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Original Article

The effectiveness of school educating program for betel quid chewing: A pilot study in Papua New Guinea

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Abstract

Background: To investigate the effectiveness of educating program among primary and secondary school students in Papua New Guinea, where has the highest incidence of oral cancer all over the world.
Methods: A cross-sectional school based survey was arranged in primary and secondary school in Papua New Guinea in June, 2015. A self-administrated questionnaire was administered before and after education done by health experts from Taiwan. The subjects were chosen by random. The schools provided the students we educated and did the questionnaires on.
Results: Ninety five primary school students and 55 secondary school students in Papua New Guinea participated in the study. Before education, both groups lacked the knowledge that betel quid is harmful to health and had no motivation to quit betel quid consumption with the average score 4.580 out of the total score of 8 for primary school students, and the average score of 4.600 out of the total score of 8 for secondary school students. After education, improvements were noted in knowledge of betel quid among both groups, and reached the statistical significance for secondary school students (mean difference 0.700 ± 0.277, 95% CI 0.164−1.248, p-value = 0.018).
Conclusion: A great achievement was gained by a short time of education. To prevent the incidence and mortality of oral cancer in Papua New Guinea, education programs should be arranged aggressively and effectively.

Keywords: Betel nut; Betel quid; Education; Papua New Guinea

1. Introduction

Betel nut chewing has been proven to be scientifically linked with several health diseases. It has several harmful effects to our health, as the International Agency for Research on Cancer concluded after reviewing the published medical research that chewing areca nut is carcinogenic to Humans.[1] However, it is commonly chewed in some countries, and approximately 600 million people worldwide. After tobacco, alcohol, and caffeine, betel nut is the fourth most common addictive substance in the world.

Studies have linked the high incidence of oral cancer in some western Pacific island countries to the concurrent use of betel nut. The high incidence of oral cancer is associated with significant morbidity and mortality rates. The average worldwide mortality rate from oral cancer, based on a 5-year cumulative mortality rate, is less than 50%; however, mortality rates as high as 67% and 80% have been reported for some countries in the Western Pacific Region.[2]

According to the WHO 2008 statistics, Papua New Guinea (PNG) has the highest incidence rate of oral cancer in the world, with 32.3 per 100,000 people suffering from oral

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cancer.[2] A study of the impact of drug use in PNG pointed out that 89.6% of respondents had tried betel nut,[3] with 11.7 years old being the average age of their first try. According to the WHO STEPS survey done during March 2007 to March 2008 in PNG, 79% of respondents were current betel nut users, with 5.5 mean times of chewing per day.[2]

Several reports pointed out that betel quid chewing often started at a very young age. A cross-sectional study done in Taiwan revealed 50% of primary school students in aboriginal areas experience chewing betel quid,[4] including 30.1% habitual chewers. Similar results were reported in Karachi, Pakistan[5] with 74% of primary school children experienced betel quid and 35% chewed betel quid daily. Another study done in the Northern Mariana Islands revealed 63.4% of regular betel quid use among high school students.[6] Oral leukoplakia, a pre-cancer lesion caused by chronic betel quid chewing, was even noted in 13% of the school children surveyed.

Similarly, previous studies pointed out that people in PNG started consuming betel quid at an early age from 11.7 to 13 years old.[2,3,7] The WHO STEPS Data Book for PNG 2007−2008 indicated that 78.2% of males and 79.5% of females aged 15−24 years were current users of betel quid. 67.3% of the young males and 72.1% of the young females were noted as daily users.[8] It means betel quid chewing is more than a habit as it has developed into their culture, thus to educate in the younger age is the most important.

In order to prevent betel nut consumption in PNG, there is a clear demand for developing an effective health education program. Previous studies pointed out that health education benefits adolescent students in resisting the use of betel nuts.[9] Considering the large population of betel nut chewing at youth in PNG, such program should start early in school. Despite the effectiveness of dental health educating to prevent plaque accumulation was widely discussed,[10] the effectiveness of health educating to prevent betel nut chewing was less investigated in this population.

