

RESEARCH ARTICLE

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High Prevalence of Lifestyle Factors Attributable for Oral Cancer, and of Oral Potentially Malignant Disorders in Rural Sri Lanka

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Abstract

Background: Oral Cancer is a major public health problem in most of the South East Asian countries including Sri Lanka. Use of tobacco in the form of smokeless tobacco and smoking, use of alcohol and betel quid chewing are the major contributory factors for causation oral cancer. The aim of this study was to investigate the prevalence of lifestyle factors responsible for causation of oral cancer and Oral Potentially Malignant Disorders (OPMD) in the Sabaragamuwa province of Sri Lanka. **Methods:** A cross-sectional community based study was conducted in Sabaragamuwa province by interviewing, then conducting an oral examination, on 1029 subjects over 30 years of age, over a one year period from November 2006. The study protocol included an interviewer-administered questionnaire to gather socio-demographic factors, recording of habits that included areca/betel chewing, smoking, and alcohol consumption. A three-day food diary was obtained, particularly to assess the consumption of tea, fruits and vegetables. The weight and height of residents was taken for calculation of Body Mass Index (BMI). **Results:** One hundred and two individuals with one or more OPMD were detected among these 1029 subjects. The prevalence of OPMD, weighted according to the estate sector and gender, was estimated as 11.3%. The prevalence of daily betel quid chewing in this study was 53.8%: 15.7% without tobacco and 47.4% with tobacco. The prevalence of individuals who reported consumption of alcohol at least weekly was 13.4%. A significant minority, 31.7%, were under nourished, with a BMI < 18.5. Forty six percent of the males practiced combined habits of betel quid chewing, smoking and regular use of alcohol. **Conclusions:** This study discloses high prevalence of OPMD and of lifestyle factors for oral cancer in these communities. There is an urgent need for a comprehensive strategy to control the use of tobacco, betel quid chewing and alcohol for prevention of oral cancer.

Keywords: Oral potentially malignant disorders- prevalence- lifestyle- socioeconomic status- BMI

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Introduction

Oral cancers (ICD-10, C00-C06), and cancers of the tonsil and other pharyngeal sites (C09-10, C12-14, thus excluding the nasopharynx, C11), taken together, is the ninth most common cancer in the world. Cancers at these sites are associated with several lifestyle factors. There were an estimated 442,760 new cases worldwide in 2012: 314,106 cases in men, (being the 8th most common), and 128,654 cases for women: (14th most common). (Ferlay et al., 2012). The Globocan 2012 database estimated that there were 241,458 deaths due to these oral and pharyngeal cancers in 2012, making these sites the 11th most common for global cancer deaths. It is also estimated that 56% of the world's oral and pharyngeal cancer burden (excluding nasopharyngeal carcinoma) is from Asia. In Sri Lanka, the incidence of oral and other pharynx cancer was 15.5 per 100,000 population per

annum, and 3981 new cases were estimated to have arisen in 2012 (Ferlay et al., 2012).

According to the National Cancer Registry Report, 2010, the incidence of cancer of the oral cavity and oro-pharynx in Sri Lanka, excluding salivary neoplasms, standardized to the world population, was 20.7 and 5.4 per 100,000 populations, in males and females respectively. Fourteen point three percent of all reported cancers were oral cancers and these carried the highest mortality rate among different types of cancers (National Cancer Control Programme Sri Lanka, 2016). Oral cancer is the most common cancer amongst Sri Lankan males, 6th among women, and second overall .

Oral cancer is often preceded with an oral potentially malignant disorder (OPMD), the global prevalence of which is reported at 1-5% (Napier and Speight, 2008), but with substantially higher prevalences described from South and SE Asia, with male preponderance, e.g. Taiwan

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(12.7%) (Chung et al., 2005), and in some Western Pacific countries, e.g. Papua New Guinea 11.7% (Thomas et al., 2008). In Sri Lanka, the prevalence of oral leukoplakia and of Oral Sub mucous Fibrosis (OSF) is reported as 26.2 and 4.0 per 1,000 respectively (Ministry of Health Sri Lanka, 2009). Such wide geographical variations are due to life styles specific to the country or region. Betel quid chewing with or without tobacco, and the chewing of areca nut alone, or packaged as Pan parag or, with tobacco powder as Gutka, are major contributory factors for causation of Oral cancer and OPMD in the South Asian region.

