome (Mirza *et al.*, 2011; Shafique *et al.*, 2013; Tsai *et al.*, 2012).

Areca chewing is widely practiced by children and adolescents in Asian countries and the Pacific islands (Milgrom *et al.*, 2013; Shah *et al.*, 2002; Wang *et al.*, 2003). Its use is also common among adolescents of South

Asian origin living in countries like the UK (Farrand *et al.*, 2001; Prabhu *et al.*, 2001). Early initiation into the habit in young people could have serious health implications. Oakley *et al.* (2005) in their study found that 63% of high schoolers in Micronesia were regular users of areca and oral submucous fibrosis and oral leukoplakia were detected in 9 and 13% of them, respectively.

In Sri Lanka, areca nut is used in various forms; green unripe, ripe but raw, dried, fermented and it is an important constituent of the betel quid. According to Lee *et al.*, (2011) all current betel quid chewers add areca to the quid but only 23–36% add tobacco. Betel quid/areca chewing has also been identified as the most important risk factor for oral cancer/oral potentially malignant disorders in the country (Amarasinghe *et al.*, 2010). Moreover due to its psychoactive properties, areca use could lead to addiction as well. Although it has been reported that the areca chewing habit starts at a young age (Farrand *et al.*, 2001), to date no studies have been conducted on the areca chewing habit among Sri Lankan adolescents. Therefore the aim of the present study was to determine the prevalence, characteristics and factors associated with areca chewing in a group of Sri Lankan adolescents.

Method

Ethical clearance for the study was obtained from the Ethical Review Committee of the Post Graduate Institute of Medicine, University of Colombo. Permission to conduct the study was also obtained from the Provincial Director of Education, Uva province, Zonal Director of Education, Bandarawela and the principals of the respective schools. Written informed consent was obtained from students and their parents. Children who were mentally challenged were excluded.

The study was carried out among 15-year-old students attending public schools in the Bandarawela education zone which is a part of the Badulla district of Sri Lanka. In Sri Lanka, a district is divided into Divisional Secretariat Divisions (DS) for administrative purposes and Bandarawela education zone extends over 4 DS divisions of the Badulla district. The total population of the study area is 195,841 of which 63% are Sinhalese while 32 and 4% are Tamils and Muslims respectively (DCS, 2011). The Headcount index of poverty which is defined as the percentage of population below the official poverty line ranges from 22-31% across the four DS divisions of the study area (DCS, 2002). Bandarawela education zone was selected as the study area because the first author was familiar with the area. Also as there are urban and rural as well as Sinhala and Tamil medium schools in the area, the sample selected would be representative of the wider population to a reasonable extent. The formula for estimating a population proportion with absolute precision was used to calculate the sample size. As data on areca nut chewing is not available for Sri Lankan school children, the prevalence of areca chewing among 8-17-year-old Indian school children (27%) reported in the study by Khandelwal *et al.* (2012) was used to calculate the sample size. Accordingly the sample size required for the present study using a prevalence of 27% at 95% level of confidence and accepting a sampling error of 5% was 303. As it was decided to use the cluster sampling method to select the sample, it was necessary to make allowance for the design effect which was considered as 2.0. Therefore the minimum sample size needed to satisfy these requirements was 606. To compensate for non-responses this was increased by 10% giving an intended sample of 673.

The sample was selected in two stages. Students who have had their 15th but not their 16th birthday were in the 10th grade class. The average size of the class (15 students) was considered as the cluster size and accordingly 45 clusters were necessary to obtain the sample ($673/15 \approx 45$). In the first stage of sampling, the sampling unit was the school and the 45 clusters were selected from 83 public schools in the Bandarawela education zone according to the probability proportionate to size technique. In the second stage, 15 students who satisfied the inclusion criteria were selected randomly from each cluster. Using the probability proportionate to size technique and selecting equal number of students from each cluster, gives each student in the population the same probability of being selected to the sample (Bennett *et al.*, 1991).