In PNG, Taiwan, India, and Sri Lanka, this is the first study to focus on the effectiveness of health education of elementary and high school students. Therefore, the aim of the present study was to investigate the effectiveness of health education among primary school and secondary school students in PNG.

2. Methods

In June, 2015, the Department of Overseas Medical Centre, Changhua Christian Hospital, Taiwan initiated a program for oral cancer prevention in PNG. This study has been approved by the Institutional Review Board of Changhua Christian Hospital. This program was also supported by the Ministry of Health and Welfare, Republic of China (Taiwan). Professor Mu-Kuan Chen, the President of Taiwan Head and Neck society was the team leader of the volunteers. Students from Markham Road primary school, Koiari Park Adventist Secondary School in Lae city were selected to participate in a survey on oral cancer, betel quid and tobacco education. Lae city, Morobe Province, is the second-largest city in Papua New Guinea, its official languages are Tok Pisin and English.

Students at Markham Road primary school and Koiari Park Adventist Secondary school received 30 min lectures on topics in oral cancer, including epidemiology, etiologic, clinical appearance, clinical management and treatment. Lecture topics reflected material in the questionnaires. English is the language of instruction at Markham Road primary school and Koiari Park Adventist Secondary School, thus English is used as the lecturing language. Two student age groups were chosen to take part in the surveys (four classes of Students from Markham Road primary school, grade 4, who were around 10-year-old; and two classes of students from Koiari Park Adventist Secondary School, grade 10, who were around 16-year-old). The subjects were chosen by random; the school provided the classes and students we educated and did the questionnaires on. The percentages of the study subjects for four classes of primary schools was 100/1000 (10%), and two classes of secondary school students was 65/447 (14.54%). One public primary school and one private secondary school were chosen that helped to avoid sample bias.

All students were measured at baseline and after the 30 min of lectures post-test on their oral cancer, betel nuts and tobacco cessation knowledge. They were allowed 15 min to write the

Table 1
Questionnaire scoring of primary school students.

Questionnaire	Pre-test	Post-test	*p*
Knowledge (Mean ± SD)			
Can Betel quid cause oral cancer?	0.810 ± 0.394	0.894 ± 0.309	0.102
Will chewing Betel quid cause throat cancer?	0.670 ± 0.473	0.737 ± 0.443	0.310
Do you think chewing Betel quid is harmful to your health?	0.350 ± 0.479	0.411 ± 0.495	0.387
Do you know of any disadvantages of chewing Betel quid?	0.810 ± 0.394	0.590 ± 0.495	<0.001*
How does chewing Betel quid affect the heart?	0.420 ± 0.222	0.405 ± 0.197	0.625
Do you think chewing Betel quid will increase your capacity to study?	0.420 ± 0.496	0.463 ± 0.501	0.546
Do you think chewing Betel quid can stimulate your salivation?	0.650 ± 0.479	0.632 ± 0.485	0.790
Does chewing Betel quid have any effect on pregnancy?	0.450 ± 0.500	0.779 ± 0.417	<0.001*
Overall	**4.580 ± 1.363**	**4.911 ± 1.363**	**0.092**
Motivation (Mean ± SD)			
If you ever get a chance, will you try to stop others from chewing betel quit?	0.640 ± 0.482	0.611 ± 0.490	0.673

*p-Value < 0.05.

Table 2
Questionnaire scoring of secondary school students.

