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1 **Betel quid dependency and associated intrapersonal, interpersonal and environmental**
2 **factors amongst adolescents: A school-based cross-sectional survey**

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51 **ABSTRACT**

52 **Background**

53 Betel quid (BQ) is one of the fourth most commonly used substance globally. Though BQ is a
54 psycho-active substance, yet little has been explored regarding dependency on it particularly
55 among adolescents.

56 **Objectives**

57 Therefore, in this study, we aimed to determine adolescents' dependency on BQ, along with their
58 intrapersonal, interpersonal and environmental determinants of dependency.

59 **Methods**

60 This cross-sectional study focused on 2200 school-going adolescents of Karachi, Pakistan in 2016.
61 Primary outcome was dependency on BQ among adolescents. Both univariate and multivariate
62 regressions were used to estimate crude and adjusted odds ratios (after adjustments for all
63 intrapersonal, interpersonal, and environmental factors) with 95% confidence level.

64 **Results**

65 **Out of 2200 students, 874 (39.7%) were found to be BQ users amongst whom** 69 (7.9%) were
66 dependent on BQ. Comparing the groups with only areca nut users as reference category, betel
67 quid with tobacco additives chewers were considerably dependent (OR = 14.08, 95% CI 3.64-
68 54.16). The individuals who chewed >5 chews per day (OR = 1.87, 95% CI 1.08-3.29) and chronic
69 users (>1year) (OR = 2.02, 95% CI 1.09-3.74) were more likely to be dependent. Older students
70 (>12 years) (OR = 2.12, 95% CI 1.06-4.23), and who studied in government schools were
71 significantly dependent (OR = 3.32, 95% CI 1.80-6.10) than those who studied in private schools.

72 **Conclusions**

73 In conclusion, intrapersonal characteristics like more than 5 chews per day, chronic chewers of
74 more than a year, BQ with tobacco chewers, older adolescents and children studying in
75 government schools were significantly associated with BQ dependency.

76 **Keywords:**

77 Betel Quid, Dependency, betel quid dependence scale, adolescents, dependency determinants.

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81 **Background**

82 Oral cancers are the third most common cancers in South Asian countries. The common causes of
83 oral cancer in this region include tobacco (both smoked and smokeless) (N. Gupta et al., 2017),
84 alcohol (Nagpal, Nagpal, Mehendiratta, Marya, & Rekhi, 2014) and betel nut (commonly eaten
85 either raw, or refined in the form of paan-betel quid or paan masala) (Humans, Organization, &
86 Cancer, 2004; Lin et al., 2006).

87 Betel quid is one of the fourth most commonly used substance globally, while others include
88 nicotine, caffeine and alcohol (Boucher & Mannan, 2002; P. Gupta & Ray, 2004; Nelson &
89 Heischober, 1999; Warnakulasuriya & Peters, 2002; Winstock, Trivedy, Warnakulasuriya, &
90 Peters, 2000). Despite of the fact that betel quid is consumed by 600 million people globally, yet
91 its consumption is considerably high in South-East Asia, South Asia and Pacific Islands (P. Gupta
92 & Warnakulasuriya, 2002; Nelson & Heischober, 1999). Typically, betel quid is made up of betel
93 nut, piper betel leaf, slaked lime (calcium hydroxide), and/or tobacco; this combination varies with
94 personal choices, cultural background, country and region at large (Humans et al., 2004). In
95 Pakistan, commonly available formulations include, supari, chaaliya, paan masala and gutka which
96 along-with areca nut also have artificial flavors, natural and synthetic scents, smokeless tobacco,
97 cardamom, catechu and/or lime (Hosein, Mohiuddin, & Fatima, 2015).

98 Oral cancers are preventable if they are due to betel quid chewing; by curbing the habit. Though it
99 is a well-established cause of oral cancer yet little has been explored to understand how dependent
100 individuals are on it psychologically as it is fundamental in quitting. This backdrop is pivotal in
101 designing an effective and customized behavioral intervention for ceasing the BQ chewing habit
102 so that global load of the disease may lessen (Herzog et al., 2014).

103 Studies conducted so far have focused on adults that too in a small group (Herzog et al., 2014; Kuo
104 & Lew-Ting, 2008; C.-Y. Lee, Chang, Shieh, & Chang, 2012). Herzog et al. and Lee et al. have
105 worked on validating scale on establishing dependency on BQ by using Betel Quid Dependency
106 Scale (BQDS). Even though the initiating age for the BQ use is 13 years on average (Sorensen et
107 al., 2005); no or very limited work has been conducted on adolescents which is of paramount
108 importance as this is the age of development brimming with inquisitiveness and trialing. Habits
109 started at this age almost inevitably endure to adulthood. Thus; it is of substantial significance to
110 identify the behavioral and psychological aspects alongside dependency of adolescents on BQ.