Before developing a semi-structured, self-administered questionnaire for data collection, those used in similar studies were considered. The questionnaire was then first drafted in English by the first author and scrutinized for item appropriateness by the second author, an expert in the field of Dental Public Health to ensure content validity. It was subsequently translated to Sinhala and Tamil languages by professional translators then back translated to English to validate the translations. The two language versions were pre-tested among two groups of 15-year-olds, each speaking one of the languages. Based on the findings certain modi-

fications were made to the questionnaires. The pre-test confirmed face validity. The questionnaires covered socio-demographic characteristics, areca chewing habits and knowledge of health implications of areca chewing. The last was assessed through 12 items where the respondent was requested to indicate the response to each item on a five point scale; strongly agree, agree, undecided, disagree and strongly disagree. Each item was scored out of 5 and a total score for each respondent was obtained by summing up the scores obtained for the 12 items. The total score ranged from 12-60 with high scores indicating that the respondent was aware of the negative health implications of areca chewing. The questionnaires were administered to the students in their classrooms in the presence of the first author who could clarify any doubts.

Data were analysed using STATA 12.0 software (Stata Corp, College Station, TX, USA). As it was found that only a very small percentage of students used commercially available areca products further analysis of data pertaining to this variable was not carried out. Areca chewing habit was categorized into three groups; never chewers (never chewed areca in his/her life), current chewers (those who have chewed areca in the past and was continuing with the habit at the time of the study) and past chewers (those who have chewed areca sometime in the past but was not chewing at the time of the study). Chi square and Fisher's exact tests were used to determine the associations between categorical variables. Those variables that were associated with past and current areca nut use at $p < 0.05$ in the bivariate analyses were included in Poisson regression analyses with robust variance to determine the independent factors associated with past- and current areca nut use.

Results

Of the 673 students selected for the sample only 633 responded to the questionnaire giving a response rate of 94.1%. The majority were Sinhalese (64%) while Tamils and Muslims consisted of 33.5 and 2.5% respectively. There was a slight preponderance of female students (52.1%). The mean knowledge score regarding health implications of areca chewing was 41.5 (SD 5.4) with 96.5% of the subjects obtaining a score of over 30.

Table 1 shows the distribution of the sample according to type of areca chewed. Nearly 7% were current areca nut chewers but only 1% chewed commercially available areca products at present. Of the sample, 41.5% had previously chewed areca nut and 3% for commercially available areca products.

Table 1. Distribution of sample according to type of areca chewed

	<i>Areca nut</i> (n=633)		<i>Commercially available areca products</i> (n=631)	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
Never	327	51.7	606	96.0
Past	263	41.5	19	3.0
Current	43	6.8	6	1.0

Chewing characteristics of the sample are presented in Table 2. Nearly 57% had first experienced the habit at home and 31% had first experienced the habit with grandparents while areca for chewing was also mainly obtained from home (59%). Most of the chewers had chewed areca with betel leaf (77%).

According to the bivariate analyses, past areca nut chewing was significantly associated with gender, ethnicity, mother's years of education, presence of an areca chewer at home and the knowledge score for health implications of areca chewing while current areca nut chewing was associated with gender, ethnicity, father's occupation, presence of an areca chewer at home and the knowledge score for health implications of areca chewing (Table 3)

According to the Poisson regression model, male students (PR 1.18; 95%CI 1.01, 1.37) and those having an arecanut chewer at home (PR 2.29; 95%CI 1.85, 2.82) were more likely to be past chewers compared to female students and those who did not have an areca chewer at home while Tamil students were less likely to be past chewers compared to Sinhalese students (PR 0.28; 95%CI 0.20, 0.39). Also current areca chewing was independently associated with the male gender (PR 3.36; 95%CI 1.66, 6.80), having a person who chewed areca nut at home (PR 2.67; 95%CI 1.29, 5.48), being a Tamil (PR 0.20; 95%CI 0.06, 0.65) and father's occupation (middle level: (PR 0.48; 95%CI 0.23, 0.97) (Table 4).