Questionnaire	Pre-test	Post-test	*p*
Knowledge (Mean ± SD)			
Can Betel quid cause oral cancer?	0.769 ± 0.425	0.964 ± 0.189	0.003*
Will chewing Betel quid cause throat cancer?	0.862 ± 0.348	0.873 ± 0.336	0.859
Do you think chewing Betel quid is harmful to your health?	0.631 ± 0.486	0.873 ± 0.336	0.003*
Do you know of any disadvantages of chewing Betel quid?	0.539 ± 0.502	0.436 ± 0.501	0.269
How does chewing Betel quid affect the heart?	0.354 ± 0.351	0.482 ± 0.430	0.075
Do you think chewing Betel quid will increase your capacity to study?	0.615 ± 0.490	0.455 ± 0.503	0.079
Do you think chewing Betel quid can stimulate your salivation?	0.323 ± 0.471	0.473 ± 0.504	0.096
Does chewing Betel quid have any effect on pregnancy?	0.508 ± 0.504	0.746 ± 0.440	0.007*
Overall	**4.600 ± 1.680**	**5.300 ± 1.282**	**0.018***
Motivation (Mean ± SD)			
If you ever get a chance, will you try to stop others from chewing betel quit?	0.815 ± 0.391	0.764 ± 0.429	0.491

*p-Value < 0.05.

same questionnaire before and after the lectures respectively. The questionnaire was divided into two sections as knowledge and attitude. In the knowledge section, information was collected on whether betel nut and tobacco are responsible for harmful health including 8 questions that are stated in Tables 1 and 2 for primary school students and secondary school students. In the attitude section, the chewing of betel nuts was assessed through the person's willingness to quit this habit and to discourage their family or friends from chewing betel quid and smoking.

Then, a post-education survey was done to look for improvements. Students who did not complete both pre- and post-questionnaires were excluded from the study.

Data were presented by mean and standard deviation. The improvement of end points between the pre-test and post-test was compared with paired sample *t*-test. Intervention was considered to be statistically significant when p-value < 0.05. Statistical analyses were performed using a commercially available statistical software, Medcalc, version 15.8 (MedCalc Software, Ostend, Belgium).

3. Results

Between June 23, 2015 and June 29, 2015, 100 primary school students and 65 secondary school students participated in the study.

3.1. Primary school students

One hundred primary school students were selected to approach the survey; 95 primary school students completed both the pre-test and post-test questionnaire enrolled for statistical analysis.

Before education, primary school students lacked the knowledge that betel quid is harmful to health and had no motivation to quit betel quid consumption; with the total score of 8, the mean score was only 4.580 for primary school students. The improvements between pre-test and post-test knowledge questionnaire are presented in Fig. 1. The overall mean difference between the pre-test and post-test were 0.331 ± 0.195, with a 95% CI (confidence interval) from −0.055 to 0.716. No statistical difference was noted between the pre-test and post-test (p-value = 0.092).

Improvements of individual questions were analyzed separately, as shown in Table 1. The scores indicate the awareness of the subjects. For example, the post-test score of cause oral cancer was 0.894, means that 89.4% awareness of the betel quid can cause oral cancer. The effect of chewing betel quid on pregnancy statistically showed statistically significant improvement, with mean difference of 0.329 ± 0.066, 95% CI 0.199–0.459, and p-value < 0.001. The effect of the disadvantages of chewing betel quid was also statistically significant, however, pre-test and post-test scoring decreased from 0.810 ± 0.394 to 0.590 ± 0.495, with mean difference of −0.221 ± 0.064, 95% CI −0.347 to −0.094, and p-value < 0.001.

