

Delivery of a one-week chewing gum for promoting smoking cessation: A pilot randomized controlled trial

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ABSTRACT

INTRODUCTION Chewing gum has been used as a self-help strategy for managing smoking cravings, yet its effectiveness has not been evaluated. This pilot trial assessed the feasibility, acceptability, and preliminary effectiveness of delivering 1-week chewing gum for promoting quitting.

METHODS Adult daily smokers were recruited from smoking hotspots in Hong Kong in February 2025. All participants received very brief advice (VBA) and a self-help booklet at baseline. The intervention group additionally received 1 week of chewing gum (2 packs) and 2 weeks of instant messaging reminders to promote gum usage, whereas the control group received no placebo or sham intervention beyond VBA and the booklet. Follow-up was conducted at 2 weeks, 3 months, and 6 months post-enrolment. The primary outcome was biochemically validated tobacco abstinence at 6 months. Risk ratios (RRs) were used to estimate the intervention effect using intention-to-treat analysis in Poisson regression.

RESULTS The recruitment rate was 91%, and the retention rate was 86%, 78%, and 74% at 2 weeks, 3 months, and 6 months, respectively. Eighty participants were randomly assigned to the intervention (n=40) and control (n=40) groups using a 1:1 allocation ratio. The intervention group had a higher validated abstinence (10% vs 0%; risk difference, RD=0.53; 95% CI: 0.41–0.64) at 6 months than the control group. Among intervention group participants, 75% (30/40) used chewing gum, and 57% (17/30) rated it as helpful in relieving cravings. Those who used the chewing gum had higher rates of quit attempts (77% vs 40%, p=0.03) and smoking reduction (73% vs 40%, p=0.06) than those who did not.

CONCLUSIONS Delivering chewing gum was feasible and showed preliminary evidence of effectiveness in cessation outcomes. Full trials with an extended intervention period are warranted.

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INTRODUCTION

Chewing gum has been used as an alternative to smoking cessation. Randomized trials have found chewing gum to be effective for reducing cravings and managing withdrawal symptoms¹⁻³, primarily by substituting the habitual hand-to-mouth action associated with smoking⁴. Whether chewing gum, as a simple behavioral adjunct, can further improve smoking cessation outcomes remains inconclusive. A literature search of PubMed, the Cochrane Library, and [ClinicalTrials.gov](https://clinicaltrials.gov) (up to 31 October 2025) using the terms ‘chewing gum’, ‘smoking cessation’, and

'smoking reduction' identified no trials evaluating the effectiveness of chewing gum on cessation outcomes. This pilot randomized controlled trial (RCT) assessed the feasibility, acceptability, and preliminary effectiveness of delivering a 1-week supply of chewing gum for quitting in daily smokers in Hong Kong.

METHODS

Study design and participant recruitment

We conducted a two-arm, parallel pilot RCT in Hong Kong between 11 February and 26 August 2025. Ethical approval was obtained from the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (UW24-812), and the trial was registered with [ClinicalTrials.gov](https://clinicaltrials.gov) (NCT06801860). Participants were recruited from community smoking hotspots, defined as public locations with a high concentration of smokers⁵. Trained research staff conducted on-site outreach by approaching adult smokers, briefly introducing the study, and screening interested individuals for eligibility. Eligible individuals were Hong Kong residents aged ≥ 18 years who smoked daily, spoke Cantonese, used instant messaging apps (e.g. WhatsApp), and were willing to use chewing gum. Exclusion criteria included communication barriers, contraindications to chewing gum (e.g. loose teeth, jaw joint disorders), or current engagement in other cessation programs. Participants received HK\$100 (US\$12.8) for completing the baseline assessment and HK\$50 (US\$6.4) for each follow-up. The study followed the CONSORT statement extension for pilot and feasibility trials⁶ ([Supplementary file](#)).

Procedures

Participants were individually randomized to the intervention group or control group (at a 1:1 ratio) using a computer-generated, concealed allocation sequence with permuted block sizes of 2, 4, and 6. Masking of participants and research staff was not feasible because of the nature of the intervention. Outcome assessors and statistical analysts remained masked until completion of the primary analyses.

