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ABSTRACT:
The effect of betel (areca catechu) nut chewing on the function of the normal human lungs is yet to be fully established. However, it has been noted that chewing betel nut could aggravate acute attacks of asthma in asthmatic patients. A total of 77 students in the age group 19 to 25 years selected randomly in higher learning institutes in Port Moresby Papua New Guinea underwent spirometry tests. Of the 77 students, 34 (44.2%) were males and 43 (55.8%) were females. Out of the 34 male students, 24 (70.6%) were betel nut chewers and 10 (29.4%) were non chewers. Of the 43 female students, 26 (60.5%) were betel nut chewers and 17 (39.5%) were non chewers. There were no statistically significant differences ($p>0.05$) in the spirometry parameters between the chewers and non-chewers in both groups. However, negative correlations were observed between number of nuts chewed per day and FEV_1/FVC in female chewers and also between frequency of chewing and FEV_1 in male chewers.

Keywords: Betel nut, lung function, students, chewers, non-chewers.
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INTRODUCTION:

Betel nut quid chewing is a common psychoactive substance or masticatory euphoriant used in the Pacific region, South-East Asia, Indo-Pakistan subcontinent, Southern China and coastal areas of East Africa [1, 2]. Betel nut (Areca catechu) chewing is a favourite pastime of Papua New Guineans and is also considered as part of their culture.

Its major alkaloid component, arecoline, is a muscarinic cholinergic agent which acts on the autonomic nervous system and produces various effects like tachycardia, flushing, alertness and warmth [2-5]. It plays a role in the pathophysiology of oral cancers [2], is reported to have cardiovascular effects [6-8] and poor glycemic control [9]. It causes reduction of birth weight among babies of pregnant women who chew betel nut [10].

Its effect on the normal healthy lung is yet to be fully studied. Kiyingi and Taylor noted that healthy subjects who chewed betel nut had no changes in Forced Expiratory Volume in the first

second (FEV_1) but a reduced lung function was noted in asthmatic subjects [2,4]. Javed et al found three studies associating areca nut chewing with respiratory discomfort [7].

Although betel nut chewing is very popular in PNG, published data on its effects on the lung function of teenagers and youths is very scanty. The major objective of this study was to assess the pulmonary function of students chewing betel nuts compared to their counterparts that do not chew betel nuts.

SUBJECTS AND METHODS:

Students from three institutions of higher learning in the National Capital District (NCD) of Papua New Guinea (PNG) were recruited to have their pulmonary function tests done in this prospective, observational cross-sectional study. The calculated sample size of 150 was considered appropriate for this study [11].

Students were selected randomly by simple coin toss and then asked to answer a pretested questionnaire. Those who had history of chronic cough, recurrent respiratory tract infection, chest or spinal deformity, asthma, emphysema, Chronic Obstructive Pulmonary Disease (COPD), Tuberculosis (TB) or cardiac illness were excluded from the study [11].

The selected subjects then had their height taken standing erect and upright without shoes and using a standard measuring stadiometer to the nearest millimetre. Weight was also taken without shoes and with light clothing on using a digital weighing scale to the nearest gram. The body mass index was then calculated as appropriate.

Pulmonary function tests were then done with the subject seated comfortably and facing away from the spirometer. The procedure was explained and demonstrated to each student before they proceeded with the test. Subjects used disposable mouthpieces to blow into a computerised spirometer, SpiroUSB model run with Spida5 software [12]. The spirometer was calibrated each morning according to the manufacturer's manual [12].

The best of three good blows was accepted as the final result. Spirometry tests were done using the American Thoracic Society (ATS) guidelines and criteria [11-14].

The pulmonary function tests recorded were: Forced Expiratory Volume in one second (FEV_1), Forced Vital Capacity (FVC), FEV_1/FVC, Peak Expiratory Flow (PEF) and Forced Expiratory Flow 25% and 75% (FEF_{25-75}).

Analysis was done using Microsoft XP Excel data package and SPSS version 20. P-value of <0.05 was considered significant.

Ethical clearance was obtained from the school of medicine and health science ethics committee and each institutional head also agreed to have tests done in their institution. Each of the selected subjects also gave consent before allowed to undergo the tests.