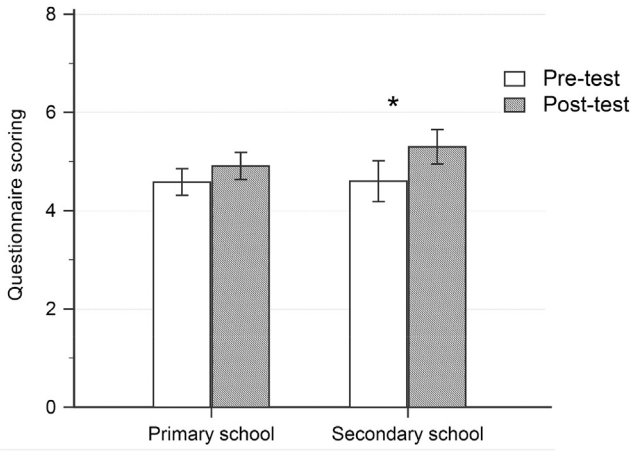

Fig. 1. Total knowledge questionnaire scoring. The mean questionnaire scoring of the Total knowledge, ranging from 0 to 1. The mean difference between the Total knowledge questionnaire scoring among primary school students was 0.331 ± 0.195, and p-value = 0.092. The mean difference between the Total knowledge questionnaire scoring among secondary school students was 0.700 ± 0.277, and p-value = 0.018. Error bars represent the 95% confidence interval of the means. *p-value < 0.05.

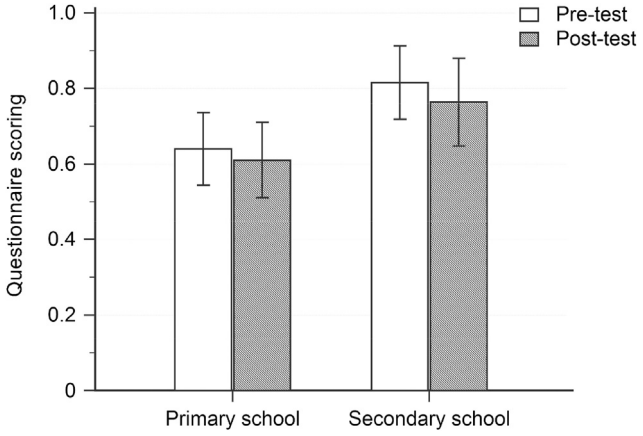

Fig. 2. Questionnaire scoring of motivation. The mean Questionnaire scoring of motivation, ranging from 0 to 1. The mean difference between the motivation questionnaire scoring among primary school students was −0.029 ± 0.070, and *p*-value = 0.673. The mean difference between the Total knowledge questionnaire scoring among secondary school students was −0.051 ± 0.075, and *p*-value = 0.491. Error bars represent the 95% confidence interval of the means. **p*-Value < 0.05.

3.2. Secondary school students

Among the 65 secondary school students approached, 55 participants completed both valid pre-test and post-test questionnaire. The improvements between pre-test and post-test knowledge questionnaire are presented in Fig. 1. With the total score of 8, the mean score of the pre-test was only 4.600. The mean score of the post-test, on the other hand, was 5.300. The overall mean difference between the pre-test and post-test were 0.700 ± 0.277, with a 95% confidence interval from 0.164 to 1.248. A statistically significant improvement was noted between the pre-test and post-test (*p*-value = 0.018).

Improvements of individual questions were analyzed separately, as presented in Table 2. Secondary school students learned more about the cause of oral cancer by betel quid, with mean difference of 0.195 ± 0.059, 95% CI 0.078−0.311, and *p*-value = 0.003. They agreed that betel quid is harmful to health, with mean difference of 0.242 ± 0.075, 95% CI 0.092−0.392, and *p*-value = 0.003. They also learned more about the effect of betel quid on heart, the relationship of chewing betel quid and saliva stimulation. Moreover, the effect of betel nuts on pregnancy with mean difference of 0.238 ± 0.087, 95% CI 0.065−0.410, and *p*-value = 0.007.

From the attitude results, lectures had a significant impact on their knowledge to recognize that chewing betel quid is harmful. However, despite educating, both primary and secondary school students didn't gain motivation on stopping others from chewing betel quid, with *p*-value of 0.673 and 0.491 respectively as shown in Fig. 2.