111 BQDS was initially developed by Lee et al. in 2012 and it was the nascent instrument for assessing
112 betel quid dependence. BQDS encompasses three factors “physical and psychological urgent
113 need,” “increasing dose,” and “maladaptive use.” This scale first was conducted on male prisoners
114 in Taiwan who were not current chewers and there were no women. And it was in Chinese
115 language (C.-Y. Lee et al., 2012). Second study included both gender with a smaller sample size,
116 was in English language and it was on adults (Herzog et al., 2014). To our knowledge, no study so
117 far has been conducted that has used this BQDS in adolescents despite of the fact that chewing
118 habit commences at an age as early as approximately 13 years (Sinha, Abdulkader, & Gupta,
119 2016).

120 This study addresses mainly two questions pertinent to the BQ use in adolescents; firstly, what is
121 the level of their dependence on BQ by using a scale, Betel Quid Dependence Scale (BQDS).
122 Secondly, what are the intrapersonal, interpersonal and environmental characteristics associated
123 with BQ chew in adolescents that increase the likelihood of their dependency on it and how they
124 defer in dependent and non-dependent chewing groups.

125 **Methodology**

126 *Data Source*

127 Karachi is populated with approximately 24 million inhabitants thus rendering it as the largest city
128 of Pakistan (Valliani et al., 2012). In 2013, the city government divided it into 06 districts and
129 subsequently into 18 towns (Ali, Mogren, & Krantz, 2013). This study was conducted in the
130 government and private schools of Karachi.

131 *Sampling and study participants*

132 Using cluster sampling, 26 secondary schools (clusters) were recruited ensuring proportionate
133 selection of both government and private sector schools. In openEpi, with two-sided significance
134 level at 95% and 0.9 power, sample size was calculated as 1606 which was increased to 2200 by
135 adding attrition rate. Cluster numbers and sizes were calculated using equations manually since
136 software was unavailable (Bennett, Woods, Liyanage, & Smith, 1991).

137 For the enrollment in the study, the principals of selected schools (both government and private)
138 were provided with the details pertinent to the rationale of the survey and were invited to
139 participate. If any school refused to participate then the invitation was sent to the other school of
140 similar profile. Schools' heads were also requested to hand out consent forms (provided to schools)
141 to the parents with all the details of the study. Parents were urged to sign an acceptance or refusal
142 and return it to the school within the stipulated time period. After seeking permission from schools'
143 principals and parents; 50-100 students of grades VI-X were selected from each school. This
144 resulted in a sample size of 2200 which was considerably representative of Karachi's school-going
145 teenagers.

146

147 *Data Collection tool and study variables*

148 We used a structured and pre-tested survey questionnaire (some of the questions were
149 adapted from Global Youth Tobacco survey (GYTS) (fact sheets Pakistan—Karachi, 2010)
150 that aimed towards gathering information regarding:

151 *Intrapersonal features* like age and gender of the participants alongside their parental
152 education and work history. This section also included queries like the type of school
153 (government or private) participants go to and the amount of their weekly pocket money
154 that they can use in any way they wish. The BQ consumption of an individual was also
155 assessed by three items; number of chews per day, since how many years they have been
156 using it and what type of BQ they use (areca nut alone or in form of paan masala, betel quid
157 without tobacco and betel quid with tobacco).

158 *Family history of betel quid use (Interpersonal)* that included the use by peers, friends,
159 teachers and parents. They were also asked a question if they will use BQ in case any if their
160 closest friend offers them.

161 *Accessibility and availability of BQ (environmental)* was assessed by asking them if BQ was
162 available in school canteen and/or at shops/hawkers outside school premises. It was also
163 important to know if they knew BQ chewing is hazardous to health thus they were asked if
164 they attended any sessions in school which imparted awareness regarding ill health effects of
165 BQ and areca nut (AN).

166 *Outcome variable - Dependency on betel quid measured based on BQDS (C.-Y. Lee et al., 2012)*

167 This 16-items scale was developed by Lee et.al. (C.-Y. Lee et al., 2012) in 2012 which was
168 subsequently validated by Herzog et.al. (Herzog et al., 2014) in adults. Binary responses were

169 **noted for items in the scale (No=0 and Yes=1). Scores were coded between one and zero thus**
170 **0.5 suggested half of the scale being validated as dependency (Herzog et al., 2014). A cut off**
171 **of 4 was suggested in adults (Zhu et al., 2017) to determine dependency. Three factors like;**
172 **“physical and psychological urgent need”, “increasing dose”, and “maladaptive use” were**
173 **used. We employed a conservative BQDS criterion score of 0.5 (or 8 out of 16 BQDS items**
174 **endorsed) to operationally define betel quid dependence in adolescents as they are likely to**
175 **overstate it (Colby, Tiffany, Shiffman, & Niaura, 2000) (Table 1).**

176 **Both the questionnaire and BQDS were translated into Urdu language (local language) and**
177 **then back to English to ensure they mean the same after translation.**

178 **Ethical Considerations:** The Institutional Review Board of Dow University of Health Sciences
179 imparted approval to this study after careful scientific evaluation and critical analysis. (Reference
180 Number: IRB-725/DUHS/Approval/2016/219).

