



Areca nut use and its association with health risk perception among youth population in China

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Abstract

This study aimed to explore the use behaviors of areca nut, associated risk perceptions, and their relationship in the Chinese youth population. A total of Chinese youth aged 18-24 participated in an online survey using a self-administered questionnaire. The analysis revealed that while the overall rate of current areca nut use was low, a higher proportion of young males reported both current and prior use compared to females. The primary motivations for using areca nut included its perceived refreshing effects and stress relief, while curiosity and social sharing were the main reasons for trying it. Participants showed limited awareness of certain health risks, such as its potential to cause gastric inflammation, perforation, and malnutrition, compared to its oral health hazards. Insufficient knowledge of these health risks was identified as a key driver of areca nut use, alongside other factors such as smoking, alcohol consumption, and residing in areas where areca nut production and processing are prevalent. The findings highlight areca nut use as a growing health concern among Chinese youth, with use behaviors closely tied to risk perceptions. Targeted educational efforts to raise awareness about the harms of areca nut are crucial to addressing this issue.

Keywords: Areca nut use, Risk perception, Youth health education.

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1. INTRODUCTION

Areca nut is the fruit of the areca tree of the palm family and contains arecane, the fourth most commonly used psychoactive substance in the world, next to nicotine, alcohol, and caffeine (Gupta & Warnakulasuriya, 2002), which is used by approximately 600 million people worldwide. The International Agency for Research on Cancer (IARC) has classified areca nut as a Group 1 carcinogen on its list of carcinogens. Previous studies have shown mutagenic and genotoxic effects of areca nut extracts (Chang, Kuo, Chen, Lin, Hua, Chen & Ko, 2017), and oral diseases in humans (e.g., oral cancer, oral leukoplakia, oral mucosal fibrosis) have been also proved to be associated with areca nut use (Hernandez, Zhu, Goodman, Gatewood, Mendiola, Quinata, & Paulino, 2017). Areca nut also affects several human systems, such as the digestive (Chuang, Wu, Yu, Wang, Lu, Wu, Kuo, Wu, & Wu, 2017), reproductive (Huang, & Jiann, 2017), cardiovascular (Wei, Chou, Yang, Chou, Lu, Chang, & Wu, 2017), nervous, and endocrine systems (Joo, Newcombe, Nosa, & Bullen, 2020). The public health problems associated with areca nut use need to be taken seriously.

Areca nut use is predominantly popular in the South Asian subcontinent, Southeast Asia, and some Pacific islands (Joo, Newcombe, Nosa, & Bullen, 2020). A study in Parsa district, Nepal, surveyed 1,359 students aged 15-18 and the areca nut use rate reached 30.4% (Wazir, Arora, Kapoor, Jayam, Sharma, & Rastogi, 2017). In a survey conducted in Myanmar, 84% of respondents used tobacco while chewing areca nuts (Papke, Bhattacharyya, Hatsukami, Moe & Glatman, 2020). In a 2011-2015 study, the prevalence rate of areca nut use in Guam was 11% within five years, while the prevalence rate in the rest of the Mariana Islands population increased from 7% to 11% in five years (Paulino, Hurwitz, Ogo, Paulino, Yamanaka, Novotny, Wilkens, Miller, & Palafox, 2017). A survey of school-age children in Indore, India, found that about 27% of children had an areca nut use habit (Khandelwal, Khandelwal, Saha, Khandelwal, Prasad, & Saha, 2012). In China, areca nut is mainly produced in Yunnan, Hainan, and Taiwan (Khandelwal, Khandelwal, Saha, Khandelwal, Prasad, & Saha, 2012), but the main prevalence is in Hunan (Zhuo-jia, 2011). A study in Taiwan, China, surveyed 5,343 high school students and the rate of areca nut use was 3.0% (B Huang, & Zachar, 2020).