Table 2. Distribution of sample (both current and past areca chewers) according to areca nut chewing characteristics

<i>Chewing characteristics</i>	<i>N</i>	<i>%</i>
Age at which chewing was first started	284	
6-9 years	18	6.3
10-12 years	189	66.5
13-15 years	77	27.1
Place where habit was first experienced	303	
Home	172	56.8
Friend's house	15	4.9
Funeral house	95	31.3
Others	21	7.0
Habit first experienced with	306	
Parents/siblings	70	22.9
Grand parents	96	31.4
Friends	89	29.1
Others	51	16.6
Source of areca	301	
Home	179	59.4
Friend	46	15.3
Self-bought	49	16.3
Other	27	9.0
Other ingredients chewed with areca	301	
Areca nut only	50	16.6
Areca with betel leaf	233	77.4
Areca with betel and tobacco	18	6.0

Table 3. Associations between areca nut use, socio-demographic and other factors

<i>Variable</i>	<i>Category</i>	<i>Past chewers</i>					<i>Current chewers</i>				
		<i>Yes, n</i>	<i>%</i>	<i>No, n</i>	<i>%</i>	<i>P value</i>	<i>Yes, n</i>	<i>%</i>	<i>No, n</i>	<i>%</i>	<i>P value</i>
Gender	Male	134	49.8	135	50.2		34	11.2	269	88.8	
	Female	129	0.2	192	59.8	0.02	9	2.7	322	97.3	<0.001
Ethnicity	Sinhala	230	62.8	136	37.2		39	9.6	366	90.4	
	Tamil	30	14.4	179	85.6		3	1.4	209	98.6	
	Muslim	3	25.0	9	75.0	0.001	1	7.1	13	93.2	<0.001*
Father's years of education	Up to 8	67	40.9	97	59.1		18	9.8	165	90.2	
	9-10	140	47.1	157	52.9		19	6.0	297	94.0	
	11 or more	56	43.4	73	56.6	0.41	6	4.4	129	95.6	0.13
Mother's years of education	Up to 8	41	31.8	88	68.2		12	8.5	130	91.5	
	9-10	165	49.3	170	50.7		28	7.7	335	92.3	
	11 or more	57	45.2	69	54.8	0.003	3	2.3	126	97.7	0.08
Father's occupation†	Lower	140	46.1	164	53.9		32	9.5	304	90.5	
	Middle	98	43.9	125	56.1		9	3.9	224	96.1	
	Upper	25	41.0	36	59.0	0.73	2	3.2	61	96.8	0.02*
Mother's occupation†	Lower	233	44.4	292	55.6		38	6.7	526	93.3	
	Middle	17	54.8	14	45.2		2	6.1	31	93.9	
	Upper	13	39.4	20	60.6	0.43	3	8.3	33	91.7	0.92*
Areca chewer at home	Yes	191	64.7	104	35.3		34	10.3	295	89.7	
	No	72	24.4	223	75.6	<0.001	9	3.0	296	97.0	<0.001
Knowledge of harmful effects of areca use‡	Low	135	49.1	140	50.9		27	8.9	276	91.1	
	High	127	40.6	186	59.4	0.03	16	4.9	313	95.1	0.04

*Associations determined by Fisher's Exact test; †Father's and mother's occupation classified as lower if labourer, lower level business, housewife, middle if clerical, technical or middle level business and upper if professional, managerial or upper level business; ‡knowledge score for harmful effects of areca use classified into low and high based on the median value

Table 4. Poisson regression model prevalence ratios (PRs) for covariates associated with past and current areca nut use

Variable	Category	Past chewers			Current chewers		
		PR	95%CI	P value	PR	95%CI	P value
Gender (ref. Female)	Male	1.18	1.01-1.37	0.03	3.36	1.66-6.80	0.001
Ethnicity (ref. Sinhala)	Tamil	0.28	0.20-0.39	<0.001	0.20	0.06-0.65	0.007
	Muslim	0.46	0.17-1.25	0.13	0.91	0.13-6.57	0.93
Mother's years of education (ref. ≤8)	9-10	1.16	0.92-1.47	0.21			
	11 or more	1.08	0.83-1.40	0.56			
Father's occupation (ref. Lower)	Middle				0.48	0.23-0.97	0.04
	Upper				0.47	0.12-1.82	0.28
Areca chewer at home (ref. No)	Yes	2.29	1.85-2.82	<0.001	2.67	1.29-5.48	0.008
Knowledge about harmful effects of areca use (ref. Low)	High	0.98	0.84-1.14	0.78	0.68	0.38-1.20	0.18