4. Discussion

Betel quid is a well known carcinogen that is very prevalent in the Pacific islands. Betel quid consumption in Papua New Guinea is more widespread than drinking alcohol, smoking tobacco or consuming caffeine.[11] Various reports revealed that habituation and addiction to betel quid often started in very young age in PNG.[2,3]

Despite the wide use of betel quid among students, Pratt pointed out that 89.2% of school student in the Solomon Islands,[12] and 97.1% of betel nut consuming students are aware of the fact that betel quid is causing oral cancer. In our study, the awareness that betel quid causing oral cancer was much lower in PNG, only 81.0% in primary school and 76.9% in secondary school participants. Moreover, both groups knew little about other disadvantages caused by chewing betel quid. In our observation, many students think that the betel nut is "green gold", and it is good to their health and can provide energy to work. The results indicated that to reduce the very high incidence and mortality of oral cancer in Papua New Guinea, education programs to the primary and secondary school students are urgent. By providing a short lecture, we enabled secondary school students to perceive the potential risk of this substance, therefore preventing them from such habit.

The test in overall knowledge of primary school students failed to show statistical significance in our study. There are some reasons which can explain the result. First of all, the designs of educating program need to be improved to attract primary school students. Secondly, the 30 min-educating program was too short. Because for most of the students, it was the very first time they have heard of disadvantages of chewing betel quid to health. Buischi et al. suggested that more comprehensive educating program worked better in educating dental health among school children at the age of 13 in Brazil.[13] Haleem et al. revealed promising outcome of teacher-led and peer-led strategies in improving oral health knowledge among 10−11 years old students.[13,14] School children often started experimenting chewing betel quid with their family members,[15] it was reasonable to involve not only school children but also their parents in the educating program. Therefore, we suggest a more comprehensive education programs including videos, longer time frames, repeating teaching by expert-led, and peer-led strategy in the future.

We expected that after education could improve knowledge. However, the effect of the disadvantages of chewing betel quid showed statistically significant decreased from 0.810 to 0.590 in primary school students. One plausible reason for this paradoxical result is because the way that the question stated was in a negative way, and this could have caused the primary school students to perceive the question in a wrong way. Misunderstanding would be caused from the complicated and confusing word usage then lead to the unbeneficial results. Therefore, it will be better to avoid negative descriptions in the future questionnaire questions for school students.

According to Senn et al.'s cross-sectional survey done in the Madang Province, PNG,[16] 94% of pregnant woman chew betel quid. Surprisingly, the main reason was mainly for preventing morning sickness (28%) and smelly mouth (26%), rather than being addict (10%). Demographic and Health Survey done in 2006 indicated that 10.4% of all females aged 15−19 had at least one child in PNG.[17] Various researches done in Taiwan

pointed out the relationship between betel quid chewing and adverse birth outcome.[18,19] A multi-centre retrospective study of 1264 new-borns in Taiwan revealed a 2.40 fold of low birth weight and 3.67 fold of full-term low birth weight among maternal betel quid chewing individuals.[20] Similar results were seen in the researches done by Senn et al. and Costa et al. in PNG.[16,21] Thus, it is necessary to emphasize the effect of pregnancy in school age. In our study, both primary and second school student showed significant improvement on understanding the effect of betel quid on pregnancy after the educating program.

