

Behavioral and Psychosocial Risk Factors that Lead Individuals to Initiate and/or Maintain Betel Quid Chewing in Developed and Developing Countries: A Systematic Review

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ABSTRACT

Background: Betel quid (BQ) is the fourth most commonly used psychoactive substance and its use is highly prevalent among southeast Asian countries due to the influence of psychosocial, behavioral, and environmental factors. As a result, even young children and women are becoming addicted and find it difficult to achieve long-term abstinence. Systematic research addressing the influence of behavioral and psychosocial factors on BQ chewing is scarce, hence pointing to the need for understanding the interplay of these factors to develop tailored intervention strategies for BQ cessation.

Objective: The objective of this systematic review is to assess various behavioral and psychosocial risk factors from pre-existing literature that lead individuals to initiate and/or maintain BQ chewing in developed and developing countries.

Materials and methods: The electronic retrieval systems and databases PUBMED [MEDLINE], EMBASE, SCOPUS, WEB OF SCIENCE, GOOGLE SCHOLAR, and SCIENCE DIRECT were searched independently by two authors for relevant articles from January 2011 to July 2021 using combinations of keywords. Primary studies published in English focusing on the behavioral and psychosocial risk factors for BQ chewing were included.

Results: Out of the initial 264 articles searched, 12 articles met the selection criteria. Included studies addressed the influence of behavioral and psychosocial factors toward the initiation and/or maintenance of BQ chewing. Included studies reported that dependent BQ was not able to quit BQ chewing due to habituation, addiction, and withdrawal symptoms. Few social BQ chewers in Southeast Asian countries were not willing to initiate quitting as they considered AN as an important social and cultural identifier and claimed that they could not resist chewing in a peer group, and it has become part of their social life.

Conclusion: In the future, studies should take into consideration behavioral and psychosocial risk factors, which are major barriers toward successful quitting. These factors should be integrated into areca nut cessation guidelines, and there is a need to develop more comprehensive culture-specific intervention approaches to achieve long-term abstinence.

Keywords: Addiction, Areca nut, Behavior, Betel quid, Habituation, Psycho-oncology, Psychosocial determinants.

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INTRODUCTION

Betel quid (BQ) is the fourth most common psychoactive substance used worldwide after tobacco, caffeine, and alcohol. Epidemiological surveys have revealed that globally approximately 600 million people, particularly in Southeast Asian countries, use BQ or areca nut (AN) on a habitual basis.¹ Betel quid commonly known as “pan or paan” is a mixture of AN as the main psychoactive alkaloid, slaked lime, and different flavoring agents with or without tobacco enclosed in a Piper betel leaf. Betel quid preparations vary among different countries, and in a few developing countries like India, tobacco is added to BQ and users ultimately develop nicotine dependence. Areca nut use is prevalent in 20–40% of the population above 15 years of age in India, Nepal, and Pakistan, which may be due to psychosocial factors, religious beliefs, and addiction.^{1,2} As early as the 15th century, BQ use has gained wide social acceptance, especially in the South Asian region, and has been described as a luxury food item that is most often consumed as a symbol of royalty. An offering of AN/BQ and its juice has become a common practice in social gatherings and religious ceremonies, as a result, even women and young children are becoming addicted and find it difficult to quit the habit.³ Murphy et al. revealed that BQ chewing is a learned behavior embedded within the culture, which is influenced by other chewers. This supports the social cognitive theory in which people learn through observation of

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others, and most of the users learned that chewing BQ is acceptable behavior in social gatherings.⁴ Substance dependence that is characterized by tolerance, craving, withdrawal symptoms, and drug-seeking behavior prevalent in habitual BQ chewers is another factor responsible for addiction. Few BQ chewers have reported a decrease in stress, feeling of well-being, heightened alertness, and enhanced body relaxation after BQ consumption. As a result, despite being aware of negative consequences on general health, users continue to chew BQ, and many of them relapse during the quitting process.⁵

Preclinical studies have demonstrated that arecoline acts on the brain's reward pathway and stimulates the release of dopamine in the ventral tegmental area, due to which users lose control over BQ use and in the need of psychoactive effects to carry out daily activities, they find it difficult to achieve long-term abstinence.^{6,7} In addition, AN has been studied to possess medicinal properties, and in India, it is being used as an alternative treatment for cough, asthma, diabetes, impotence, leprosy, and tooth pain.⁸ In 2004, International Agency for Research on Cancer (IARC) and World Health Organization (WHO) have classified BQ with or without tobacco as a group I carcinogen. Literature has been documented as a single etiological factor for the development of oral submucous fibrosis and an increased risk of oropharyngeal cancer when the BQ contains tobacco as an additive.⁹ Due to the adverse consequences of habitual BQ use, it is important to recognize the etiological factors responsible for the initiation of habit, to understand the interplay of behavioral and psychosocial factors contributing toward substance use behavior, and to develop effective BQ cessation strategies to motivate and support BQ user to make successful quit attempts. Therefore, the objective of our review was to assess published literature on behavioral and psychosocial risk factors that lead individuals to initiate and/or maintain BQ chewing.