Discussion

The present study assessed the prevalence, characteristics and factors associated with areca chewing in a group of Sri Lankan adolescents. Despite the fact that betel quid/areca chewing is associated with social and cultural practices in Sri Lanka, it is encouraging to note that only 7% of the sample were current chewers of areca nut. A similar figure has been reported for Pakistani adolescents as well (Qidwai *et al.*, 2010). In contrast 54-92% of adolescents of South Asian origins living in London were currently chewing areca in some form (Farrand *et al.*, 2001) while Tiwari *et al.*, (2014) found that 25% of adolescents from Chhattisgarh state, India chewed areca nut. Also the prevalence of past areca nut users in the present study was lower than the prevalence reported for adolescents from other countries (Milgrom *et al.*, 2013). The low prevalence of the habit among this group of adolescents may be due to the high awareness about the adverse effects of areca chewing. In fact it has been reported that in adolescent populations where the prevalence of areca chewing habit is high, many are unaware of the adverse health consequences of the habit (Prabhu *et al.*, 2001). In addition, it may be that Sri Lankans acquire the areca habit later in the life course rather than during adolescence.

Commercial areca products which are sold in sachets and include sliced or powdered areca, artificial sweeteners with or without tobacco have become widely available in many countries in the last few years. Although the import and sale of these products are banned in Sri Lanka, media reports indicate that they are illegally brought to the country and sold in shops near schools targeting school children. Also according to recent reports large quantities of these products have been seized during raids conducted by the police in various parts of the country. However despite such information, empirical data related to the use of commercial areca products are not available for Sri Lanka. The present study found that adolescent chewing of commercially available sweetened areca products was extremely rare in this group (1% of areca chewers) in contrast to 81% of their counterparts in India and 74% in Pakistan (Khandelwal *et al.*, 2012; Shah *et al.*, 2002).

Areca chewing characteristics vary from population to population. The majority in the present study had first experienced the habit around the age of 10-12 years.

However in their study Farrand *et al.* (2001) found that 50-70% of adolescent areca chewers had started the habit before the age of 10 years. Nearly 60% of the sample obtained areca from home which indicates that areca was readily available and was within easy reach for most of the students. But in some studies “friends” have been cited as the main source (Milgrom *et al.*, 2013; Wang *et al.*, 2003) while in others the respondents had purchased areca from shops with their pocket money (Oakley *et al.*, 2005). Farrand *et al.* (2001) reported that a majority in their study chewed only areca, but most subjects of the present study chewed areca with betel leaf. In Sri Lanka, areca is an important constituent of the betel quid (Lee *et al.*, 2011).

With respect to factors associated with areca chewing, it was observed that male students were more likely to be both past and current chewers than female students. Similar findings have been observed in several other studies (Shah *et al.*, 2002; Wang *et al.*, 2003). Areca causes staining of teeth and as adolescent girls are generally more conscious of their appearance than adolescent boys and this may explain why fewer girls than boys use areca.

This is the first study to have observed ethnic differences in areca chewing among adolescents with the prevalence being lower among Tamils than Sinhala students. Previous studies have not assessed the influence of ethnicity despite their populations being ethnically diverse. There was also a significant inverse association between father's occupational status and areca chewing. Students whose fathers belonged to the middle level occupation category were less likely to be current areca chewers than those whose fathers in the low occupational category. The habit of betel quid chewing being mainly practiced by those in low occupational categories in Sri Lanka (Chiba, 2001) might explain this finding. Moreover compared to non-chewers, both current and past areca chewers were more likely to have a chewer at home (either a parent or a member of the extended family). Having a chewer at home increases access to and availability of areca. Also, the presence of an areca chewer in the household could encourage initiation and maintenance of the habit (Wang *et al.*, 2004). According to Farrand and Rowe (2006), family plays a crucial role in maintaining the areca habit in adolescents possibly due to shared socio-cultural and environmental factors (Madathil *et al.*, 2015).

