



Jurnal Penelitian Pendidikan IPA



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Cognitive Dissonance-Based Smoking Cessation: Comparing Individual Versus Group Interventions Among University Students

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Received: January 29, 2025 Revised: April 20, 2025 Accepted: May 25, 2025 Published: May 31, 2025

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DOI: 10.29303/jppipa.v11i5.11108

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their understanding of the risks of smoking and their choice to keep on smoking. This research is to assess the efficacy of cognitive dissonance-based therapies and contrast individual with group strategies in lowering smoking habit in college students. Conducted on 150 smoking college students in Bangkinang City, this research used a randomized controlled trial approach with three parallel groups. Participants were randomly allocated to control (n=50), group intervention (n=50), or individual intervention (n=50). Eight weekly sessions meant to tackle cognitive dissonance made up the intervention. At six-month follow-up, the main result was biochemically confirmed 7-day abstinence. Other results included ongoing abstinence, lower cigarette use, shifts in cognitive dissonance, and self-efficacy. Of the individual group, 38.0%, of the group group, 32.0%, and of the control, 12.0% (p<0.05), this research found 7day abstinence. Compared to the control, both treatments greatly raised the likelihood of abstinence (individual: OR=4.50, 95% CI:1.65-12.27; group: OR=3.45, 95% CI:1.24-9.62). The two intervention strategies showed no notable change (p=0.519). Changes in cognitive dissonance accounted for 42.1% of the effect of the individual intervention and 38.7% of the impact of the group intervention. While its efficacy was similar to the individual approach, the group intervention (IDR1,875,000 per abstinence) was more efficient than the individual intervention (IDR2,150,000) according to cost-effectiveness analysis. Although its efficacy was similar to the individual approach, the group intervention (IDR1,875,000 per abstinence) was more efficient than the (IDR2,150,000). individual intervention Cognitive dissonance-based interventions were successful in raising abstinence in college smokers; the group approach was more cost-effective. These results back up the use of cognitive dissonance-based treatments in campus smoking cessation programs.

Abstract: College students' smoking habits reveal cognitive dissonance between

Keywords: Cognitive dissonance; Group intervention; Individual intervention; Smoking Behavior.

Introduction

The smoking habits of university students is a major public health concern that calls for great focus. Research shows that Indonesian university students still smoke rather much despite growing knowledge of the health hazards related to smoking. With a growing frequency especially among university students, the Basic Health Research (Riskedas, 2018), shows that 28.8% of persons between 18 and 24 are active smokers. The Global Adult Tobacco Survey (2011) uncovered a surprising contradiction: Many students admit to health

How to Cite:

Hamidi, M. N. S., Syahda, S., & Apriyanti, F. (2025). Cognitive Dissonance-Based Smoking Cessation: Comparing Individual Versus Group Interventions Among University Students. *Jurnal Penelitian Pendidikan IPA*, *11*(5), 61–73. https://doi.org/10.29303/jppipa.v11i5.11108

issues connected to smoking, yet a large percentage still smoke, therefore underlining a notable gap between knowledge and action.

Festinger (1957) theory of cognitive dissonance explains this. Conflicting thoughts or beliefs define cognitive dissonance. Tension over student smoking behavior is produced by the conflict between students' awareness of smoking risks and their choice to keep the habit. This difference causes psychological discomfort and drives people to lower dissonance by means of cognitive adjustment, behavioral change, or reasoning (Cooper, 2007; Harmon-Jones & Mills, 2019). Studies done earlier have shown how well cognitive dissonancebased strategies change health behaviors like smoking. Fotuhi et al. (2013) meta-analysis revealed that cognitive dissonance treatments had moderate to high effect sizes in changing health behaviors. Particularly in culturally varied settings, the best intervention method is still up for debate.

Treatments using cognitive dissonance exploit the psychological suffering resulting from the awareness of contradictions between human desires and actual reality. McGrath (2017) claims that particularly when people have an inherent need to match their actions with their values, this growing knowledge could be a strong engine for behavioral change. According to Freijy & Kothe (2013), this approach could be more successful for behaviors with addictive qualities like smoking as it might break down the rationalization mechanisms usually used to sustain such habit.

Each provide specific benefits for the delivery of therapies: individual and group strategies. Personalized strategies help the treatment to meet particular psychological problems and personal circumstances, thereby offering advantages connected to confidentiality and customization (Fiore et al., 2008; Lancaster & Stead, 2017). On the other hand, groupbased therapies could increase motivation by means of shared experiences and group efficacy enabled by social support systems and observational learning tools (Bandura, 2000; Westmaas et al., 2010).