MATERIALS AND METHODS

Search Protocol (Search Strategy and Data Extraction)

A systematic review of the literature was done to evaluate published literature on behavioral and psychosocial risk factors that lead individuals to initiate and/or maintain BQ chewing in developed and developing countries. The electronic retrieval systems and databases PUBMED [MEDLINE], EMBASE, SCOPUS, WEB OF SCIENCE, GOOGLE SCHOLAR, and SCIENCE DIRECT were searched independently by two authors for relevant articles from January 2011 to July 2021 using combinations of the following keywords: areca nut, betel nut, betel quid chewing, behavior, culture, gutka, *gutkha*, ghutka, habit, psychosocial determinants, and quid. The inclusion criteria were publications reporting primary studies focussing on the behavioral and psychosocial risk factors that contribute toward the initiation and/or maintenance of BQ chewing habit and written in English. The exclusion criteria were commentaries, short communications, literature reviews, case reports, and studies in other languages. [Flowchart 1](#) shows the search strategy for inclusion of eligible studies in this systematic review and 12 studies met our inclusion criteria.^{4,6,8,10-18} The abstracts of the papers were individually screened by authors, and after a full-text review of eligible articles, only 12 met our inclusion criteria. Any disagreement was resolved by a mutual discussion between the authors. [Table 1](#) summarizes 12 eligible studies discussing the behavioral and psychosocial risk factors contributing toward the initiation and/or maintenance of BQ chewing habits in developed and developing countries based on PICO format (P- Population, Patient or Problem, I-Intervention

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or Exposure, C-Comparison, O-Outcome), with detailed information on study design, aims and objectives, results, and conclusion.

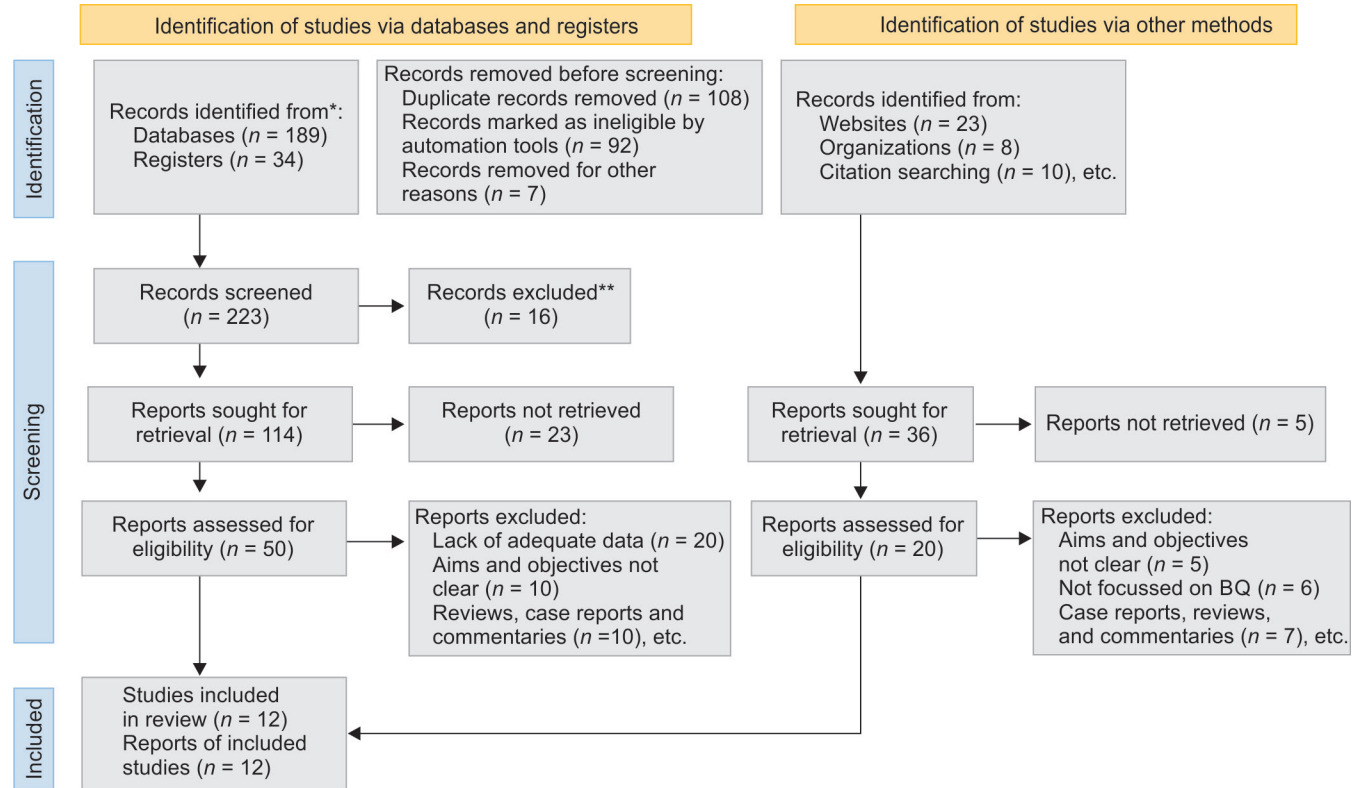
Risk of Bias and Methodological Quality Assessment

[Table 2](#) shows risk of bias and quality assessment across twelve observational cross-sectional studies by Newcastle-Ottawa Scale (NOS).¹⁹ The scale is categorized into three domains as selection of study groups, comparability of groups and outcome. Each numbered item within the selection and outcome categories were awarded one star represented by asterisk symbol (*) and maximum of two stars were assigned for comparability group. A total score ranges from 0 to 9 and was calculated for each study. Risk of bias domains were scaled as high risk of bias (0–3 stars), moderate risk of bias (4–6 stars), and low risk of bias (7–9 stars) indicative of poor-quality studies, medium and high-quality studies respectively. In this systematic review by use of NOS seven studies showed low risk bias scores, five studies moderate risk bias scores, and no study had high risk bias score ([Table 2](#)). [Table 3](#) shows an assessment of the methodological quality of included studies by the JBI critical appraisal tool.²⁰