There are a few limitations to this study. Due time constraints, the study had to be confined to a comparatively small geographical area thus limiting the generalization of findings to the wider population. Also, as areca use is generally viewed as an undesirable behavior, it may be under-reported here.

It is well established that many health risk behaviors are established during adolescence and often maintained into adult life. For example Paavola *et al.* (1996) found that smoking in adolescence increases the risk of smoking later on in life. As areca has psycho-active properties, the same could be expected with the areca nut habit as well. However adverse effects of areca use are not currently highlighted in Sri Lankan school health education programmes. There may be value in informing children of the health impacts of areca use in such programmes. Preventing the initiation of this habit may be better and easier than trying to stop it once established.

References

- Amarasinghe, H.K., Usgodaarachchi, U.S., Johnson, N.W., Laloo, R. and Warnakulasuriya, S. (2010): Betel-quid chewing with or without tobacco is a major risk factor for oral potentially malignant disorders in Sri Lanka: a case-control study. *Oral Oncology* **46**, 297-301.
- Bennett, S., Woods, T. and Liyanage, W.M. (1991): Simplified general method for cluster-sample survey in developing countries. *Health Statistics Quarterly* **44**, 98-106.
- Chiba, I. (2001): Prevention of betel quid chewers' oral cancer in the Asian-Pacific area. *Asian Pacific Journal of Cancer Prevention* **2**, 263-269.
- Department of Census and Statistics Sri Lanka, DCS (2002): *Head count index and population below poverty line by DS Divisions-Sri Lanka*. Colombo: DSC.
- Department of Census and Statistics Sri Lanka, DCS (2011): *Sri Lanka Census of Population and Housing 2011*. www.statistics.gov.lk/popousat/cph2011/index.php?filename=pop31&gp=activities&tpl=3
- Farrand, R., Ro, R.M., Johnston, A. and Murdoch, H. (2001): Prevalence, age of onset and demographic relationships of different areca nut habits amongst children in Tower Hamlets, London. *British Dental Journal* **189**, 150-154.
- Farrand, P. and Rowe, R. (2006): Areca nut use amongst South Asian schoolchildren in Tower Hamlets London: The extent to which the habit is engaged in within the family and used to suppress hunger. *Community Dental Health*, **23**, 58-60.
- Gupta, P.C. and Warnakulasuriya, S. (2002): Global epidemiology of areca nut usage. *Addiction Biology* **7**, 77-83.
- Gupta, P. and Ray, C.S. (2004): Epidemiology of betel quid usage. *Annals of the Academy of Medicine Singapore* **33**(Suppl), 33s-36s.
- International Agency for Research on Cancer, IARC (2004): *Evaluation of carcinogenic risks to humans: 35, 45, Betel-quid and areca-nut chewing and some areca-nut derived nitrosoamines*. Lyon: WHO IARC.
- Khandelwal, A., Khandelwal, V., Saha, M.K., Khandelwal, S., Prasad S. and Saha, S.G. (2012): Prevalence of areca nut chewing in the middle school-going children of Indore, India. *Contemporary Clinical Dentistry* **3**, 155-157.
- Lee, C-H., Ko, A.M-S., Warnakulasuriya, S., Yin, B-L., Sunarjo, Zain, R.B., Ibrahim, SO., Liu, Z-W., Li, W-H., Zhang, S-S., Kuntoro, Utomo, B., Rajapakse, PS., Warusavithana, SA., Razak, I.A., Abdullah, N., Shrestha, P., Kwan, A-L., Shieh, T-Y., Chen, M-K. and Ko, Y-C. (2010): Intercountry prevalence and practices of betel-quid use in south, southeast and eastern Asia regions and associated oral preneoplastic disorders: an international collaborative study by Asian betel-quid consortium of south and east Asia. *International Journal of Cancer* **129**, 1741-1751.