181 **Statistical Analysis:** Data of the current study were analyzed by using SPSS v17. Descriptive
182 statistics including mean, frequency and percentages were reported. Chi-square analysis was
183 performed to determine significance of association between independent variables {intrapersonal
184 (age, gender, school type, parents ‘education and work status, betel quid consumption and weekly
185 pocket money), interpersonal (BQ use by peers, parents, teachers and use susceptibility if close
186 friend offers it) and environmental determinants (awareness sessions regarding ill effects of BQ
187 use, and its availability at school canteen and/or outside school hawkers)} and outcome variable
188 **“Dependency on betel quid”** which was measured based on BQDS. Further, multivariate logistic
189 regression was employed to ascertain the presence of dependency on BQ by controlling all other
190 study variables. Results were reported as adjusted odds ratio (aOR) after adjusting for all above

191 mentioned study variables with 95% confidence level. P-value was deliberated significant at <
192 0.05.

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195 **Results**

196 Out of 2200 students, 2140 participants provided complete information on which analysis was
197 performed. School response rate was 80%. The betel quid and smokeless tobacco consumers were
198 912 amongst whom 874 (39.7%) were found to be BQ users (any type) (Table 2). Out of 874
199 individuals, 837 (95.7%) were areca nut and paan masala users, 25 (2.86%) were betel quid
200 chewers without tobacco and 12 (1.37%) were betel quid with tobacco users. Based on BQDS, 69
201 (7.9%) individuals were found to be dependent on BQ while 805 (92.1%) consumers formed non-
202 dependent betel quid chewing group.

203 **Endorsement of betel quid dependence scale items**

204 Table 1 demonstrates the items for the BQDS under 3 factors. Most adolescents highly endorsed
205 the “increasing dose” (mean % = 18.36) and “physical and psychological urgent need” (mean % =
206 18.18) factors. Whereas, the “maladaptive use” (mean % = 9.15) was least marked by the
207 participants.

208 **Intrapersonal, interpersonal and environmental determinants of dependency on BQ**

209 **Intrapersonal determinants of dependency on BQ**

210 Intrapersonal determinants suggested that the adolescents (n=247) who consumed 5 or more chews
211 per day were positively linked with dependency ($\chi^2 = 18.64$, $df= 1$, $p\text{-value} < 0.001$) on BQ as
212 compared with those who consumed less than 5 chews. Likewise, individuals (n=472) who chewed
213 for more than a year were more likely to be dependent ($\chi^2 = 15.68$, $df= 1$, $p\text{-value} < 0.001$) on BQ
214 than those who chewed for less than a year. Out of 69 dependent individuals, 62 (89.9 %) were
215 only areca nut or paan masala users, while remaining 6 (8.69%) and 1 (1.45%) were betel quid
216 with tobacco and betel quid without tobacco users respectively. Significant differences in the

217 distribution of dependency on BQ were observed in older age group (>12 years) ($\chi^2 = 7.03$, $df= 1$,
218 p-value 0.008), in individuals who were mostly studying in government schools ($\chi^2 = 26.66$, $df=$
219 1, p-value <0.001) and adolescents whose mothers were educated ($\chi^2 = 7.97$, $df= 1$, p-value 0.005)
220 (Table 2).

221 The results of both univariate (Chi-square analysis) and multivariate analyses corroborated with
222 each other. The effect size of likely dependency on BQ with tobacco additives group further
223 substantially increased (aOR = 14.08, 95% CI 3.64-54.16) when compared with only areca nut
224 chewers after adjusting for other intrapersonal, interpersonal and environmental factors. Older
225 students (>12 years) were more dependent on BQ (aOR = 2.12, 95% CI 1.06-4.23) as compared
226 with younger group. Government school students were more significantly dependent on BQ (aOR
227 = 3.32, 95% CI 1.80-6.10) as compared with private school candidates (Table 3).

228 Interpersonal factors of dependency on BQ

229 There were no significant differences noted in interpersonal factors except for the use susceptibility
230 of adolescents when their close friend will offer them BQ in any form ($\chi^2 = 8.75$, $df= 1$, p-value
231 0.003) (Table 2), which after multivariate analysis became non-significant (Table 3).