RESULTS

A total of twelve articles were selected from 223 screened articles for systematic review ([Flowchart 1](#)).^{4,6,8,10-18} All the included studies demonstrated the strong influence of behavioral and psychosocial factors toward the initiation and/or maintenance of BQ chewing. Osborne et al.¹⁰ characterized the psychological effects of BQ intoxication through assessment by electroencephalography (EEG) and found that psychological aspects of perception, such as slowing of prospective time, increased arousal ($p = 0.01$), and perceived ability to think, were strongly influenced by BQ intoxication ($p = 0.05$). Murphy and Herzog¹¹ stated that cultural and social factors have an important role in the determination of the perception of an individual whether he/she is willing to quit. In their study, 50% of chewers ($n = 15$) claimed that chewing BQ was an important cultural identifier, 27% ($n = 8$) felt that there was peer pressure to chew, and 43% ($n = 13$) chewed for socialization. Lin et al.¹² reported that BQ initiation usually occurs during childhood due to cultural/social traditions, and to remain energetic, an individual chews; therefore, integration of comprehensive cessation programs at an individual level is required to achieve successful abstinence from BQ use.

Mawali et al.¹³ elucidated the significant impact of peer pressure and cultural factors in the development of BQ chewing habit, 60% admitted that they were influenced by friends, 62.5% initiated chewing BQ by witnessing other people who habitually chew the quid, and 37.5% said that it was part of their culture and tradition to use AN/BQ. Yen et al.¹⁴ found that BQ-only users had significantly higher scores for confusion and mood ($p = 0.32$), fatigue, anger, tension, and depression ($p = 0.024$) than substance nonusers, and concluded that habitual BQ chewing is associated with a negative mood, however, linkage between BQ use, mood, and personality is ambiguous and requires validation by further innovative researches.

Flowchart 1: Flowchart shows study selection criteria based on the Preferred Reporting Items for Systematic Reviews (PRISMA) guideline

* Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

** If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

Source: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: <http://www.prisma-statement.org/>

Htin¹⁵ revealed that the effect of beliefs on chewing behavior was significantly positive, especially among the rich and poor, and they stated that health education programs should be designed based on a good understanding of the target population, including socioeconomic and wealth status. Murphy et al.,⁴ in another study concluded that culturally appropriate cessation programs should be developed for effective reduction of BQ use as chewing behavior was embedded within their culture, and participants felt disrespected when they do not chew with friends and in social gatherings.

In a survey conducted by Sadath et al.,¹⁶ high BQ dependency was found among indigenous tribes in Wayanad, Kerala, as chewers were aware of the consequences of BQ on their health, but were unable to quit due to severe cravings on making a quit attempt. In addition, BQ was readily available as few shops were in the tribal colonies, few tribal people were engaged in selling AN, and elderly tribes with no regular income tried to get BQ from their family members. Lee and Chang¹⁷ evaluated behavior changes by transtheoretical model (TTM), in which, in the precontemplation stage, chewers showed no motivation to change their behavior due to the need for psychoactive effects of BQ and few chewed to maintain cultural identity. In the action stage, few chewers decided to quit; however, the relapse rate was high in the action stage as they could not resist craving, and even in the maintenance stage, it was expected that chewers might relapse due to temptations such as the aroma of BQ. Huang and Zachar¹⁸ examined the behavioral determinants of BQ chewing and found a higher prevalence in the

participants who were older ($p < 0.001$), were male ($p < 0.001$), who lived with at least a nonbirth parent ($p = 0.003$), had family heads with primary ($p = 0.001$) or secondary level of education ($p < 0.001$), and had a low level of self-perceived physical fitness ($p < 0.001$). They suggested future investigations to understand neurocognitive influences that may lead to BQ dependency.

Sariah et al.⁶ studied neurocognitive influences by the recording of functional connectivity in the brain of habitual chewers by magnetic resonance imaging (MRI). They found that individuals who chronically use BQ have higher functional connectivity of the orbitofrontal cortex and inferior temporal and angular gyri, and this could be related to the craving for betel. Acute effects of BQ are due to an increase in the functional connectivity of the basal ganglia, which is known for rewarding effects contributing toward the initiation and maintenance of habit. Kumar et al.⁸ found high levels of physical and psychological dependence for BQ. Despite being aware that AN can cause oral cancer, the attempted quit rate among participants was relatively low due to the influence of the family member who chewed or they chewed due to peer pressure, hence, there is a need to integrate AN use cessation into the guidelines for cessation.