Tobacco is consumed in different ways in the form of smoking, i.e. cigarettes, cigar, beedi and reverse smoking, and smokeless tobacco by chewing, snuffing, and dipping dissolvable tobacco. According to the Global Youth Tobacco Survey 2015 conducted in Sri Lanka, 3.2% of boys and 0.2% of girls between 13-15 years of age smoked tobacco anytime during the past 30 days (current smokers), leading to an overall prevalence of 1.7%. This study also assessed the smokeless tobacco prevalence among school children and Sri Lanka has shown that 2.4% of the students, 4.2% of boys and 0.5% of girls among 13-15 years age group, were current smokeless tobacco users (WHO, 2015).

STEP wise Approach to Surveillance (STEPS) survey 2015 conducted in Sri Lanka also assessed the tobacco and alcohol use among 18-69 years in Sri Lanka in 2015. This study showed: prevalence of smoking among Male 29% and Female 0.1%, Smokeless Tobacco use among Male 26% and females 5% and Alcohol use among male 35% and female less than 1% (Ministry of Health, 2015).

The aim of the present community-based study was to determine the prevalence of OPMD and of lifestyle factors among the population in the Sabaragamuwa Province of Sri Lanka.

Materials and Methods

A cross-sectional community survey, employing a house-to-house method to screen for OPMD was conducted in the Sabaragamuwa province with ethical approval from the ethics review committee, Faculty of Medicine, University of Colombo. Subjects signed their informed consent before data collection. The population characteristics, ethnic mix, socioeconomic diversity, sampling technique and methods are described in detail elsewhere (Amarasinghe et al., 2010b).

An interviewer-administered questionnaire collected the socio-demographic variables: age, gender, ethnicity, occupation and education. Lifestyle questions covered all types of chewing habits, smoking and use of alcoholic beverages, defined as those who had never or ever practice a habit. 'Ever' habits were further subdivided into past, occasional and weekly/daily (Morse et al., 2007). Weight and height were obtained for Body Mass Index (BMI).

The consumption of fruit, vegetables and tea was measured using a three-day diet diary for 2 days in the week and 1 day on the weekend, prior to the oral examinations. Participants were instructed to write the items and amount consumed according to common

household utensil units (e.g. 'table- spoonful') without changing their food consumption pattern.

A total of 1,029 subjects above the age of 30 years were recruited over a 1-year period from November 2006 and blinded to the lifestyle factor status at the time of clinical examination. Oral examination was carried out by the principal investigator under natural light with a standard dental kit to diagnose OPMD. The diagnostic criteria for the detection of OPMD: leukoplakia, erythroplakia, OSF, lichen planus and other oral mucosal abnormalities were based on the recommendations of WHO (Warnakulasuriya et al., 2007, Zain et al., 1999, Axell and Rundquist, 1987). Chewer's mucosa, quid-induced lichenoid reactions, smoker's keratosis, denture stomatitis, angular cheilitis and oral manifestations of anaemia, were considered as "other" oral mucosal abnormalities.

Statistical Analysis

Data were recorded on proformas, using the pre-tested questionnaire (available on request from principal author), and entered into the SPSS 17 software package, which was used for all statistical analyses.

Weighted prevalence was calculated for all lifestyle factors to overcome the effects of over sampling of estate sector population and gender. The population in the estate sector is much more variable than those in the villages with regards to their socioeconomic and socio-behavioural aspects. Moreover, it is a common finding in a community based study that more females are encountered in the sample as males are away from the houses during the day time when the investigator visits for data collection. Therefore, following steps were followed to calculate the weighted prevalence of all lifestyle factors.

1. Calculate the observed prevalence of lifestyle factors of the study in relation to the Male/Female, Village rural/Estate.
2. Find out actual population in the Sabaragamuwa province in the above parameters.
3. Calculate the expected population with lifestyle factors, according to the observed prevalence from the study.
4. Calculate the weighted/standardized prevalence by dividing expected population by total population.