The Indonesian setting suggests that social elements play a major role in the start and continuation of smoking behavior among university students, so implying the possible efficacy of group strategies using social dynamics (Kumboyono et al., 2020; Rosilawati et al., 2024; Talip et al., 2016). Recent studies indicate that nations with collectivist cultures, such as Indonesia, may gain additional advantages from socially networked initiatives (Kim et al., 2015; Thrul et al., 2013). This supports Indonesian cultural traits stressing group identification and close social ties. According to Padmawati et al. (2018), social norms and community settings in Indonesia often influence personal health choices; hence, programs with social components might be more culturally appropriate.

Programs aimed at quitting smoking present particular difficulties in Indonesian culture. The efficacy of treatments is affected by strong social relationships, collectivist values, and views of smoking as a male pastime (Ng et al., 2007; Nichter et al., 2009). Research performed on Indonesian university students reveals that social norms and peer pressure considerably impact the onset and persistence of smoking behaviors (Bigwanto et al., 2017; Smet et al., 1999). Understanding the influence of cultural features on reactions to individual versus group treatment enables the development of culturally suitable approaches (Kreuter et al., 2003; Resnicow et al., 2000).

Earlier research on smoking cessation using cognitive dissonance strategies revealed several shortcomings. Experiential dissonance induction's efficacy has been investigated primarily in terms of motivation; no evaluation of delivery methods exists (Dobber et al., 2021; Simmons et al., 2013). Peterson et al. (2009) and Shirazi et al. (2024) discovered that research on the short-term consequences of group-based therapy lacked individual comparative settings. Many studies on smoking cessation in Indonesia have relied on conventional teaching techniques that ignore basic psychological elements (Aditama et al., 2008; Ayuningtyas et al., 2021).

From the standpoint of health economics, colleges usually lack the means to carry out successful smoking cessation initiatives. Though research on the costeffectiveness of smoking therapy points that group treatment would be more advantageous, no studies have specifically compared individual treatment to group treatment based on cognitive dissonance theory. In resource-limited settings where optimizing intervention effectiveness is crucial, this financial element is especially important (Chisholm et al., 2016; Jha et al., 2006).

Primarily on cost-effectiveness, health initiatives carried out in Indonesian educational institutions – including smoking cessation programs – as described by Matheos et al. (2023); Meilissa et al. (2022); Prabandari (2013). Bangkinang in Kampar Regency, Riau Province was chosen as the study location because of its semiurban nature and greater smoking incidence among university students relative to the national norm. These qualities provide Bangkinang a perfect site for evaluating the effectiveness of smoking cessation programs based on cognitive dissonance. The lack of thorough studies on smoking cessation techniques in semi-urban areas like Bangkinang underlines the importance of this research in providing scientific proof relevant across many geographical locations in Indonesia.

This study aims to investigate the relative efficacy of cognitive dissonance treatments in individual vs group environments, hence filling current knowledge gaps and highlighting the necessity to address smoking behaviors among university students. This research is to clarify the psychological processes behind these behavioral changes and to find the degree to which these strategies might improve smoking cessation rates among university students in Bangkinang. Using psychological mediators, contextual modifiers, and costeffectiveness analysis, the study underlines the necessity to assess the effectiveness of cognitive dissonance treatments in individual versus group formats for lowering smoking behaviors among university students. This study intends to show how certain cultural and social elements in Indonesia affect reactions to both treatment modalities, hence enabling the creation of culturally appropriate and durable smoking cessation plans in Indonesian university settings. This study is to fill information gaps on evidence-based strategies to change smoking habit among Indonesian university students and to provide practical consequences for creating efficient smoke-free campus policy.

Method

Research Design

This study employed a randomised controlled trial design with three parallel groups to compare the effectiveness of cognitive dissonance interventions between individual and group formats in reducing smoking behaviour among university students. This experimental design was chosen for its ability to establish cause-effect relationships between interventions and measured outcomes while minimizing bias and confounding factors (Anderson-Cook, 2005). The research was conducted over a sixmonth period, including an eight-week intervention phase and a four-month post-intervention follow-up period to assess the sustainability of treatment effects.

Location and Time

The research was conducted at universities in Bangkinang City, Kampar Regency, Riau Province, Indonesia. This location was selected based on the high prevalence of smoking among university students (34.5%), which exceeds the national average. The semiurban characteristics of Bangkinang City provided an opportunity to explore the effectiveness of interventions in a geographical context that is under-represented in Indonesian tobacco control literature. Data collection was conducted over six months, from January to June 2023.