DISCUSSION

Betel quid chewing is an important practice in India and many Southeast Asian countries highly influenced by culture and

Table 1: Characteristics of included studies about behavioral and psychosocial risk factors contributing towards the initiation and/or maintenance of BQ chewing habit in developed and developing countries based on Population, Intervention, Comparison, and Outcome (PICO) model

| Author (Year) | Country | Aim and objective | Study design | Sample | Results and conclusion | Conclusion |
|----------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Osborne et al. (2011) ¹⁰ | Taidong, Taiwan | To characterize the psychological effect of BQ chewing and subsequent BQ intoxication through assessment by electroencephalography (EEG). | Observational | 31 male chewing gum or BQ chewers of age between 20 and 54 years. | Betel quid intoxication strongly influenced the psychological aspects of perception. When compared to chewing gum taken as control, slowing of the prospective perception of passage of a 1-minute time interval was observed in 8 subjects ($p = 0.05$). Perceived increased arousal ($p = 0.01$) and perceived decreased ability to think ($p = 0.05$) was seen in 31 subjects. The EEG spectral profile recorded from mental states associated with open and closed eyes, and mental tasks such as reading and eyes closed mental arithmetic were significantly modified ($p = 0.05$) relative to chewing gum by betel quid intoxication in 10 subjects. | BQ intoxication is characterized by its rapid onset and short duration. Gross behavioral indices of working memory, simple visual-motor performance was not affected, however, the psychological aspects of perception such as slowing of prospective time, perceived levels of arousal, and perceived ability to think were strongly influenced by BQ intoxication. Further investigatory studies using MRI are recommended to characterize the central effects of BQ intoxication. |
| Murphy and Herzog (2015) ¹¹ | Guam, United States | To examine sociocultural factors that affect the chewing behavior in BQ chewers and ex-chewers. | Cross-sectional | Current BQ chewers ($n = 15$; 6 males and 9 females) who chewed BQ for 3 years at least once a week. Ex-chewers ($n = 15$; 7 males and 8 females) who chewed BQ at least once per week for 3 or more years and have quit chewing for 6 weeks or longer. Age of subjects was 18 years and above. | 43% of chewers ($n = 13$) stated that to chew betel nut is an integral part of rosaries and other ceremonies. 50% of chewers ($n = 15$) claimed that chewing BQ was an important cultural identifier, 27% ($n = 8$) felt that there was peer pressure to chew, 43% ($n = 13$) stated that chewing was important to connect socially. Among ex-chewers, 30% ($n = 9$) stated their medical issues was the main reason that made them to quit the habit, and 53% ex-chewers revealed that cold turkey was used to make them quit. | It was concluded that social and cultural factors have strong influence on BQ chewing, and in determination of perception of chewer if he/she is willing to quit. Chewers were not aware of health issues related to BQ use, however, ex-chewers revealed health issues as the main reason that made them to quit the habit. |
| Lin et al. (2017) ¹² | Taichung, Taiwan | To identify the social, contextual, and cultural factors related to initiation, continuous use, and cessation of BQ chewing. | Cross-sectional | 41 BQ chewers (male $n = 27$, female $n = 14$) with an age range between 22 and 59 years. | Participants stated that BQ initiation usually occurs during childhood and reported cultural/social traditions, to achieve an energetic feeling, and to avoid boredom as the common reasons to chew BQ. Cost of BQ, prohibition to chew at workplace, and dental concerns were the commonly reported reasons for quitting, however, peer pressure and withdrawal symptoms were a frequent barriers for successful quitting. | Integration of comprehensive cessation programs with an aim to address individually regarding the social and cultural impact on chewing behavior is required to achieve successful abstinence from BQ use. |

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| Mawali et al. (2018) ¹³ | Zamboanga City, Philippines | To evaluate the profile of the individuals who generally chew, considering age, ethnicity, and educational attainment, and to determine factors that influence the habit. | Cross-sectional | 40 BQ chewers who had the habit of chewing for at least 1 year. | <p>70% of chewers admitted that it was difficult to get out of the habit, majority of chewers stated that they were influenced by their friends (60%), followed by family (25%), then neighbors (10%), and lastly by classmates (5%) to chew.</p> <p>Regarding chewing frequency, 70% admitted that they were able to chew five (5) or more quid per day; 12.5% twice per day, 10% only chewed once; while the remaining 7.5% chewed after every meal.</p> <p>The cultural influence was observed as 62.5% stated that they were encouraged to start chewing BQ by witnessing other people who habitually chew the quid, while 37.5% said that it was part of their culture and tradition.</p> <p>In terms of the political environment, 100% of the chewers answered that the government has nothing to do with their reason of chewing the BQ.</p> | <p>It was concluded that the tradition and culture is the common reason of practicing the habit, and peer pressure is the most significant factor contributing to the development of BQ chewing habit.</p> <p>Chewers were not well aware about the oral health risks that may occur with BQ use, hence, there is a need of health education program which emphasizes the associated oral health effects of this habit.</p> |
| Yen et al. (2018) ¹⁴ | Kaohsiung, Taiwan | To explore the relationships between BQ chewing, personality, and mood. | Cross-sectional | <p>494 participants (62.6% male; mean age of 49.0 ± 13.1) divided into four groups as:</p> <p>(i) only BQ users, (ii) BQ chewers who smoke and/or drink alcohol, (iii) only smokers and/or drinkers, and (iv) only nonusers.</p> | <p>The mean duration of BQ use was found to be 25.3 ± 12.3 years.</p> <p>BQ-only users had significantly lower scores (1.9 ± 4.34) on extraversion than substance nonusers (7.0 ± 6.5) as defined by DSM-IV and ICD-10 criteria.</p> <p>BQ-only users had statistically significant higher scores on confusion and total mood than substance nonusers ($p = 0.32$).</p> <p>BQ-only users had significantly higher scores on fatigue, anger, tension, and depression than substance nonusers; BQ users who smoke and/or drink, and smokers and/or drinkers only ($p = 0.024$, $p = 0.066$, $p = 0.061$, $p = 0.021$, respectively).</p> | <p>Results concluded that only BQ chewing is associated with low extraversion and negative mood. Understanding of association between BQ chewing, personality, and mood would help in development of tailored interventions to prevent BQ consumption.</p> |