The relationships between two categorical variables were tested by Chi-square test. Correspondence analysis was used to combine information on occupation and education to produce a single score for SES, on a continuous scale, for each subject (Zurriaga et al., 2004). Consumed fruit and vegetables were later quantified into portions (Ministry of Health Sri Lanka, 2002): 3-4 spoon full of cooked vegetable, 100 ml cup of uncooked/raw vegetable, one medium size banana, orange and apple, 9-11 grapes or similar fruits, ¼ of medium size papaw, ½ portion of avocado and 100 ml cup of undiluted fruit juices were considered as single portions. Quantification of the tea cup was made by 100 ml and classified according to the content of β carotene as described elsewhere (Amarasinghe et al., 2013).

Results

The number of individuals contacted was 1,118. Of these 1,029 consented: a non-response rate of 8%. Of the respondents, 64.6% were Sinhalese and 34.9% Tamils (Table 1). More than half (52.7%) of the subjects had limited formal education – eight years or less - and only 9.3% had received tertiary level education, namely 12 or more years of formal education. Professional, clerical and technical occupations were represented by only 4.6% of the subjects, 48.8% belonged to skilled / unskilled workers and 46.6% were unemployed / house wives. As to the geographical distribution, 64.9% of the study subjects were rural (village) dwellers, 35.1% lived and worked on estates and none were from urban areas.

One hundred and two Oral Potentially Malignant Disorders were detected among 1,029 subjects. When weighted for over-sampling of the estate sector and of gender, the prevalence of OPMD was estimated as 11.3%. Among the OPMD, reported prevalence of leukoplakia was 8.9% and Oral Submucous Fibrosis 1.7% as presented in our previous communication (Amarasinghe et al., 2010a). The prevalence of areca nut and of betel quid chewing is higher in the estate sector (79.3%) compared to the villages (51.5%) (Table 2). When

daily chewers were weighted for over sampling of the estate sector and sex composition according to the population of the Sabaragamuwa Province, the overall prevalence of one or other of these habits fell to 53.7%. The prevalence of betel quid chewing without tobacco was 15.7%; of betel quid chewing with tobacco, 47.4%. One quarter of the population was chewing 1-3 quids per day, with 43.8% chewing more than 3 quids per day. In villages, 24.8% of males were consuming alcohol at least weekly, whereas the admission of alcohol consumption by females was rare. In the estate sector, 48.5% of males and 3% of females consumed alcohol at least weekly, representing an average of weekly alcohol consumers of 13.4%. The weighted prevalence of arrack consumption was 14.1% and of “Kassippu” consumption, 2.3%. There is a high prevalence of “kassippu” consumption in the estate sector when compared to the villages. About one third of the study population reported that they consumed alcohol up to 21 units per week; only 6.2% were heavy drinkers.

None of the females and 55.3% of the males in this sample smoked. Overall daily smoking prevalence was 11% in this population, weighted for over sampling of the estate sector and imbalanced sex ratios. The prevalence of daily smoking was high in males in the estate sector (35%) as compared to males in villages (21%). Cigarette smoking

Table 1. Socio-demographic Characteristics of the Sample (N=1,029)

Characteristics	Study sample 2006-2007 n (%)	Sabaragamuwa ^a Province - 2001 %	Sri Lanka ^a - 2001 %
Sex			
Male	405 (39.3)	49.7	49.5
Female	624 (60.6)	50.3	50.5
Age groups (years)			
30-39	245 (23.8)	29.0	31.3
40-49	259 (25.2)	27.6	28.0
50-59	255 (24.8)	21.4	19.6
≥ 60	270 (26.2)	21.9	21.0
Ethnicity			
Sinhalese	665 (64.6)	86.3	74.0
Tamils	359 (34.9)	9.4	18.2
Others	5 (0.5)	4.2	7.8
Education			
No schooling	112 (10.9)	9.9	0.6
Up to 8 years of education	541 (52.7)	42.1	48.2
9-11 years of education	278 (27.1)	38.7	26.0
12 or more years of education	95 (9.3)	9.3	25.3
Occupation			
Unemployed and house wives	480 (46.6)	35.1	7.1
Skilled and unskilled	502 (48.8)	55.2	63.1
Professional and clerical	47 (4.6)	9.6	29.7
Place of residence			
Urban	-	4.0	21.5
Rural (village)	668 (64.9)	87.4	72.2
Estate	361 (35.1)	8.6	6.3