At baseline, all participants received very brief advice (VBA) following the AWARD model and a 12-page self-help booklet outlining strategies to manage withdrawal symptoms. Participants in the

intervention group additionally received a 2-week support consisting of a 1-week supply of chewing gum (Extra[®]; 2 packs; US\$1.5 per pack) provided in person at baseline recruitment, and 2 weeks of instant messaging reminders (twice per week, 4 in total). The reminders grounded in the Love and Care approach, provided brief and empathetic encouragement without behavioral counselling and functioned only as prompts to remind gum adherence. A leaflet summarized the potential role of chewing gum in supporting smoking cessation and oral health, and the proper gum usage, recommended timing, dosage, and disposal were provided to the participants. Participants were encouraged to use the gum when experiencing smoking urges. Chewing gum is generally safe, although participants were advised to report any allergies or adverse effects. Participants in the control group only received VBA at baseline.

Outcomes

Data were collected by questionnaire at baseline and telephone follow-up at 2 weeks, 3 months, and 6 months, after intervention initiation. The primary outcome was biochemically validated past 7-day reported tobacco abstinence at 6 months (exhaled CO < 4 ppm measured by a Smoklyzer, and salivary cotinine < 10 ng/mL measured by NicAlert[®] strips)⁷. Secondary outcomes included self-reported 7-day point-prevalence abstinence (PPA), $\geq 50\%$ reduction in daily cigarette consumption (defined by a reduction of at least 50% in daily cigarette consumption compared with that at baseline; excluding quitters), and quit attempts (≥ 24 hours of abstinence) at 2 weeks, 3 months, and 6 months follow-up. Feasibility outcomes included recruitment rate, retention rate at each follow-up, and adherence to the intervention, defined as the proportion of participants who used the xylitol gum as instructed. Acceptability was evaluated through user ratings of perceived helpfulness of the gum for smoking reduction and cessation (0–10 scale, higher score indicating greater perceived helpfulness) and perceived oral-health benefits (4 items rated on a 0–5 scale, higher score indicating greater perceived helpfulness). Participants received HK\$250 (US\$32) for each successful validation at 3 months and 6 months.

Statistical analysis

No formal sample-size calculation was performed for the pilot RCT. Our previous pilot RCT on smoking cessation (n=80) was considered adequate for feasibility assessment and estimation of parameters for a future definitive trial⁸.

Descriptive statistics were used to summarize participant characteristics and cessation outcomes. Continuous variables are presented as means and standard deviations (SD), and categorical variables as frequencies and percentages. Primary analyses were by intention-to-treat (ITT), assuming no behavior change for participants lost to follow-up⁹. Group differences were examined using Poisson regression with robust variance to estimate risk ratios¹⁰, risk differences were reported when zero events occurred. Quitting outcomes were analyzed using both unadjusted and adjusted models, with the latter adjusted for key predictors of cessation outcomes, including previous quit attempts, intention to quit, and nicotine dependence¹¹. The smoking reduction by at least 50% was analyzed, excluding participants who

self-reported quitting. We did a planned sensitivity analysis using complete-case analysis. *Post hoc* as-treated analysis was conducted to evaluate outcomes based on the intervention actually received rather than the initial assignment. All analyses were performed in Stata/MP 15.1 (StataCorp), with two-sided $p < 0.05$ considered statistically significant.

RESULTS

In February 2025, 88 individuals were screened, of whom 80 were enrolled, resulting in a 91% recruitment rate. Forty participants were randomized to the intervention and 40 to the control group ([Supplementary file Figure 1](#)). Most participants were male (64/80; 80%), 70% (56/80) were aged <50 years, and 73% (58/80) had a tertiary education. At baseline, 51% (41/80) had moderate to high nicotine dependence, and 71% (57/80) had no plan to quit within 30 days. Baseline characteristics were similar between groups ([Supplementary file Table 1](#)). Follow-up retention was 86% at 2 weeks (n=69), 78% at 3 months (n=62), and 74% at 6 months (n=59),