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Table 1: (Contd...)

| Author (Year) | Country | Aim and objective | Study design | Sample | Results and conclusion | Conclusion |
|-----------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Htin (2019) ¹⁵ | Tokyo, Japan | To clarify the association between belief and knowledge and socioeconomic status on BQ chewing behavior. | Cross-sectional | Of 1492 adult participants who chewed BQ, 744 (49.9%) were men, and 748 (50.1%) were women with an age range of 25–64 years. | 904 (60.6%) participants were current betel quid chewers, and 42 (2.8%) and 546 (36.6%) were ex- and non-betel quid chewers, respectively. Results of analysis revealed that the effect of belief on chewing behavior was significantly positive, especially among the rich and poor. The effect of knowledge was significantly negative in part of the middle class, and significantly positive in the rich and poor depending on the levels of beliefs and knowledge. | It was suggested that promoting proper knowledge is an effective way of reducing betel quid chewing behavior in some middle-class people. Health education programs should be designed based on a good understanding of the target population, including socioeconomic status. |
| Murphy et al. (2019) ⁴ | Guam, United States | To assess psychometric effects of sociocultural factors, negative sociocultural influence, internal psychological benefits in a survey developed for betel nut chewers. Secondly, to investigate the influence of sociocultural variables on betel nut chewing behaviors among Chamorro and non-Chamorro Micronesians in Guam. | Cross-sectional | 600 participants Chewers (n = 375) Former chewers (n = 255) Mean age: 35.27 ± 20.44 | Three observed measures used to capture the socio-cultural construct: "I chew betel nut or betel quid because all of my friends chew," "I chew betel nut or betel quid because my family members chew," and "I chew betel nut or betel quid because it is part of my culture were significantly correlated (r = 0.78). Two measures for negative socio-cultural influence: "I am rude not to chew" and "people will not respect me if I don't chew" were significantly correlated (r = 0.88). Three measures used for psychological aspects: "I chew betel nut or betel quid because it relaxes me," "I chew betel nut or betel quid because it gives me energy," and "I chew betel nut or betel quid because I like the way it makes me feel" were significantly correlated (r = 0.86). The variance extracted for each construct (i.e., the common variance shared by the indicators) was above 0.50, this supports the reliability and validity of each construct. | Chewing behavior was found to be embedded within the culture, and participants felt disrespected when they don't chew with friends. Therefore, culture-appropriate cessation programs should be developed for effective reduction of BQ use. |

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| <p>74% of chewers stated that they chewed daily and the average time of chewing betel nut ranged from 1 to 30 times per day. 50.9% of chewers reported that they began chewing because of influences from various family members, that is, parents (56.8%), aunts/uncles (58.9%), brothers and sisters (60%), and other children in the home (19.7%).</p> <p>45.9% of chewers indicated that they began chewing because betel nut was readily available in the home.</p> | | | | |
| <p>Findings revealed different pathways to BQ use, nature of intake and impact, dependence, and access and availability of the BQ in tribal dominant areas. Hence, community education programs are needed for cessation of BQ at a young age.</p> | | | | |
| <p>BQ chewing among tribes was observed to be initiated at a young age, with the influence of the home environment, parental, peer, and spouse-related factors. BQ dependency was seen as many participants were aware of the consequences of BQ on their health, they were unable to quit and experienced severe cravings when they attempted to quit.</p> <p>BQ was readily available as few shops were in the tribal colonies, few tribal people were engaged in selling areca nuts, and elderly tribes with no regular income tried to get BQ from their family members.</p> | | | | |
| <p>The most important reasons for failure to quit BQ chewing were the craving and need of its psychoactive effects; to combat stress and socialization, which requires culture-specific intervention programs for prevention of BQ chewing.</p> | | | | |
| <p>In the precontemplation stage, chewers showed no motivation to change their behavior due to the need of psychoactive effects derived from BQ chewing and few chewed to maintain cultural identity.</p> <p>In the contemplation stage, dependent chewers were aware of oral damage and pain and considered quitting the habit, however, they could not resist cravings.</p> <p>In the action stage, chewers decided to quit; and "to stop immediately" or</p> | | | | |

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Table 1 (Contd...)