^a Sources - Census of Population and Housing - 2001 Sri Lanka

Table 2. Prevalence of Identified Risk Factors of the Group of 1029 Subjects

Risk factors	Village Prevalence			Estate prevalence			Weighted prevalence ^b % (\pm 95% CI)
	Male %	Female %	Total ^a %	Male %	Female %	Total ^a %	
Betel chewing							
No chewing	13.2	51.6	32.6	8.6	14.6	11.6	30.8 (27.9-33.7)
Ever chewing	86.8	48.4	67.4	91.4	85.4	88.4	69.1 (66.3-72.0)
Daily chewing	70.2	33.1	51.5	82.8	75.8	79.3	53.7 (50.7-56.8)
Types of chewing habits							
Betel chewing without tobacco	13.1	16.8	15.0	18.8	29.2	24.0	15.7 (13.5-17.9)
Betel chewing With tobacco	70.9	21.6	46.0	71.8	54.5	63.1	47.4 (44.3-50.5)
Frequency of chewing (quids per day)							
1- 3 quids	23.2	24.9	24.0	19.5	27.8	25.8	24.2 (21.5-26.8)
More than 3 quids	62.9	21.5	42.0	71.7	56.7	64.1	43.8 (40.7-46.8)
Alcohol Drinking							
No drinking	34.3	100.0	67.5	11.7	88.9	50.6	66.1 (63.2-69.0)
Ever drinking	65.7	0	32.5	88.3	11.1	49.43	33.9 (31.0-36.8)
Weekly drinking	24.8	0	12.3	48.5	3.0	25.6	13.4 (11.3-15.5)
Type of Alcohol							
Arrack ^c	27.0	0	13.4	35.1	9.1	22.0	14.1 (12.0-16.2)
Kasippu ^c	4.3	0	2.1	7.1	1.0	4.0	2.3 (1.4-3.2)
Two combinations	19.3	0	9.5	22.7	0.5	11.5	9.7 (7.9-11.5)
Three combination	13.7	0	6.8	22.7	0.5	11.5	7.2 (5.6-8.8)
Alcohol consumption units per week							
\leq 21 units	52.4	0	25.9	66.9	11.1	38.8	27.0 (24.2-29.7)
> 21 units	11.7	0	5.8	20.8	0	10.3	6.2 (4.7-7.7)
Smoking							
Never	45.9	100	73.3	42.9	100	71.7	73.1 (70.4-75.8)
Ever	54.1	0	26.7	57.1	0	28.3	26.9 (24.2-29.6)
Daily	21.1	0	10.4	35.0	0	17.32	11.0 (9.1-12.9)
Types of smoking							
Cigarette	11.1	0	5.5	8.3	0	4.1	5.4 (4.0-6.8)
Beedi	7.2	0	3.5	13.3	0	6.6	3.8 (2.6-5.0)
Cigar	0.7	0	0.3	15.8	0	7.8	1.0 (0.4-1.6)
Combinations	8.5	0	4.2	4.2	0	2.1	4.0 (2.8-5.2)
Frequency per day							
\leq 3	15.4	0	7.6	33.1	0	16.4	8.3 (6.6-10.0)
> 3	35.7	0	17.7	21.4	0	10.6	17.1 (14.7-19.3)

^a, Weighted prevalence calculated considering sex composition in each sectors in the Sabaragamuwa province; ^b, Weighted prevalence calculated considering over sampling of estate sector and sex composition; ^c, Arrack hard liquor produced legally, many brands, old arrack, special arrack. Kasippu is an illicit liquor

was higher in villages (5.5%) compared to the estate sector (4.1%): beedi (6.6%) and cigar (7.8%) smoking were higher in the estate sector. Overall, the weighted prevalence of cigarette smoking was 5.4%, for beedi 3.8% and for cigar smoking 1%. Only 17% were smoking more than 3 sticks per day and 8.3% were smoking less than or equal to 3 sticks.