Population and Sample

The target population for this study was all active smoker university students (aged 18-24 years) enrolled in universities in Bangkinang City, Kampar Regency, Riau Province. Active smoker criteria were defined as individuals who had smoked at least 100 cigarettes in their lifetime and currently smoke at least one cigarette per day for the last 30 days, according to the definition established by the World Health Organizations (WHO, 2019).

Inclusion and Exclusion Criteria

Inclusion criteria included: university students aged 18-24 years; active smokers according to the WHO definition; demonstrating willingness to quit smoking; willing to participate in all intervention sessions; and signing informed consent forms. Exclusion criteria included: currently undergoing other smoking cessation program; having severe psychiatric disorders based on screening with the Depression Anxiety Stress Scale (DASS-21) (Lovibond & Lovibond, 1995); very severe nicotine dependence (score ≥8 on the Fagerström Test for Nicotine Dependence) (Fagerstrom & Schneider, 1989) and using psychoactive drugs or nicotine replacement therapy products in the past three months.

Sampling Technique

The sampling technique used stratified random sampling to ensure representation of various study programmes and cohort years. The recruitment process began with information campaigns on campus through various communication channels. Prospective participants who met the inclusion and exclusion criteria were then randomized into three groups using a computerized random allocation system with a 1:1:1 ratio to ensure balanced participant numbers between groups.

Sample Size Determination

Sample size determination was based on hypothesis testing calculation for proportions using the Formula 1 (Cohen, 1988).

$$n = (Z\alpha/2 + Z\beta)^2 \times [p_1(1 - p_1) + p_2(1 - p_2)] / (p_1 - p_2)^2 (1)$$

Assuming a 95% confidence level ($Z\alpha/2 = 1.96$), 80% statistical power ($Z\beta = 0.84$), abstinence proportion in the control group (p₁) of 12% based on previous studies (Simmons et al., 2013), and abstinence proportion in the intervention group (p₂) of 35% based on meta-analysis of cognitive dissonance interventions (Fotuhi et al., 2013), the minimum sample size was calculated as 42 people per group. To anticipate a possible 20% drop-out during the research period, the sample size was increased to 50 people per group, resulting in a total sample of 150 participants.

Intervention Protocol

Personal Intervention Group

Over eight straight weeks, participants in the individual intervention group attended eight face-to-face counseling sessions, each lasting 45 to 60 minutes. Trained clinical psychologists following a consistent cognitive dissonance-based approach carried out the sessions. The intervention's key components were:

Assessment and Sessions 1-2: Exploration Examining personal values, views about smoking, consumption habits, and smoking history. Finding discrepancies between smoking habit with participants' health beliefs, academic aims, and long-term life objectives. Increasing awareness of discrepancies between beliefs and conduct by use of the hypocrite paradigm during Dissonance Induction (Sessions 3-4). Then, participants were requested to reflect on their own conduct after writing articles about the hazards of smoking and producing short instructional films targeting other smokers. Assisting attendees in finding positive strategies to lower cognitive dissonance by means of behavioural change rather than justification during Dissonance Resolution (Sessions 5-6). Strengthening the desire to stop smoking by use of cognitive reframing and motivational interviewing strategies.

Reinforcement and Relapse Prevention (Sessions 7-8): Teaching coping techniques to handle high-risk circumstances and withdrawal symptoms. The group also created individualised relapse prevention strategies and predicted possible obstacles to keeping sobriety.

Group Intervention Team

Over eight straight weeks, individuals in the group intervention group attended eight group intervention sessions, each lasting 90 to 120 minutes in small groups of 8 to 10 people. The intervention's content and methods were comparable to the individual group, but they used group dynamics to improve efficacy. Other group intervention components included:

Observational Learning: In line with Bandura (2000) social learning theory tenets, helping others to learn by means of observation of other group members' experiences. Creating social support systems among group members to boost one another's drive to stop smoking. Creating systems of shared responsibility to improve dedication to the process of behavioral transformation. Offering chances for participants to understand that the challenges they face in the smoking cessation journey are shared experiences. *Group in Control*

Through eight organized educational sessions, control group participants received conventional health education on the risks of smoking and advantages of quitting. Included in the educational materials were accurate data on smoking's health effects, smoking cessation techniques, and treatment of withdrawal symptoms. The control group's lack of clear cognitive dissonance induction components was the key difference from the intervention groups.

Result and Discussion

Demographic and Baseline Characteristics of Participants

A total of 150 smoking university students participated in this research, with 50 participants randomly allocated to each of the individual intervention, group intervention, and control groups. Demographic and baseline characteristics of participants are presented in Table 1. There were no significant differences in demographic characteristics and baseline variables between the three groups (p>0.05), indicating successful randomization in creating equivalent groups.