In terms of factors influencing areca nut use behavior in young people, previous studies have focused on gender, smoking, alcohol consumption (Wang, Tsai, Huang, & Hong, 2003; Tsai, Wong, & Chen, 2002), ethnic background (Wazir, Arora, Kapoor, Jayam, Sharma, & Rastogi, 2017; Tsai, Wong, & Chen, 2002; Yen, Yang, Su, Wang & Lan, 2009), urbanization rate (Wang, Tsai, Huang, & Hong, 2003, family situation (Hussain, Zaheer & Shafique, 2017), school type (Abraham, Cash, Durand, Denholm, Moadsiri, Gopalani, & Johnson, 2018) and so on. The studied population was concentrated in a small number of areas, with limited numbers and inconsistent findings on the role of each factor (B Huang, & Zachar, 2020), and studies on the health risks perception of areca nut are particularly limited. In terms of target selection, studies have been conducted with adolescents (Paulino, Ettiienne, Novotny, Wilkens, Shomour, Sigrah, Remengesau, Johnson, Alfred, & Gilmatam, 2017), secondary school students (Pokhrel, Dalisay, Pagano, Buente, Guerrero, & Herzog, 2019), young adults [22] or people aged 15 and older (Yang, Dang, Yu, He, Shi, Yi, Gao, Li, Zhou, & Ma, 2022). However, as a bad habit, young people aged 18-24 are more likely to try or adopt it as the restraint goes from strong to suddenly weak. Given that improving the health risks perception of areca nut among youth has important impacts on early prevention and reduction of the incidence of oral cancer and oral mucosal fibrosis (Chang, Kuo, Chen, Lin, Hua, Chen, & Ko, 2017), this paper investigates the use of areca nut in a group of Chinese youth aged 18-24 and explores the

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association between the health risks perception of areca nut and areca nut use behaviors, to provide evidence to further improve health behaviors associated with areca nut use in the youth population.

2. METHOD AND MATERIALS

2.1. Data collection instruments

Based on previous studies (Pokhrel, Dalisay, Pagano, Buente, Guerrero, & Herzog, 2019; Yang, Dang, Yu, He, Shi, Yi, Gao, Li, Zhou, & Ma, 2022; Chen, & Shaw, 1996; Chatterjee, Gupte, & Mandal, 2022), an online cross-sectional survey was conducted through the Wenjuanxing platform investigating areca nut use and health risk perceptions of areca nut. More than 1,200 questionnaires were collected and 792 valid questionnaires were screened, with a valid rate of 64.39%. 127 (16.04%) of those surveyed had eaten areca nut and 16 (2.02%) had the habit of chewing areca nut (i.e. not just trying it once or twice).

The first part of the questionnaire included gender, education, smoking, alcohol consumption, place of birth, and place of regular residence. Due to its special geographical location and historical and cultural reasons, Hainan in China has become the main source of areca nut and Hunan has become the place of consumption. Therefore, this paper classifies birthplace and regular residence into two categories: Hunan-Hainan (where areca nut is produced and processed) and non-Hunan-Hainan (where areca nut is not produced and processed). The second part of the questionnaire is about areca nut use behavior, including whether or not they use areca nut, the age at which they first tried areca nut, the frequency of areca nut use, the reasons for starting to use areca nut, and the reasons why some people quit using areca nut. The frequency of areca nut use was divided into three categories, including regular use (three times a week or more), occasional use (twice a week or less, total use more than three times), and only a few times (other cases). According to behavioral theory, the study classifies the factors influencing young people's areca nut use into four categories: subjective experience: the subjective feelings of young people about areca nut use (for instance, not tasty, stress relief, unconscious habit); objective effects: the objective effects of areca nut use on young people's physiology (for instance, physical discomfort, refreshment, thirst relief); social needs: reflecting the influence of the surrounding social environment on university students (for instance, social needs or family members not allowing them to eat); material conditions: showing the influence of the youth's economic ability and other conditions on areca nut use (for instance, economic accessibility).