A high proportion of people across the Province were under nourished, with a BMI less than 18.5, and the prevalence was higher in the estate sector (43%) compared to the villages (30.7%) (Table 3).

The weighted prevalence of under-nutrition was 31.71%.

Half of the study population were of low SES: only 13.8% of high SES: the latter mostly in the villages.

When considering the weighted prevalence of total fruit and vegetable portions, 51.5% consumed more than two portions per day, but disparity again exists between villages and estates. Only 36% of the people consumed more than two portions of beta-carotene containing fruits and vegetables per day. The majority of people, 81%, consumed 2-3 teacups per day and only 3.5% drank more than 3 cups per day, notably in estate sector.

Table 3. Prevalence of Identified Nutritional Factors among Study Subjects N=1,029

Nutritional Factors	Village Prevalence			Estate prevalence			Weighted prevalence ^b (± 95% CI)
	Male %	Female %	Total ^a %	Male %	Female %	Total ^a %	
BMI							
0 – 18.5	37.2	24.3	30.7	38.9	47.2	43.1	31.7 (28.9-34.5)
> 18.5	62.8	75.7	69.3	61.1	52.8	56.9	68.3 (65.5-71.1)
SES							
Low SES	54.5	45.5	49.9	88.3	92.3	90.3	53.3 (50.2-56.3)
Middle	32.6	37.3	34.9	9.8	7.7	8.7	32.8 (29.9-35.6)
High	12.8	17.1	14.9	1.8	0	0.9	13.8 (11.7-15.9)
Total fruit and vegetable portion							
≤ 1 portion	15.2	8.5	11.8	47.0	48.6	47.8	14.8 (17.0-12.6)
>1 - ≤2 portion	36.6	31.1	33.8	34.0	30.3	32.1	33.7 (36.6-30.8)
>2 portion	48.2	60.3	54.3	19.0	21.1	20.0	51.5 (54.5-48.4)
Only β-carotene containing fruit and vegetable							
≤ 1 portion	26.8	19.8	23.3	55.1	58.1	56.6	26.2 (23.5-28.9)
>1 - ≤2 portion	39.1	37.9	38.5	29.4	30.4	29.9	37.8 (34.8-40.8)
>2 portion	34.1	42.3	38.2	15.4	11.5	13.5	36.0 (33.1-38.9)
Consumption of tea per cup							
≤ 1 per day	8.5	5.8	7.1	10.1	17.8	14.0	7.7 (6.1-9.3)
>1 - ≤3 per day	78.7	83.7	81.2	84.8	80.4	82.6	81.3 (78.9-83.7)
>3 per day	12.8	10.5	11.6	5.1	1.9	3.5	10.9 (9.0-12.8)

^a, Weighted prevalence calculated considering sex composition in each sectors in the Sabaragamuwa province; ^b, Weighted prevalence calculated considering over sampling of estate sector and sex composition.

Table 4. Percentage of Prevailing combined Habits among Study Subjects N=1029

Habits	Village Prevalence			Estate prevalence			Weighted prevalence ^b (± 95% CI)
	Male %	Female %	Total ^a %	Male %	Female %	Total ^a %	
No habits	6.6	51.6	29.3	2.5	14.6	8.5	27.6 (24.9-30.3)
Smoking only	1.7	0	1.2	0	0	0	0.8 (0.3-1.3)
Betel chewing only	19	48.4	33.8	8.6	74.2	41.6	34.5 (31.6-37.4)
Smoking and betel chewing	7	0	3.5	0.6	0	0.3	3.2 (2.1-4.3)
Alcohol only	0.4	0	0.2	3.1	0	1.5	0.3 (0-0.6)
Smoking and alcohol	4.5	0	2.2	3.1	0	1.5	2.2 (1.3-3.1)
Betel chewing and alcohol	19.8	0	9.8	28.8	11.1	19.9	10.6 (8.7-12.5)
Betel chewing, smoking and alcohol	40.9	0	20.2	53.4	0	26.5	20.7 (18.2-23.2)

^a, Weighted prevalence calculated considering sex composition in each sectors in the Sabaragamuwa province; ^b, Weighted prevalence calculated considering over sampling of estate sector and sex composition.