Despite improvement in knowledge, the result of motivating school children to stop others from chewing betel quid was discouraging. Knowledge can be improved, but attitude is hard to change. In the primary school students, there was a decrease in motivation of willingness to quit betel and discourage their family or friends. Although the scores of motivation are decreased from 0.640 to 0.611, they were not statistically significant with p-value = 0.673. Therefore, there was no significant evidence to support the scores decreased after 30 min lecture. Meanwhile, from the results of the secondary school students, the scores of motivation are decreased from 0.815 to 0.764, and they were not statistically significant with p-value = 0.491. Therefore, there were also no significant evidences to support the scores decreased after 30 min lecture. One possibility is that children were influenced by their parents into believing that betel quid should always be chewed because there are positive effects. So, if someone thinks that betel quid is negative to your life, they are grouped to be wrong. Therefore, the children's motivation to discourage their family to stop chewing betel quid decreases. Another possible reason for the discouraging results could link to the fact that the speech sessions were too short. Because so, the students were not able to fully understand why chewing betel quid has to be stopped. Also, due to betel quid being embedded to the native culture, to change the perspective or the people from PNG is very difficult. Betel nut consumption is closely linked with speechmaking, authority and politics in Papua New Guinea.[22] Along with fish, banana, and sweet potato, betel quid is one of the most important locally produced items in the diets of people from PNG.[23] Gibson reported that 25.4% of the population in PNG received income from betel quid in 1996.[24] The total income from betel was as much as 9.5% of total agricultural income by that time.[25] Since betel quid has an important cultural, social, and economic role in PNG, it was never a habit easy to abstain. To solve such a complicated problem in PNG, we know it is still a long way to go but the only solution is through education to the students, as younger as possible. However, even though the time of education program is too short, the school children can still gain some healthy concepts from it and start to think about the disadvantages of betel quid.

From the 30 min education sessions we conducted on the students, many results showed improvements in knowledge in both primary and secondary school students as shown in Tables 1 and 2. In the primary school questionnaire, there were 5 questions that had improvements: can betel quid cause oral cancer, will chewing betel quid cause throat cancer, do you think chewing betel quid is harmful to your health, do you think chewing betel quid will increase your capacity to study, and does chewing betel quid have any effect on pregnancy. In the secondary school questionnaire, there were 6 questions that had improvements: can betel quid cause oral cancer, will chewing betel quid cause throat cancer, do you think chewing betel quid is harmful to your health, how does chewing betel quid affect the heart, do you think chewing betel quid can stimulate your salivation, and does chewing betel quid have any effect on pregnancy. Because of how much improvement was shown from the students in such a short time of education, we can conclude that this is the most cost-effective way to prevent betel quid chewing.

4.1. Study limitations and future research suggestions

There were some limitations to this pilot study. Firstly, the sample size was too small, with limited schools being tested. The sample size included 100 primary school students in grade 4, and 65 secondary school students in grade 10. However, we did get one public school (Markham Road Primary School) and one private school (Koiari Park Adventist Middle School) that helped to avoid some sample bias. Secondly, the native ways of living are hard to change. Because betel quid is very commonly used among all populations of PNG, it has not only become a regular source of food but also a cultural item. Thirdly, there was a language barrier. English was the second language for most students in PNG, and second language for most informers as well. To break the obstacle and enforce the presentation, we had professor Mu-Kuan Chen and a volunteer Gene Chen whose mother tone is English to be lecturers. Finally, the presentations may not have been something students were generally interested about, even though the preparation of figures and power point text had been well prepared. From our study, we have found that the shorter attention span of students and perhaps the lack of interest towards the lectures was a problem.

There are ways to broaden our pilot study in future research. Firstly, more in depth studies where specific people can be chosen to do the survey for different results will allow more specific results to be found. The specific categories will allow more detailed information to be known. Secondly, a larger sample size would also help to ensure the results are trustable. More surveys should be conducted among people. Thirdly, students can be put into smaller groups with increased education time for each lecture. The lectures can be directed into small groups of 10–20, effectively reducing the class size so students can ask questions and understand the information better. With more time, more information can be taught and digested by the students. Fourthly, we can add more performance enhancing details and fun educational activities instead of lectures. Finally, the main future goal should be to expand this education program broader and larger for all places in PNG to prevent betel quid chewing.

In conclusion, betel quid plays an important cultural, social, and economic role in PNG, so it was never a habit easy to

abstain. Our pilot study showed that by a simple education program, it improved the knowledge among both primary school students and secondary school students. Considering the high prevalence and mortality of oral cancer in Papua New Guinea, a more effective school-based education program should be launched as soon as possible to further improve the knowledge of both children and adults in PNG nation-wide, and help them gain motivation to stop the harmful habit of chewing betel quid.

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