Participant Compliance and Retention

Intervention compliance and participant retention rates during the follow-up phase are presented in Table 2. Overall, 132 of 150 participants (88.0%) completed the eight-week program and 127 participants (84.7%) completed the 6-month follow-up period. There were no significant differences in compliance and retention rates between the three groups (p>0.05).

Intervention Effectiveness on Smoking Abstinence 7-Day Abstinence at 6-Month Follow-up

The main research outcome showing the proportion of participants who achieved 7-day abstinence at 6-month follow-up is presented in Table 3. There was a significant difference in the proportion of 7-day abstinence between the three groups ($\chi^2 = 9.87$, p = 0.007). Post-hoc analysis showed that the proportion of 7-day abstinence was significantly higher in the individual intervention group (38.0%) and group intervention group (32.0%) compared to the control group (12.0%). There was no significant difference between the individual intervention group and the group intervention group (p = 0.519).

Continuous Abstinence

Continuous abstinence from the end of intervention until 6-month follow-up also showed significant differences between groups ($\chi^2 = 8.41$, p = 0.015). The proportion of continuous abstinence in the individual intervention group (30.0%) and group intervention group (26.0%) was significantly higher compared to the control group (10.0%), while there was no significant difference between the two intervention groups (p = 0.648) (Table 4).

Table 1. Demographic and	l Baseline Chara	acteristics of Participant	S
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Characteristic	Individual Intervention	Group Intervention	Control	p-
	(n=50)	(n=50)	(n=50)	value
Demographic Characteristics				
Age (years), mean ± SD	20.8 ± 1.6	21.2 ± 1.5	20.9 ± 1.7	0.426
Gender, n (%)				
- Male	41 (82.0)	40 (80.0)	43 (86.0)	0.713
- Female	9 (18.0)	10 (20.0)	7 (14.0)	
Field of study, n (%)				
- Health	11 (22.0)	13 (26.0)	10 (20.0)	0.852
- Social & Humanities	21 (42.0)	19 (38.0)	22 (44.0)	
- Engineering & Science	18 (36.0)	18 (36.0)	18 (36.0)	
Family income, n (%)				
- Low (<idr 3,000,000)<="" td=""><td>18 (36.0)</td><td>16 (32.0)</td><td>19 (38.0)</td><td>0.907</td></idr>	18 (36.0)	16 (32.0)	19 (38.0)	0.907
- Middle (IDR 3,000,000-7,000,000)	24 (48.0)	25 (50.0)	22 (44.0)	
- High (>IDR 7,000,000)	8 (16.0)	9 (18.0)	9 (18.0)	
Smoking Characteristics at Baseline				
Age started smoking (years), mean ± SD	15.3 ± 2.4	15.7 ± 2.1	15.2 ± 2.5	0.511
Smoking duration (years), mean ± SD	5.5 ± 2.3	5.5 ± 2.2	5.7 ± 2.4	0.889
Cigarettes per day, mean ± SD	12.3 ± 5.8	11.8 ± 5.2	12.6 ± 6.1	0.763
FTND score, mean ± SD	4.6 ± 1.9	4.5 ± 1.8	4.7 ± 2.0	0.842
Nicotine dependence level, n (%)				
- Mild (0-3)	14 (28.0)	15 (30.0)	14 (28.0)	0.967
- Moderate (4-6)	27 (54.0)	25 (50.0)	25 (50.0)	
- Severe (7-10)	9 (18.0)	10 (20.0)	11 (22.0)	
Psychological Variables at Baseline				
Cognitive dissonance score (SDS), mean	58.2 ± 14.6	60.1 ± 13.8	57.4 ± 15.2	0.629
± SD				
Self-efficacy score (SASEQ), mean ± SD	8.3 ± 3.7	8.6 ± 3.5	8.2 ± 3.8	0.858
Social support score (MSPSS), mean ±	53.7 ± 14.2	55.6 ± 13.7	52.9 ± 14.8	0.642
SD				
Previous quit attempts, n (%)	32 (64.0)	34 (68.0)	30 (60.0)	0.705

Note: FTND = Fagerström Test for Nicotine Dependence; SDS = Smoking Dissonance Scale; SASEQ = Smoking Abstinence Self-Efficacy Questionnaire; MSPSS = Multidimensional Scale of Perceived Social Support. P-values calculated using one-way ANOVA for continuous variables and chi-square test for categorical variables.