As to combination of habits, only 28% of the subjects reported no habits (Table 4): 29% in villages and a more 8.5% in the estate sector. More than one third (34.5%) of the study sample both male and female subjects chewed betel quid alone. One fifth (20.7%) of the study subjects practiced all three habits: betel chewing, smoking and alcohol use.

Table 5 reveals that 75% of the past smokers are now chewing betel quid, some of whom started before, but some also after quitting smoking.

Discussion

This study provides an over view of the exposure of the population to known lifestyle factors for oral cancer.

The same lifestyle factors relate to OPMD. The data can be generalised as they were collected before the oral examinations and are not related to oral or other diseases or disorders.

In Sri Lanka, the prevalence of oral cancer is known to be high among the estate sectors of our population, and this causes considerable morbidity and mortality. According to the year 2010 Cancer Registry, 13.5% of oral cancer patients reported in year were Tamils (National Cancer Control Programme Sri Lanka, 2016). Most of the oral cancer patients who were of Tamil ethnicity were from the estate sector. Moreover, a high prevalence of OPMD was also reported in a study conducted in the estate sector in the Central Province (Ariyawardana et al., 2007). Over sampling of the estate sector was deliberate in order to

Table 5. Distribution of Betel Chewing Practices and Smoking Practices among Study Subjects

Smoking	Betel chewing				
	No (%)	Past (%)	Occasional (%)	Daily (%)	Total (%)
No (%)	275 (34.2)	27 (3.4)	75 (9.3)	428 (53.2)	805 -100
Past (%)	8 -10	9 (11.2)	3 (3.8)	60 -75	80 -100
Occasional (%)	1 (2.8)	1 (2.8)	5 (13.9)	29 (80.6)	36 -100
Daily (%)	11 (10.2)	8 (7.4)	10 (9.3)	79 (73.1)	108 -100
Total (%)	295 (28.7)	45 (4.4)	93 -9	596 (57.9)	1029 -100

capture these risks.

A concern is the relatively high percentage of females included in the sample. However, this is common with house-to-house surveys, because when investigators visited houses, males are usually away from home. All prevalence data were, therefore, weighted for gender and the geographical location.

In the present study, the as reported by the subjects, prevalence of OPMD and the lifestyle factor prevalence were very high. This forecasts the future burden of oral cancer.

The weighted prevalence of betel quid chewing without tobacco was 15.7% and of betel chewers who included tobacco in their quids was 47.4%: higher in the estate sector at 63%. This could be attributed to their poorer education and knowledge about the lifestyle factors of oral cancer and potentially malignant disorders. Most people in the estate sector work in work in tea or rubber fields and are habituated to chewing betel quid as a stimulant. Chewed betel is also used to remove leeches latching onto the legs. These data can be compared to the even higher prevalence of betel chewing without tobacco, reported as 64.5%-82.7% in Hunan Province in China (Zhang and Reichart, 2007) and 76.8% in the Solomon Islands (Tovosia et al., 2007). A study in Taiwan showed a comparatively low prevalence of areca quid chewers, at 7.2% and this was practised particularly by males (Chung et al., 2005).

The overall prevalence of weekly consumption of alcohol in this study was 13.4% and it was higher in the estate sector (25.6%) when compared to the villages (12.3%). Reason could be due to the factors that most of the people in the estate sector were labourers in low educated groups as compared to the villages. However, according to study in estate sector in Sri Lanka (Ariyawardana et al., 2007), a higher prevalence (61%) of consumption of alcohol was reported for the estate sector than in the present study. In villages, 24.8% of the males were consuming alcohol at least weekly. In the estate sector, it was 48.5% for males and 3% for females. Because of the cultural barrier, alcohol consumption would have been under reported in females. Higher prevalence of alcohol drinking was reported (34.7%) in a study conducted among female tea labourers in the Nuwaraeliya district of