| Author (Year) | Country | Aim and objective | Study design | Sample | Results and conclusion | Conclusion |
|---------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Huang and Zachar (2020) ¹⁸ | Minneapolis, United States | To identify social and behavioral determinants of AN consumption among Taiwanese adolescent population. | Cross-sectional | 5343 high school students aged between 15 and 18 years | <p>"reduce quantity" were the most frequent strategies reported. In this stage, chewers tolerated withdrawal symptoms and refused betel quid from others but tended to relapse easily.</p> <p>Participants entering the maintenance stage were not affected by withdrawal symptoms; however, chewers were found to still relapse because they were unable to resist the temptation of BQ.</p> <p>The overall prevalence of AN consumption was 3.0%. Higher prevalence was observed in the participants who were older ($p < 0.001$), were male ($p < 0.001$), who lived with at least a non-birth parent ($p = 0.003$), had family heads with primary ($p = 0.001$) or secondary level of education ($p < 0.001$), and had a low level of self-perceived physical fitness ($p < 0.001$).</p> | <p>AN consumption is addictive and users chew due to social influence.</p> <p>Future investigations into neuro-cognitive influences of risk-taking behavior on AN consumption and social dependence of the habit are recommended.</p> |
| Sariah et al. (2020) ⁶ | Changsha, China | To elucidate the impact of both initial and chronic BQ use on brain functional connectivity assessed through functional brain MRI. | Observational | 24 male BQ-dependent chewers and 28 male controls with mean age for BQ-dependent chewers and healthy controls was 23.5 ± 3.88 years and 24.9 ± 2.60 years, respectively. | <p>Before chewing BQ, higher functional connectivity in BQ-dependent chewers than in controls were found between the temporal, parietal, and frontal brain regions ($p < 0.001$).</p> <p>In control, the effect of acute BQ chewing significantly increased functional connectivity between subcortical regions (including the caudate, putamen, pallidum, and thalamus) and visual brain regions (including the bilateral superior occipital gyrus and right middle occipital gyrus networks), which may relate to the acutely rewarding and visual effects of betel produced by arecoline.</p> | <p>These findings show that individuals who chronically use BQ have higher functional connectivity than controls of the OF cortex, and inferior temporal and angular gyri and could be related to craving for betel.</p> <p>Acute effects of betel quid are due to increase in the functional connectivity of the basal ganglia and thalamus. Basal ganglia is known for modulating the rewarding effects of BQ use and play a role in initiation of habit, thereby contributing toward development and maintenance of addictive behaviors.</p> |

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| <p>In habitual users of betel, networks comprising the right medial orbitofrontal cortex (OFC), right lateral OFC, bilateral inferior temporal gyrus, right angular gyrus, superior parietal gyrus, and right medial superior frontal gyrus had higher functional connectivity as compared to the controls before BQ chewing ($p < 0.001$).</p> | <p>Persistent psychoactive substance use has been linked with impaired brain function which disrupts the ability of self-control over BQ use which ultimately results in addiction.</p> |
| <p>441 (92%) participants chewed AN to derive pleasure and 327 (68%) chewed to relieve stress.</p> <p>86 (18%) of subjects had tried to quit chewing AN and 387 (81%) thought that it was highly addictive.</p> <p>High levels of endorsement for “physical and psychological urgent need” (43%) and ‘increasing dose’ (50%) were observed, whereas endorsement level for “maladaptive use” was low (16%).</p> | <p>Despite being aware that AN can cause oral cancer, the attempted quit rate among participants was relatively low due to influence of the family member who chewed or they chew due to peer pressure.</p> <p>Patient should be communicated about harmful effects of AN on overall health.</p> <p>There is a need to integrate AN use cessation services in the guidelines for cessation, and to develop policy measures on reducing the demand by communication and behavior change strategies.</p> |
| <p>479 chewers of AN alone with or without BQ, <i>guttika</i>, and tobacco, aged range between 18 and 80 years (mean age above 40 years).</p> | <p>High levels of endorsement for “physical and psychological urgent need” (43%) and ‘increasing dose’ (50%) were observed, whereas endorsement level for “maladaptive use” was low (16%).</p> |
| <p>To understand the pattern of AN (tamul) consumption, to determine the knowledge, attitude, and practices (KAP) among AN users and the dependency associated with AN use.</p> | <p>High levels of endorsement for “physical and psychological urgent need” (43%) and ‘increasing dose’ (50%) were observed, whereas endorsement level for “maladaptive use” was low (16%).</p> |
| <p>Mumbai, India</p> | <p>High levels of endorsement for “physical and psychological urgent need” (43%) and ‘increasing dose’ (50%) were observed, whereas endorsement level for “maladaptive use” was low (16%).</p> |
| <p>Kumar et al. (2021)⁸</p> | <p>High levels of endorsement for “physical and psychological urgent need” (43%) and ‘increasing dose’ (50%) were observed, whereas endorsement level for “maladaptive use” was low (16%).</p> |

tradition. Areca nut is derived from a tropical palm tree known as *Areca catechu* and has been suggested as the fourth most commonly used psychoactive alkaloid following tobacco, alcohol, and caffeine.^{21,22} Betel quid preparations differ among various countries, and in different parts of the world, BQ products are not usually chewed but are placed in the mouth or are kept in contact with the oral mucosa. Areca nut contains four major alkaloids namely, arecoline, arecaidine, guvacoline, and guvacine, among these, arecoline is highly psychoactive, is an agonist of acetylcholine muscarinic receptors, and can affect parasympathetic and sympathetic function, hence producing both stimulation and relaxation.²¹ Few chewers have reported that they are not able to quit the habit as chewing provides them a feeling of euphoria, well-being, pleasure, and warmth, and increases their alertness and capacity to work. The neuropsychological activity of BQ has been attributed to arecoline that is responsible for habituation, addiction, and withdrawal symptoms.⁶ Burton–Bradley described three conditions associated with betel chewing, that is, habituation, addiction, and toxic psychosis. They stated that habitual BQ chewers who consumed several to a few AN quids per day find a day without BQ impossible and develop withdrawal symptoms such as headache, anxiety, mood swings, sleep disturbances, craving, and sadness on cessation of the habit.²³ Studies have revealed alteration in brain functional activity in habitual BQ chewers, which supports the neurobiological basis for chewing. Osborne et al.¹⁰ in their study concluded that gross behavioral indices of working memory and simple visual–motor performance were not affected by BQ intoxication; however, the psychological aspects of perception, such as slowing of prospective time, perceived levels of arousal, and perceived ability to think, were strongly influenced by BQ intoxication. Sariah et al.⁶ found that persistent psychoactive substance use has been linked with impaired brain function, which disrupts the ability of self-control over BQ use, and this eventually results in addiction. They suggested that individuals who chronically use BQ have higher functional connectivity of the orbitofrontal cortex and inferior temporal and angular gyri, and this could be related to a craving for betel. Acute effects of BQ are due to an increase in the functional connectivity of the basal ganglia, which is known for modulating the rewarding effects of BQ use and has been studied to have a contributing role in the development and maintenance of addictive behaviors.⁶