Table 1. Smoking cessation outcomes at multiple follow-up time points comparing intervention versus control groups in a 2-arm pilot randomized controlled trial in Hong Kong, 11 February – 26 August 2025 (intention-to-treat analysis; N=80) ^a

| | Intervention (N=40) n (%) | Control (N=40) n (%) | Crude risk ratio (RR)/ Crude risk difference (RD) (95% CI) | p |
|-----------------------------------------|------------------------------|-------------------------|------------------------------------------------------------------|------|
| Validated abstinence | | | | |
| 3 months | 2 (5) | 2 (5) | 1.00 (0.15–6.84) | 1.0 |
| 6 months (primary outcome) ^b | 4 (10) | 0 (0) | 0.53 (0.41–0.64) | 0.04 |
| Self-reported PPA^c | | | | |
| 2 weeks ^b | 0 (0) | 5 (13) | -0.53 (-0.65 – -0.42) | 0.02 |
| 3 months | 4 (10) | 6 (15) | 0.67 (0.20–2.20) | 0.51 |
| 6 months | 8 (20) | 7 (18) | 1.14 (0.46–0.87) | 0.78 |
| Smoking reduction^d | | | | |
| 2 weeks | 26 (65) | 13 (37) | 1.75 (1.07–2.86) | 0.03 |
| 3 months | 8 (23) | 6 (18) | 1.30 (0.50–3.36) | 0.60 |
| 6 months | 4 (13) | 6 (18) | 0.69 (0.21–2.23) | 0.53 |
| Quitting attempts | | | | |
| 2 weeks | 27 (68) | 21 (53) | 1.29 (0.89–1.86) | 0.18 |
| 3 months | 13 (33) | 10 (25) | 1.30 (0.64–2.62) | 0.46 |
| 6 months | 18 (45) | 16 (40) | 1.13 (0.67–1.88) | 0.65 |

^a Missing observations were treated as not quitting or reducing. ^b Risk difference was reported only for 6-month biochemically validated abstinence and 2-week self-reported 7-day PPA because the risk ratio could not be estimated due to complete separation (i.e. zero events in one group). ^c PPA: point-prevalence abstinence. ^d At least a 50% reduction in baseline daily cigarette consumption; participants who self-reported quitting were excluded.

corresponding to 11, 18, and 21 participants with missing outcome at each time point. Retention did not differ by group (retention rate ratio ranged from 1.03 to 1.21).

Table 1 shows that based on ITT analysis, validated tobacco abstinence was higher in the intervention group than in the control group at 6 months (4/40; 10% vs 0/40; 0%; RD=0.53; 95% CI: 0.41–0.64) but similar at 3 months (2/40; 5% vs 2/40; 5%; RR=1.00; 95% CI: 0.15–6.84). Self-reported 7-day PPA was similar at 6 months (20% vs 18%; RR=1.14; 95% CI: 0.46–2.87) but lower in the intervention than the control group at 3 months (10% vs 15%; RR=0.67; 95% CI: 0.20–2.20) and 2 weeks (0% vs 13%; RR=-0.53; 95% CI: -0.65 – -0.42). More participants in the intervention group reported smoking reduction (excluding quitters; RR: 1.52–1.91) and quit attempts (RR: 1.13–1.30) across follow-ups, except for smoking reduction at 6 months (13% vs 18%; RR=0.69; 95% CI: 0.21–2.23). Sensitivity analyses using complete-case and as-treated approaches yielded consistent results ([Supplementary file Table 2](#)).

In the intervention group, 75% (30/40) of participants used chewing gum in the past 7 days, and 60% (18/30) users reported using it on all 7 days ([Supplementary file Table 3](#)). Among gum-users, 57% (17/30) reported that the gum helped reduce smoking cravings, and the overall rating for its usefulness in smoking reduction and cessation was 4.10 (SD=2.77). Participants also reported perceived benefits in relieving oral dryness (mean=2.67, SD=1.71), refreshing breath (mean=3.13, SD=1.61), increasing saliva secretion (mean=2.63, SD=1.61), and reducing oral discomfort (mean=2.20, SD=1.54). No adverse events were reported by participants.