Sri Lanka (Weerakoon et al., 2009). According to the study conducted in the two districts of Sri Lanka, reported prevalence of alcohol drinking in the rural areas was 20.8% for men (de Silva et al., 2009). Arrack was the commonest alcohol product used in this community: the figures indicate the tendency as same as the current study in Sri Lanka. High prevalence was reported in USA (National Health Interview Survey), 52% of the adults 18 years of age and over were current regular drinkers (at least 12 drinks in the past year). Moderate to low prevalence was reported from different countries in Asia: 36.8% was reported from Islands - plural (Tovosia et al., 2007), 18.14% in Taiwan (Chung et al., 2005).

The weighted prevalence of arrack consumption was 14.1% and "Kassippu" consumption was 2.3%. Kassippu has been banned in Sri Lanka from 2006, but is still produced and sold illegally in the estate sector. Kassippu was the most frequently used alcoholic beverage in early era in Sri Lanka (Ustun et al., 2003).

The adult smoking rate in the Sri Lankan general population was reported as 21% in 2005 (Perera et al., 2005), and has shown a slight decline over the past few years. In this study, the daily smoking prevalence observed in the estate sector was 17.3% (Table 1), which is lower than the X% reported by Ariyawardana et al (2007). A similar prevalence (X%), has been reported from Taiwan. Otherwise we don't know similar to what. (Ariyawardana et al., 2007). Similar prevalence was reported in Taiwan (Chung et al., 2005). None of the females was smoking in this study sample. In contrast, at this time, a much higher proportion of females were smoking in Western countries: eg. 18% in Australia (Winstanley and White, 2008).

STEP study conducted in 2015, showed current figures for lifestyle factors but it does not show the details of lifestyles in relation to type, number per day specially for smokeless tobacco use.

A high percentage of people are under-nourished in this population, which is a noteworthy feature in the estate sector (Table 3). Although, the total fruit and vegetable consumption in "village" was higher than estate sector, consumption of beta-carotene containing portions is very low in estate community. This is mainly due to bulk of the total vegetable. Most of the feely available vegetables consumed in villages are starchy - jackfruit, manioc,

sweet potatoes - which contain little beta carotene 36% of the population consumed more than 2 portions of beta-carotene containing fruits and vegetables, which gives the protective effect against cancer. The generally accepted view is that an individual should consume 5 portions of fruit and vegetables but this population is hardly keeping abreast with these achievable targets. If these are cultivated in a home plot garden rather than purchasing the expenditure incurred will be comparatively very low and the nutrition value will be very high. Therefore, people should be educated and motivated to grow and consume more home-grown fruit and vegetables. Moreover, majority of the people drink 2-3 teacups per day, which is a fermented black tea not the green tea. Therefore, the protective effect of tea consumption need to be discussed in terms of bioflavonoids content in black tea amounting to 2-3 cups per day.

Despite a wealth of literature on the effect of poverty and inequalities of oral health, the socioeconomic inequalities of oral cancer and OPMD are given little recognition until recently. Occupation and education were employed to define SES in this study and it SES did not emerge as an independent lifestyle factor following adjustment for potential behavioural confounders. A systematic review of 41 case:control studies of oral cancer (Conway et al., 2008) concludes that SES is an independent risk factor. Methodological differences that exist in this meta-analysis were discussed in a later review (Warnakulasuriya, 2009). It has been suggested that observed differences may be due to macro environment associated with Low SES: hygiene, poor nutrition, the effects of poor education on health, lack of access to health care and knowledge of risk behaviors often encountered in any low SES group.

In conclusion, this study demonstrates a very high prevalence of the chewing of betel quids in some form or another, of alcohol use, of tobacco smoking and of low intake of fruit and vegetables in this population. These are well established lifestyle factors for oral cancer, confirmed by the high prevalence of OPMD seen. These data indicate the need for public education and for screening for lifestyle factors and for estimating the prevalence of OPMD in other regions of Sri Lanka, and neighbouring populations. Although an overall economic uplift is required, which the health professions cannot themselves engineer, education, health promotion and population screening for oral cancer and OPMD should be advanced. This will save lives.

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