RESULTS:

One hundred and fifty six (156) students volunteered for the test out of which 116 (74.4%)

students were randomly selected. Of the 116 students 39 (33.6%) were further excluded after analysis of their questionnaires and their spirometry results. The major reasons for their exclusion were based on the American Thoracic Society (ATS) guidelines and criteria, and also their age [11-14]. Thus, the data obtained from 77 students made up of 34 male (44.2%) and 43 females (55.8%) were finally accepted for analysis. All the students were within the age group 19 to 25 years. Female students had a mean age of 22±1.6 years and male students' 22±1.5 years (Mean ± SD). Out of the 34 male students, 24 (70.6%) were betel nut chewers and 10 (29.4%) were non chewers.

The summary statistics for the pulmonary function indices for male betel nut chewers and non-chewers are shown in Table 1. There were no statistically significant differences ($p>0.05$) in the spirometry parameters of male betel nut chewers compared to their non-betel nut chewing counterparts. Betel nut does not significantly affect the FEV_1, FVC, PEF and FEV_1/FVC% values for male students in the 19 to 25 years age group. Out of the 43 female students, 26 (60.5%) were betel nut chewers and 17 (39.5%) were non chewers. The pulmonary function results for the female chewers and non-chewers of betel nut are shown in Table 2.

No statistically significant differences ($p>0.05$) were obtained in the spirometry results between the female betel nut chewers and the non-chewers.

When the male chewers were compared to the female chewers, males had a significantly higher ($p < 0.05$) mean values for FEV_1, FVC and PEF. However, there was no significant difference ($p>0.05$) between the mean FEV_1/FVC% of the male and female betel nut chewers.

The comparison of the non-betel nut chewers showed that males had a significantly higher ($p=0.001$) FEV_1, FVC and PEF compared to their female counterparts, but there was no significant difference in FEV_1/FVC% between the male and female non-chewers.

The duration of betel nut chewing habits was similar among the male and female chewers; 4 (16.7%) of the male and 4 (15.4%) of the female students had been chewing for less than a year; whereas, 20 (83.3%) of the male and 22 (84.6%) of the female students had been chewing for over a year.

The number of betel nuts chewed per day was also similar among the male and female students. Among the 24 male chewers, 19 (79.2%) chewed one to two betel nuts per day compared to 20 (76.9%) of the 26 female chewers. More than 3 betel nuts per day were chewed by 5 (20.8%) male students compared to 6 (23.1%) female students.

Table 1: Summary statistics of the Pulmonary Function Indices for male betel nut chewers and non-chewers

Parameters	FEV_1 (Litres)		FVC (Litres)		PEF (Litres/min)		FEV_1/FVC (%)	
	Chewers	Non chewers	Chewers	Non chewers	Chewers	Non chewers	Chewers	Non chewers
Mean	3.68	3.76	4.15	4.23	601.0	581.1	88.9	88.9
Std. Dev	0.43	0.42	0.57	0.50	83.3	135.7	4.4	3.9
Range	2.87- 4.51	2.96- 4.38	3.23- 5.52	3.43- 4.95	460.0 - 785.0	415.0-767.0	79.0 - 96.0	81.0 - 95.0
95% CI	3.49- 3.86	3.46- 4.06	3.91- 4.39	3.87- 4.58	565.9 - 636.2	484.0-678.2	87.0 - 90.7	86.1- 91.7
Median	3.67	3.84	4.03	4.28	601.5	552.0	89.0	89.0
Interquartal Range (IQR)	3.42- 3.96	3.51- 4.02	3.73- 4.51	3.78- 4.67	555.2 - 640.5	451.5-743.8	86.3 - 92.0	87.5 - 91.0
Mann Whitney (p)	0.515		0.707		0.467		0.985	

Table 2: Summary statistics of the Pulmonary Function Indices for female betel nut chewers and non-chewers

Parameters	FEV_1 (Litres)		FVC (Litres)		PEF (Litres/min)		FEV_1/FVC (%)	
	Chewers	Non chewers	Chewers	Non chewers	Chewers	Non chewers	Chewers	Non chewers
Mean	2.97	2.82	3.34	3.11	466.3	434.8	88.9	90.8
Std. Dev	0.42	0.32	0.60	0.38	74.8	65.3	4.4	3.6
Range	2.39-3.79	2.35-3.49	2.64-4.81	2.56-3.95	359.0-655.0	326.0-569.0	79.0-96.0	85.0-98.0
95% CI	2.80-3.14	2.66-2.99	3.10-3.58	2.92-3.30	436.1-496.5	401.2-468.3	87.0-90.7	88.9-92.6
Median	2.92	2.79	3.16	3.10	471.0	430.0	89.0	91.0
IQR	2.64-3.31	2.59-3.06	2.85-3.80	2.89-3.37	402.5-508.0	385.0-489.5	86.3-92.0	88.0-92.5
Mann Whitney (p)	0.308		0.378		0.180		0.600	

Results presented in table 3 show the data obtained for the frequency of chewing by the male and female students. The majority, 41.7% of male and 50% of female students have been chewing betel nut every day since they started chewing.