Post hoc analysis showed that participants who used the gum at least one day had higher rates of 2-week smoking reduction (73% vs 40%) and 2-week quit attempts (77% vs 40%) compared with non-users ([Supplementary file Table 4](#)).

DISCUSSION

This pilot RCT evaluated the delivery of 1-week chewing gum for quitting in community smokers, showing that chewing gum was acceptable and provided preliminary evidence of effectiveness, with a higher biochemically validated abstinence rate at

6 months. Chewing gum may be considered a low-threshold option for smokers who are unwilling or reluctant to use nicotine replacement therapy (NRT) or other pharmacological cessation aids. Our findings support the need for a larger trial to explore how offering chewing gum increases quit attempts and sustained abstinence.

Despite the low willingness to quit at baseline, most participants in the intervention group used the chewing gum. The usage rate in this pilot trial was higher than that reported in our previous RCTs offering 1-week NRT among smokers with low quit intention¹², and among daily smokers recruited from smoking hotspots¹³. This might be due to the ease of use, low cost, and wide accessibility of chewing gum, which make it suitable for smokers who are not ready to quit. Given its non-pharmacological nature and the absence of medication-related side effects¹⁴, chewing gum could serve as a supplementary option within smoking cessation services, especially for individuals who are not suited to NRT in future applications.

In this trial, more than half of the participants using chewing gum reported that it helped reduce smoking cravings, which may be due to the act of chewing occupying the mouth, distracting attention from cravings, and providing psychological relief for smokers¹⁵. These findings were consistent with RCTs showing that chewing gum can assist in managing smoking cravings, particularly in smoking-restricted settings^{1,2}. Our results further showed that higher proportions of gum users reported smoking reduction and quit attempts than non-users at 2 weeks post-enrolment. Future studies should explore the optimal duration and dosage of gum use (e.g. extending provision beyond 2 weeks), identify mHealth-based strategies to improve adherence, and combine with other behavioral cessation interventions (e.g. motivational interviewing, chat-based instant messaging) to enhance cessation support.

Limitations

Our study had limitations. The intervention period was brief, which restricted our ability to assess the durability of behavioral change. The short exposure may limit the examination of dose-response patterns and long-term adherence. The abstinence rate observed in this study was lower than that reported

in previous trials using NRT gum at 6 months¹⁶. However, this comparison should be interpreted cautiously because the intervention was not designed to replace pharmacotherapy, and the study was not powered to evaluate effectiveness. The secondary outcomes of intervention engagement (e.g. perceived helpfulness of the gum for smoking reduction and cessation, and perceived oral-health benefits) were based on self-reports. We did not assess oral-health improvement, and this outcome will be evaluated in a separate, dedicated trial. The reminder messages were included solely to prompt gum use and did not contain cessation counselling, making it unlikely that the outcomes were driven by the reminders. Our pilot trial was conducted in Hong Kong, where the prevalence of smoking is low, and smokers are predominantly male¹⁷. The generalizability of the findings to other places is unclear.

CONCLUSIONS

We showed the initial feasibility and acceptability of delivering 1-week chewing gum for smoking cessation and preliminary evidence of its potential effectiveness. Large trials with extended intervention periods are warranted to evaluate its effectiveness more definitively.

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CONFLICTS OF INTEREST

The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

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ETHICAL APPROVAL AND INFORMED CONSENT

Ethical approval was obtained from the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (Approval number: UW24-812; Date: 20 January 2025). Participants provided informed consent.

DATA AVAILABILITY

The data supporting this research are available from the authors on reasonable request.

AUTHORS' CONTRIBUTIONS

MPW and MYL: conceptualized the study. MYL: conducted data preparation, statistical analyses and drafted the first version of the manuscript. All authors: reviewed the manuscript, interpreted the data, critically revised the manuscript. All authors read and approved the final version of the manuscript.

PROVENANCE AND PEER REVIEW

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