Betel quid use is considered a multifactorial behavior with an interplay of social, cultural, and environmental factors. Murphy et al.⁴ suggested BQ chewing as a learned behavior that is influenced by the other chewers, and sociocultural factors have an important role in the initiation and habituation of BQ use. In their study, chewing BQ was regarded as positive and acceptable social behavior, and participants modeled the chewing behavior, which points to the necessity of culture-specific and behavior-change programs. Lee and Chang¹⁷ suggested that BQ use is embedded within the culture in Taiwan, and an individual chews BQ in religious ceremonies and social gatherings to maintain cultural and ethnic identity despite being aware of oral health risks. They used TTM framework to understand behavior changes and to develop tailored cessation programs. Transtheoretical model moves an individual through six stages such as (i) precontemplation (within the next 6 months), an individual is unaware of the negative consequences of BQ on health and is reluctant to change chewing behavior, (ii) contemplation (within the next 6 months), an individual recognizes the harmful effects of BQ use, becomes more thoughtful, and makes an initiative to change his/her behavior, (iii) preparation stage, an individual is

Table 2: Risk of bias and quality assessment across individual cross-sectional observational studies using Newcastle-Ottawa scale

| Sl. no. | Author name and year | Representativeness of sample | | | Selection | | Non-responders | Comparability | | Outcome | | Summary scores |
|---------|----------------------------------------|------------------------------|-------------------------------|-------------|-------------------------------|------------------------------------------------------------------------------------------------|----------------|-----------------------|-------------------|---------|---|----------------|
| | | Sample size | Ascertainment of the exposure | Sample size | Ascertainment of the exposure | The subject in different outcome groups are comparable, based on the study design or analysis. | | Assessment of outcome | Statistical tests | | | |
| 1 | Osborne et al. (2011) ¹⁰ | * | ** | * | ** | - | * | * | * | * | * | 7 |
| 2 | Murphy and Herzog (2015) ¹¹ | * | * | * | * | * | * | * | * | * | * | 7 |
| 3 | Lin et al. (2017) ¹² | * | ** | * | ** | * | - | - | - | - | - | 5 |
| 4 | Mawali et al. (2018) ¹³ | * | ** | * | ** | - | - | - | - | - | - | 5 |
| 5 | Yen et al. (2018) ¹⁴ | * | * | * | * | * | * | * | * | * | * | 7 |
| 6 | Htin (2019) ¹⁵ | * | ** | * | ** | - | * | * | * | * | * | 7 |
| 7 | Murphy et al. (2019) ⁴ | * | ** | - | ** | - | * | * | * | * | * | 6 |
| 8 | Sadath et al. (2019) ¹⁶ | * | * | * | * | * | - | - | - | - | - | 5 |
| 9 | Lee and Chang (2019) ¹⁷ | * | * | * | * | * | - | - | - | - | - | 5 |
| 10 | Huang and Zachar (2020) ¹⁸ | * | ** | - | ** | * | * | * | * | * | * | 7 |
| 11 | Sariah et al. (2020) ⁶ | * | ** | * | ** | - | * | * | * | * | * | 7 |
| 12 | Kumar et al. (2021) ⁸ | * | ** | * | ** | * | * | * | * | * | * | 8 |

Table 3: Assessment of methodological quality of included cross-sectional observational studies by JBI critical appraisal tool

| First Author et al. | Osborne et al. (2011) ¹⁰ | Murphy and Herzog (2015) ¹¹ | Lin et al. (2017) ¹² | Mawali et al. (2018) ¹³ | Yen et al. (2018) ¹⁴ | Hitin (2019) ¹⁵ | Murphy et al. (2019) ⁴ | Sadath et al. (2019) ¹⁶ | Lee and Chang (2019) ¹⁷ | Huang and Zachar (2020) ¹⁸ | Sariyah et al. (2020) ⁶ | Kumar et al. (2021) ⁸ |
|--------------------------------------------------------------------------|-------------------------------------|----------------------------------------|---------------------------------|------------------------------------|---------------------------------|----------------------------|-----------------------------------|------------------------------------|------------------------------------|---------------------------------------|------------------------------------|----------------------------------|
| Study | | | | | | | | | | | | |
| Were the criteria for inclusion in the sample clearly defined? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Were the study subjects and the setting described in detail? | Y | Y | Unclear | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Was the exposure measured in a valid and reliable way? | Y | Y | Unclear | Y | Y | Y | Y | Unclear | Y | Y | Y | Y |
| Were objective, standard criteria used for measurement of the condition? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Were confounding factors identified? | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Were the outcomes measured in a valid and reliable way? | Y | Y | Unclear | Y | Y | Y | Y | Unclear | Unclear | Y | Y | Y |
| Was appropriate statistical analysis used? | Y | Y | N | Unclear | Y | Y | Y | N | N | Y | Y | Y |