Tables 4 and 5 show the correlation of duration, frequency and number of nuts chewed per day with pulmonary function among the female and male chewers respectively.

There is an inverse statistically significant relationship between the number of nuts chewed per day and the FEV_1/FVC ratio (rho= -0.471, p=0.015) among the female chewers.

Among the male chewers correlation coefficient showed inverse statistically significant relationship between the frequency of chewing betel nut and the FEV_1. (rho= -0.504, p=0.012).

Table 3: Frequency of betel nut chewing by the male and female chewers

Frequency	Male students (n=24)	Female students (n=26)
Every day	10 (41.7%)	13 (50.0%)
Every other day	6 (25.0%)	2 (7.7%)
Once/week	6 (25.0%)	6 (23.1%)
Once/month	0	4 (15.4%)
Once or twice a year	2 (8.3%)	1 (3.8%)

Table 4: Correlation between the duration, frequency of chewing and number of nuts chewed per day, and the pulmonary function of female chewers

	FEV_1		FVC		FEV_1/FVC	
	r*	p-value	r*	p-value	r*	p-value
Duration	-0.128	0.533	-0.299	0.138	0.157	0.443
Frequency	0.131	0.522	0.023	0.910	0.059	0.774
Number of nuts/day	0.095	0.645	0.243	0.232	**-0.471**	**0.015**

*Spearman correlation coefficient; p-value <0.05 is significant.

Table 5: Correlation between the duration, frequency of chewing and number of nuts chewed per day, and the pulmonary function of male chewers

	FEV_1		FVC		FEV_1/FVC	
	r*	p-value	r*	p-value	r*	p-value
Duration	0.307	0.145	0.097	0.652	0.235	0.269
Frequency	**-0.504**	**0.012**	-0.337	0.107	0.213	0.318
Number of nuts/day	0.332	0.113	0.034	0.875	0.106	0.621

*Spearman correlation coefficient; p-value <0.05 is significant.

DISCUSSION:

Betel nut chewing is a habit prevalent in PNG. Betelnut causes bronchoconstriction in asthmatic patients and thus aggravates their asthma [2, 4]. Kiyingi and Saweri looked at the effects of betelnut in healthy non-asthmatic subjects and found no changes in FEV_1 [2]. Taylor and colleagues also tested arecholine inhalation in healthy subjects. Even though there was more bronchoconstriction found in asthmatic people (6 out of 7 patients), one out of six healthy subjects developed bronchoconstriction [4]. Yanga and Datta studied Melanesian male 18-40 year olds and found that betel nut chewers had significantly reduced FVC and FEV_1 [3].

Our results, however, showed no significant difference between male and female chewers and non-chewers of betel nut. Yanga and Datta [3] excluded smokers from the chewing and non-chewing groups and only included chronic chewers (those who chewed 3-5 betel nuts per day for 2-5 years).

In this study chewers could also be smokers and the definition of chewing encompassed all types of chewers. This could explain why we didn't identify any significant differences between the two categories.

In a recent study published in 2014 by Wang et al, a large sample of 600 asthma patients and 1200 controls were studied to investigate the connection between asthma and betel nut use [15]. They found that a higher arecoline level was associated with worse lung function FEV_1 (rho = -0.359, p=0.004), FVC (rho = -0.309, p=0.02) in the male asthma group and concluded that betel nut chewing is associated with asthma. Correlation coefficient of the case group was not done.

Our study, however, looked only at apparently healthy young people. The number of betel nuts chewed per day by the female chewers was negatively correlated with FEV_1/FVC and the frequency of chewing was negatively correlated with FEV_1 among the male chewers. A suggested larger sample size may identify more significant changes.

CONCLUSION:

This study shows negative correlations between betel nut chewing and lung function of students aged 19 to 25 years in Port Moresby Papua New Guinea.

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