The third part of the questionnaire was on the health risks perception of areca nut. The assessment of risk perceptions was based on a study by Nilesh et al (Chatterjee, Gupte, & Mandal, 2022), in which seven questions related to the possible diseases caused by areca nut and three related distracting options were set based on oral diseases due to mechanical damage caused by areca nut use, oral diseases caused by chemicals in areca nut and other chronic diseases. Seven of the questions related to perceptions of health risks were answered with "disagree", "don't know" and "agree" (see Table 1). The subject of the study was a group of young Chinese people aged 18 to 24.

Table 1.
Scoring of health risk perception of areca nut of survey samples

Serial number	Question	Point
1	Areca nut chewing turns teeth yellow and black	1 point for agree; 0 point for disagree; 0 point for don't know
2	Areca nut chewing causes inflammation and swelling of the roots of the teeth	1 point for agree; 0 point for disagree; 0 point for don't know
3	Areca nut chewing causes widening and enlargement of the face	1 point for agree; 0 point for disagree; 0 point for don't know
4	Areca nut chewing causes inflammation and perforation of the gastric mucosa	1 point for agree; 0 point for disagree; 0 point for don't know
5	Chewing areca nut can cause oral cancer	1 point for agree; 0 point for disagree; 0 point for don't know
6	Areca nut chewing causes dental calculus	1 point for agree; 0 point for disagree; 0 point for don't know
7	Areca nut chewing impairs taste nerves and saliva production	1 point for agree; 0 point for disagree; 0 point for don't know

2.2. Statistical analysis

Excel 2016 software was used to input and establish the database and conduct the preliminary screening, and SPSS 26.0 statistical software was applied to data analysis. The statistical data were described as rates or percentages. In this paper, frequent and occasional users are defined as areca nut users, while those who have tried areca nut only a few times are classified as non-users. The χ^2 distribution between whether or not to use areca nut with the survey respondents' basic information (whether they drink alcohol, smoke, and so on), health risks perception of areca nut, and preference for receiving publicity on the health hazards of areca nut was also tested separately. For further multifactorial analysis, frequency of areca nut use was used as the dependent variable (never used areca nut = 0; only tried a few times = 1; occasional areca nut use = 2; frequent areca nut use = 3), and the association of areca nut use behavior was analyzed using ordered logistic regression analysis with a test level of $\alpha = 0.05$ and the independent variables assigned in Table 1. In this paper, health risk perceptions were assigned a value (disagree = 0; don't know = 0; agree = 1), and a correct rate was calculated for each item (correct rate = number of people agreeing/total number of people), reflecting the survey sample's perception of each health risk associated with areca nut use, and an ordered logistic regression analysis was carried out with the total score.

3. RESULTS

3.1. Basic information

Of the 792 people who responded effectively, 558 (70.45%) were male and 234 (29.55%) were female. For different educational levels, there were 45 junior college students, 693 undergraduate students, 39 master's degree students, and 15 PhD students. There were 30 people (3.79%) born in areca nut production and processing areas and 762 people (96.21%) born in non-areca nut production and processing areas; 12 people (1.52%) had their regular residence in areca nut production and processing areas and 780 people (98.48%) had their regular residence in non-areca nut production and processing areas (Table 2).

Table 2.