- Madathil, S.A., Rousseau, M-C., Allison, P., Netuveli, G., Humphris, G.M., Varghese, I., Shiraz, S., Castonguay, G., Thekkepurakkal, A-S., Shahul, H.P. and Nicolau, B. (2015): Maternal and paternal contribution to intergenerational psychosocial transmission of paan chewing. *Community Dentistry and Oral Epidemiology* **43**, 289-297.
- Milgrom, P., Tut, O.K., Gilmatam, J., Gallen, M. and, Chi, D.L. (2013): Areca use among adolescents in Yap and Pohnpei, the Federated States of Micronesia: *Harm Reduction Journal* **10**, 26.
- Mirza, S.S., Shafique, K. and Arain, M.I. (2011): Areca nut chewing and dependency syndrome: is the dependence comparable to smoking? A cross sectional study. *Substance Abuse Treatment, Prevention and Policy* **6**, 23.
- Oakley, E., Demaine, L. and Warnakulasuriya, S. (2005): Areca (betel) nut chewing habit among high-school children in the Commonwealth of the Northern Mariana Islands (Micronesia). *Bulletin of the World Health Organization* **83**, 656-660.
- Paavola, M., Vartiainen, E. and Puska, P. (1996): Predicting adult smoking: the influence of smoking during adolescence and smoking among friends and family. *Health Education Research* **11**, 309-315.
- Prabhu, N.T., Warnakulasuriya, A.A.S., Gelbier, S. and Robinson, P.G. (2011): Betel quid chewing among Bangladeshi adolescents living in East London. *International Journal of Paediatric Dentistry* **11**, 18-24.
- Qidwai, W., Ishaque, S., Shah, S. and Rahim, M. (2010): Adolescent lifestyle and behaviours: a survey from a developing country. *Plos One* **5**, e12914
- Shafique, K., Zafar, M., Ahmed, Z., Khan, N.A., Mughal, M.A. and Imtiaz, F. (2013): Areca nut chewing and metabolic syndrome: evidence of a harmful relationship. *Nutrition Journal* **12**, 67.
- Shah, S.M.A., Merchant, A.T., Luby, S.P. and Chotani, R.A. (2002): Addicted school children: Prevalence and characteristics of areca nut chewers among primary school children in Karachi, Pakistan. *Journal of Paediatrics and Child Health* **38**, 507-510.
- Sharan, RN., Mehrotra, R., Choudhury, Y. and Asotra, K. (2012): Association of betel nut with carcinogenesis: revisit with a clinical perspective. *Plos One* **7**, e42759.
- Tiwari, R.V., Megalamanegowdru, J., Gupta, A., Agrawal, A., Parakh, A., Pagaria, S. and Sahu, A. (2014): Knowledge, attitude and practice of tobacco use and its impact on oral health status of 12 and 15year-old school children of Chhattisgarh, India. *Asian Pacific Journal of Cancer Prevention* **15**, 10129-10135.
- Tsai, W.C., Wu, M.T., Wang, G.J., Lee, K.T., Lee, CH., Lu, Y.H., Yen, H.W., Chu, C.S., Chen, Y.T., Lin, T.H., Su, H.M., Hsu, P.C., Cheng, K.H., Duh, T.H., Sheu, S.H. and Lai, W.T. (2012): Chewing areca nut increases the risk of coronary artery disease in Taiwanese men: a case-control study. *BMC Public Health* **12**, 162.
- Wang, S-C., Tsai, C-C., Huang, S-T. and Hong, Y-J. (2003): Betel nut chewing and related factors in adolescent students in Taiwan. *Public Health* **117**, 339-345.
- Wang, S-C., Tsai, C-C., Huang, S-T. and Hong, Y-J. (2004): Betel nut chewing: The prevalence and the intergenerational effect of parental behavior on adolescent students. *Journal Adolescent Health* **34**, 244-249.