232 Environmental determinants of dependency on BQ

233 Environmental factor between the two groups like when this product is available at school canteen
234 was the sole significant finding associated with BQ dependency ($\chi^2 = 4.86$, $df= 1$, p-value 0.027)
235 (Table 2) which disappeared after multivariate analysis (Table 3).

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237 **Discussion**

238 In the current study, we observed dependency syndrome in the users of all three types of betel quid
239 like areca nut only, betel quid without tobacco, and betel quid with tobacco. Amongst
240 intrapersonal, interpersonal and environmental factors, the former was significantly associated
241 with BQ dependency in adolescents. Intrapersonal characteristics like more number of chews per
242 day, older adolescents and students studying in government schools were convincingly associated
243 with BQ dependency.

244 The dependency on BQ was found to be 7.9% in our study group. This was comparatively less
245 probably because we focused on adolescents (who were using the product for less number of years)
246 while the other studies (reported so far) had adults who were using BQ for more than 10-30 years
247 (Bhat, Blank, Balster, Nichter, & Nichter, 2010; C. H. Lee et al., 2014; Mirza, Shafique, Vart, &
248 Arain, 2011). In this study, approximately 90% of the dependent chewers were consumers of 'areca
249 nut only' in the form of paan masala which may probably be corroborated with the more number
250 of chewers in this group, and the dependency can be attributed to the arecoline in betel nut (Lord,
251 Lim, Warnakulasuriya, & Peters, 2002; Papke, Horenstein, & Stokes, 2015). This unique finding
252 can be accredited to adolescents as compared with adults who used betel nut with tobacco and
253 formed larger 'BQ with tobacco' dependent group in other studies (C. H. Lee et al., 2014; Mirza
254 et al., 2011).

255 The consumers who used 'BQ with tobacco' were 14 times more likely to develop dependency as
256 compared with 'areca nut alone' users in the current study. And this effect size significantly
257 increased (which can be explained by the presence of both nicotine and arecoline in the product
258 (Lord et al., 2002; Papke et al., 2015) after adjusting for BQ intake items, age, gender and other
259 remaining intrapersonal, interpersonal and environmental variables. This finding was consistent

260 with previous studies where adults who were chronically using 'BQ with tobacco' more were
261 found to be convincingly dependent on it (C. H. Lee et al., 2014; Mirza et al., 2011). In our study
262 with increasing age, dependency increased which remained significant after adjustments for other
263 variables in multivariate analysis suggesting the association between duration of use (in years)
264 which increases as individual ages.

265 We found no positive association between BQ use by family and dependency, whereas, previous
266 study witnessed a profound family influence on BQ dependency and suggested family based
267 interventions to curb the habit (C.-H. Lee et al., 2012).

268 The findings of our study render adolescents' dependency on BQ to be more clearly associated
269 with its intake, increasing age and that, a majority of dependent chewers were concentrated in
270 government schools of Karachi. This thus suggests a focused modus operandi for future
271 interventions to cease the habit and as a result, a reduction in the related disease burden.

272 Our knowledge base suggests this to be the first study of its kind focusing on large school-going
273 adolescent's population of Karachi, Pakistan providing evidence of their dependency on betel quid
274 alongside comprehensive intrapersonal, interpersonal and environmental contributors of
275 dependency on BQ. The current study also used BQDS for detecting dependency first time in
276 adolescents (Herzog et al., 2014; C.-Y. Lee et al., 2012; Zhu et al., 2017).

277 This study has certain limitations: as this is a self-reportedly generated data therefore its quality
278 may have been compromised due to under-statement of the BQ use by the participants based on
279 various social and cultural barriers. These children were though assured the maintenance of
280 anonymity of data and it was also consented information. As with all such comparable studies,
281 second limitation is the recall bias in the first section of the questionnaire where basic information

282 was gathered. Although, that was taken care of in the subsequent sections where counter checks
283 for vital data were incorporated in addition to BQDS like number of chews per day, number of
284 years of BQ chews and type of BQ used. Finally, as it is a cross-sectional study thus causality must
285 be ascertained cautiously as it requires higher levels of evidences.

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300 **Conclusion**

301 In this study, the BQ dependency was observed in adolescents (in all three types of BQ chewers)
302 by using BQDS. Individuals who consumed more than 5 chews per day, chronic chewers of more
303 than a year, BQ with tobacco chewers, older adolescents (>12 years) and children studying in
304 government schools were significantly associated with BQ dependency, which also positively
305 differed between BQ dependent and non-dependent groups. These determinants can play a
306 dynamic role in reducing dependency on BQ thus may be considered strongly considered while
307 designing and implementing future interventions for the said cause.

308 **Author's contributions:** KS and AH comprehended the basic theme of the work, AH sorted all
309 approvals and collected the data, AH ran the analysis with statistical support from SZ, both AH
310 and SZ interpreted the results, KS supervised throughout the project and in drafting of manuscript.

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