Basic information about the surveyed population

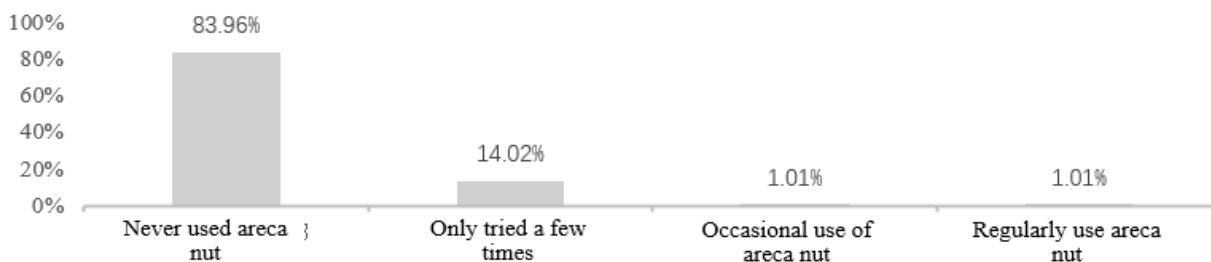
	Gender		Education background				Hometown		Regular residence	
	Male	Female	Junior college student	Undergraduate Student	Master's degree students	PhD students	Areca nut production and processing area	Non-areca nut production and processing area	Areca nut production and processing area	Non-areca nut production and processing area
Number of people	558	234	45	693	39	15	30	762	12	780
Proportion %	70.45%	29.55%	5.68%	87.50%	4.92%	1.89%	3.79%	96.21%	1.52%	98.48%

3.2. Areca nut use behavior

A total of 127 people (16.04%) of the 792 valid questionnaires had used areca nut. Of these 127, 111 (87.40%) “only tried a few times”, 8 (6.30%) had “occasional use of areca nut” and 8 (6.30%) “regularly use areca nut”, with an ongoing use (occasional and regular use) rate of 2.02% (Figure 1). There were 558 (70.45%) males, of whom 90 (16.13%) had used areca nut 16 (2.87%) used it regularly or occasionally, and 234 (29.55%) females, of whom 37 (15.81%) had used areca nut and 0 (0%) used it regularly or occasionally. Male use rate was significantly higher than females, the difference was statistically significant (Fisher exact probability method: $P=0.005$). Of the 127 areca nut users, 18 (14.17%) first used areca nut at an age less than or equal to 12, 13 (10.24%) first used areca nut at an age between 13-15, 40 (31.50%) first used areca nut at an age between 16-18 and 56 (44.09%) used areca nut at an age 19. The majority of the youth group was exposed to areca nuts after the age of 16, especially after adulthood.

Figure 1.

Areca nut use behavior of the survey sample.

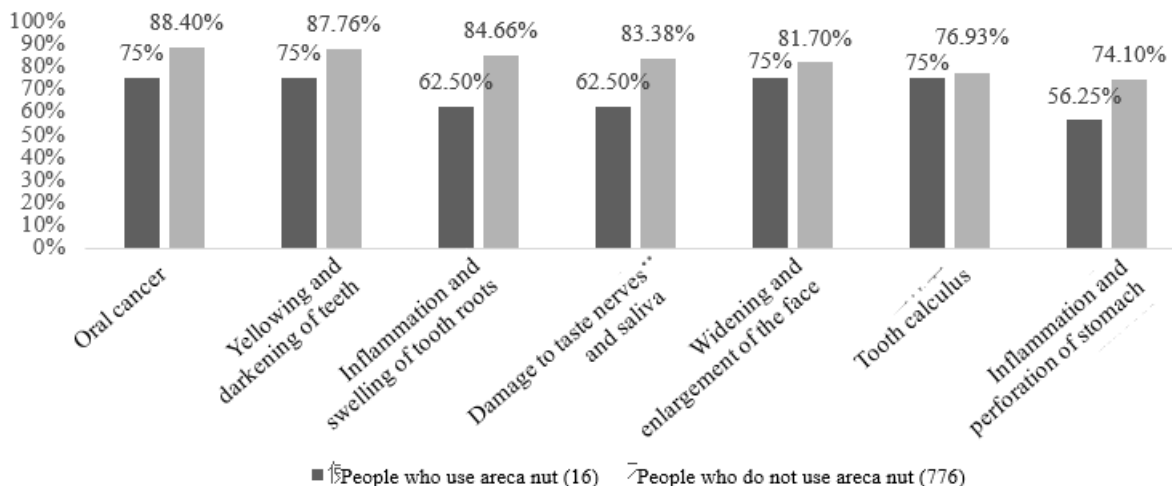


The most common reasons for trying areca nut for the first time were “curiosity” (55.47%) and “areca nut handed to me by others” (47.66%), while “bought after seeing the ad campaign”, “people around me are eating it” and “other” accounted for only 4.69%, 13.28%, and 6.25% respectively.