Y, yes; N, no

ready to take an action toward change within the next 30 days, (iv) action stage (within the next 6 months), an individual has changed his behavior to stop using BQ, (v) maintenance stage (more than 6 months), an individual makes the best possible effort to sustain the changed behavior and to prevent relapse, and (vi) termination stage, an individual feels confident that he/she will not chew BQ again.²⁴

Lee and Chang¹⁷ in their study found significant changes in the addictive behavior of BQ chewers in the precontemplation, contemplation, action, and maintenance stages. In the contemplation stage-dependent, BQ chewers have started to realize the harmful effects of BQ on oral health that included damage to oral mucosal tissue, oral ulcerations, and dental wear, and became thoughtful toward quitting the habit; however, chances of relapse were found to be high, particularly in action stage, and it was suspected that even in the maintenance stage, chewers might revert to the precontemplation stage due to temptations such as the aroma of BQ. The majority of dependent BQ chewers in the action stage reported that they were unable to quit BQ due to withdrawal symptoms, stress cravings, and need psychoactive effects to feel more energetic. It was suggested that TTM could be used to explain the stages of behavior change among dependent chewers, however, the main challenge was to change the addictive behavior of social-type BQ chewers who claimed that they chew BQ during social events and they find it difficult to quit; hence, it was concluded that there is a need of more in-depth investigation to develop culture-specific intervention programs.

Several studies have addressed the behavioral and psychological dependence on BQ.^{8,14} Kumar et al.⁸ found that BQ with Tamul was commonly chewed by both men and women, and around 441 (92%) chewers reported pleasure when chewing AN, 327 (68%) chewed it to relieve stress, and in 43%, chewers had high levels of physical and psychological dependence. In another study, Yen et al.¹⁴ suggested that arecoline in BQ is central and autonomic nervous system stimulant that negatively affects the mood leading to mood swings, anxiety, and sleep disturbances, and the association of psychological factors with BQ needs to be understood and validated by further researches. Another growing concern is young children and adolescents who are becoming addicted to BQ as they consider AN/BQ as a popular and acceptable product. They get lured by tobacco or *gutkha* advertisements featuring celebrities, by a display of colorful *gutkha* packages in the shop outlets, and some are not able to resist chewing due to social stigma and peer pressure. Adolescent is a crucial period of physical and psychosocial growth, and multiple factors, including family, ethnicity, gender, and culture, play a key role in shaping the behavior of the adolescents.²⁵ Therefore, it is important to recognize the addictive behavior in the adolescence period and to change their perceptions toward BQ chewing.

The impact of socioeconomic status has been elucidated in a study by which beliefs have accelerated the BQ chewing behavior in middle- and low-income countries, and initiation and habituation of chewing BQ depend upon the level of knowledge and beliefs of the rich and the poor people. As a result, health education programs with a focus on the health risks associated with BQ/AN chewing should be organized at both community and individual levels.¹³ Moreover, it is suggested that when AN/BQ is perceived as a symbol of cultural heritage and an important part of social life, quitting becomes a challenging process. Therefore, an in-depth understanding of psychological and cultural risk factors is needed

for the tailored preventive program and to change perceptions of an individual toward BQ.²⁶

CLINICAL IMPLICATIONS

Betel quid has become the most common psychoactive substance and has gained wide social acceptance in Southeast Asian countries such that even youngsters and women are becoming addicted to it and find it difficult to quit the habit. Betel quid use is considered a multifactorial behavior with an interplay of social, cultural, and environmental factors. Behavioral and sociocultural factors have an important role to play in initiation and continuation of habit. As a result, the majority of chewers consider chewing BQ/AN as a necessity to maintain socialization and cultural heritage and despite of being aware of the negative consequences on oral and systemic health, they find it difficult to resist chewing. Hence, tailored BQ cessation programs with a focus on the health risks associated with BQ/AN chewing should be organized at both community and individual levels to change perceptions of BQ chewers, which is the need of the hour.

LIMITATIONS

Variations in the age and gender of subjects, BQ preparations, and duration of BQ exposure among included studies might have influenced the outcome. Second, the majority of the studies were observational, hence, for better results, further longitudinal studies focussed on both male and female populations addicted to BQ/AN should be planned to analyze the effect of behavioral and psychosocial risk factors on BQ chewing. Few of the studies have not taken into consideration synergistic consumption of tobacco or alcohol along with BQ/AN, which could have led to biased results; therefore, future studies should be conducted on a larger population and should take the above etiological factors into account for unbiased results.

CONCLUSION

Analysis of findings of studies included in this systematic review suggests the high psychosocial dependence of an individual on BQ, and few chewers, although well aware of the risk of oral cancer, are reluctant to change their addictive behavior to maintain socialization and cultural identity. Therefore, to achieve successful BQ cessation, future studies should take into account psychosocial and behavioral risk factors, and comprehensive preventive programs should be planned with a goal to address an individual about the harmful effects of BQ chewing, reasons of addiction, and various coping strategies to overcome barriers like withdrawal symptoms, craving, peer pressure, etc. Moreover, thorough clinical and cultural understanding is needed to change the addictive behavior of an individual, and this can be accomplished by the use of behavior change models such as TTM, which moves an individual through different stages to elicit their perceptions for BQ use and to assess the readiness to quit. In addition, existing cessation programs or guidelines should be evaluated and improvised with the integration of AN/BQ cessation protocols.

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