The most important reasons for using areca nuts were “refreshing” (82.35%), “release stress” (70.59%), and “quenches thirst and refreshes the mouth” (52.94%), while “social need”, “just a habit”, “good for health” and “other” only accounted for 29.41%, 29.41%, 23.53%, and 11.76% respectively (Figure 2).

Figure 2.

Composition of reasons for the first time and regular use of areca nut in the survey sample.



3.3. The association between areca nut use behavior and perceived health risks of areca nut

Logistic regression models were statistically significant with frequency of areca nut use as the dependent variable (never used areca nut = 0; only tried a few times = 1; occasional areca nut use = 2; regular areca nut use = 3) and total health risk perception score as the independent variable (chi-square = 138.847, P = 0.000). The results showed that smoking, alcohol consumption, geography, gender, and health risk perception scores all showed statistical differences, while educational attainment showed no statistical difference. The frequency of areca nut use was higher among smokers, alcohol drinkers, those born or regularly lived in areca nut production and processing areas, and males, and the standardized regression coefficient for the health risk perception score was negative, indicating that those had a better health risks perception of areca nut were less likely to use areca nut (Table 3).

Table 3.

Logistic regression analysis of the association between areca nut use behavior and areca nut risk perception scores among Chinese youth

	Coefficient	Standard deviation	Statistical magnitude	p	95% confidence interval
Areca nut health risk perception score	-0.123	0.046	7.220	0.007	(-0.213, -0.033)
Education level	-0.027	0.218	0.015	0.902	(-0.463, 0.409)
Gender (female as reference)	0.586	0.248	5.575	0.018	(0.100, 1.072)
Smoking (non-smoking as reference)	1.394	0.191	53.528	0.000	(1.020, 1.767)
Alcohol consumption (non-drinking as reference)	0.802	0.207	15.050	0.000	(0.397, 1.207)
Place of birth or residence (place of areca nut production and processing as reference)	-1.874	0.381	24.202	0.000	(-2.620, -1.127)

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4. Discussion and Conclusion

The research on areca nut has multiple implications for China. Areca nut is a traditional food and medicine in China, with a long history and rich folk culture. Areca nut is endowed with profound social meanings in some regions of China, such as Hunan, Hainan, Taiwan, etc., where it is an essential item for rituals, sacrifices, weddings, and other occasions. Areca nut is also one of the important economic crops in China. In 2019, the total output value of the areca nut industry was close to 100 billion yuan, providing employment and income sources for local farmers and enterprises. But at the same time, areca nut is also an addictive and carcinogenic substance, posing a threat to public health and hygiene. Therefore, conducting in-depth research on the areca nut can not only explore its medicinal value and cultural connotations but also formulate reasonable management policies and regulatory measures to promote the healthy development of the areca nut industry and the health protection of consumers.

The ongoing use of areca nut in the survey sample was 2.02%, a result close to that found in Taiwan, and China. The ever-attempted rate of areca nut use was 16.04%, with 75.59% of ever-attempted users being exposed to areca nut between the ages of 16-19. The majority of areca nut users started to try it in their youth, similar to previous studies (Wang, Tsai, Huang, & Hong, 2004). Areca nut use among youth has become a public health problem that cannot be ignored. Youth's first use of areca nut is mainly related to personal subjective factors (curiosity), and social behavior (areca nut handed by others). Curiosity is the main reason for young people to try areca nut (Wang, Tsai, Huang, & Hong, 2004). In addition, the behavior of young people who try areca nut may also be related to psychological factors such as impulsiveness and self-control (Chen, & Waigandt, 2009), and a statistical association between areca nut use and ARTS scores has been found (BHuang & Zachar, 2020); young people who are using areca nut consider the subjective experience to be key, followed by social need, with little influence from economic accessibility.

There is still a large unknown space for young people to understand the health risks brought by areca nuts. The health risks perception of areca nut is rarely mentioned in previous studies. This study shows that the risk perception score of areca nut use among young people affects the rate of areca nut use, and those with poor risk perception scores have higher rates of areca nut use. Therefore, it is necessary to strengthen public education on the health risks of "excessive areca nut chewing is harmful to health" through various media, medical institutions, and primary and secondary school students' health textbooks. In particular, health promotion programs should be designed and implemented for high school students and college undergraduates aged 16-19 who have first contact with areca nut products to popularize health knowledge related to areca nut. In addition, geography, smoking, alcohol consumption, and gender were also factors that influenced areca nut use among young people. Males were more likely to use areca nuts than females, which is consistent with previous studies by (Hussain, Zaheer, & Shafique, 2017); (Wang, Tsai, Huang & Hong, 2003); and (Heck, Marcotte, Argos, Parvez, Ahmed, Islam, Sarwar, Hasan, Ahsan, & Chen, 2012). It was also found that those whose hometown or regular residence is in the production and processing area of areca nut had a higher frequency of use than those in other provinces, which is possibly due to the long history of areca nut use and cultivation in Hainan (2020) and cultural influences that led to higher rates of use among youth in both provinces. In this study, areca nut use was associated with higher rates of smoking and drinking, and those who smoked and drank had a higher frequency of areca nut use, which is consistent with previous studies (Wang, Tsai, Huang & Hong, 2003; Tsai, Wong, & Chen, 2002). This suggests that interventions for youth health risk factors could be considered comprehensive interventions targeting high-risk groups.

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The main limitations of this study are that the study did not cover all provinces in China due to the limitations of the survey methodology and that the proportion of youth participating in the survey in different provinces could not be controlled. Correspondingly, the use of the areca nut itself has significant regional characteristics, so the sample of this study could not fully represent all youth in China. Specifically, in this study, the samples from Jilin accounted for a high proportion, while Jilin, as a northern province, had a relatively low areca nut use rate, which would inevitably lower the areca nut use rate of the whole survey sample. At the same time, due to limitations in the data collection methodology, a small group of youth aged 18-24 who were not involved in university education were not included in this study because they could not be covered, leaving some youth populations with other behavioral and demographic characteristics to be excluded. Another limitation of this study is that no time limit for those who have tried to access areca nut. For those who have had early contact with areca nut, there may have been a greater recall bias due to the longer period, resulting in inaccurate measurements of behaviors related to the use of areca nut. In addition, the validity rate of this questionnaire (64.39%) was low. In future studies, data on the number and frequency of areca nut consumption among youths and the reasons for initiating this behavior could be collected more precisely to provide further insights.

The results of this study suggest that low perceptions of the risk of areca nut in youth groups may increase the likelihood of areca nut use and that youth from areca nut producing and processing areas are also more likely to use areca nut; In addition, this study reaffirms that smoking and alcohol consumption are influential factors in areca nut use, which is consistent with previous studies (Wang, Tsai, Huang, & Hong, 2003; Tsai, Wong, & Chen, 2002). Areca nut use has become a persistent health-related problem in the youth population (BHuang & Zachar, 2020), and government interventions in public health education should be strengthened to enhance the youth population's awareness of the association between areca nut use and diseases such as digestive system, oral cancer and oral mucosal fibrosis (Hernandez, Zhu, Goodman, Gatewood, Mendiola, Quinata, & Paulino, 2017), and to improve the youth population's ability to perceive the health risks of areca nut use to reduce the youth population's dependence on areca nut

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