Table 2. Participant Compliance and Retention

Variable	Individual Intervention	Group Intervention	Control	p-
	(n=50)	(n=50)	(n=50)	value
Compliance with Intervention				
Number of sessions attended, mean ±	6.8 ± 1.6	7.1 ± 1.3	6.6 ± 1.7	0.259
SD				
Session attendance, n (%)				
- Complete (8 sessions)	28 (56.0)	32 (64.0)	25 (50.0)	0.352
- Partial (5-7 sessions)	17 (34.0)	15 (30.0)	17 (34.0)	
- Minimal (1-4 sessions)	5 (10.0)	3 (6.0)	8 (16.0)	
Retention at Follow-up				
Completed 8-week program, n (%)	45 (90.0)	46 (92.0)	41 (82.0)	0.232
Completed 3-month follow-up, n (%)	43 (86.0)	45 (90.0)	40 (80.0)	0.319
Completed 6-month follow-up, n (%)	43 (86.0)	44 (88.0)	40 (80.0)	0.469

Note: P-values calculated using one-way ANOVA for continuous variables and chi-square test for categorical variables.

Table 3. Proportion of 7-Day Abstinence at 6-Month Follow-up

	1		
Group	7-Day Abstinence, n (%)	OR (95% CI)*	p-value*
Individual Intervention (n=50)	19 (38.0)	4.50 (1.65-12.27)	0.003
Group Intervention (n=50)	16 (32.0)	3.45 (1.24-9.62)	0.018
Control (n=50)	6 (12.0)	Reference	-
Individual vs. Group Intervention	-	1.30 (0.58-2.93)	0.519
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*Note: OR = Odds Ratio; CI = Confidence Interval. OR and p-values compared to control group (reference) or between the two intervention groups.

Table 4. Proportion of Continuous Abstinence at 6-Month Follow-up

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Group	Continuous Abstinence, n (%)	OR (95% CI)*	p-value*
Individual Intervention (n=50)	15 (30.0)	3.86 (1.34-11.14)	0.012
Group Intervention (n=50)	13 (26.0)	3.16 (1.07-9.32)	0.037
Control (n=50)	5 (10.0)	Reference	-
Individual vs. Group Intervention	-	1.22 (0.51-2.92)	0.648
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*Note: OR = Odds Ratio; CI = Confidence Interval. OR and p-values compared to control group (reference) or between the two intervention groups.

Changes in Daily Cigarette Consumption

The table 5 shows changes in daily cigarette consumption during the study period. There was a significant decrease in the number of cigarettes consumed per day in all groups, but greater reductions were observed in the individual and group intervention groups compared to the control group (p<0.001 for time

× group interaction effect in repeated measures ANOVA). At 6-month follow-up, the mean reduction in cigarettes per day was 7.9 \pm 5.1 in the individual intervention group, 7.4 \pm 4.9 in the group intervention group, and 3.5 \pm 3.2 in the control group.

Table 5. Changes in Daily Cigarette Consumption

Measurement Time	Individual Intervention (n=50)	Group Intervention (n=50)	Control (n=50)	p-value*
Baseline	12.3 ± 5.8	11.8 ± 5.2	12.6 ± 6.1	0.763
Week 4	8.1 ± 4.7	7.9 ± 4.5	10.8 ± 5.6	0.004
End of intervention (Week 8)	5.2 ± 4.3	5.6 ± 4.1	9.7 ± 5.3	< 0.001
3-month follow-up	4.8 ± 4.5	5.2 ± 4.3	9.3 ± 5.1	< 0.001
6-month follow-up	4.4 ± 4.6	4.4 ± 4.7	9.1 ± 5.3	< 0.001
Reduction from baseline to	7.9 ± 5.1	7.4 ± 4.9	3.5 ± 3.2	< 0.001
6-month follow-up				

*Note: Data presented as mean ± standard deviation. P-values for comparisons between groups at each time point using oneway ANOVA with post-hoc tests.

Changes in Psychological Variables

Changes in Cognitive Dissonance

Changes in cognitive dissonance scores from baseline to 6-month follow-up are presented in the Table 6. There was a significant increase in cognitive dissonance scores in both intervention groups compared to the control group (p<0.001). The highest increase was observed in the individual intervention group, followed by the group intervention group, although the difference between the two intervention groups was not significant at 6-month follow-up (p=0.286).

Table 6. Changes in Cognitive Dissonance Scores (SDS)

0				
Measurement Time	Individual Intervention (n=50)	Group Intervention (n=50)	Control (n=50)	p-value*
Baseline	58.2 ± 14.6	60.1 ± 13.8	57.4 ± 15.2	0.629
Week 4	72.4 ± 16.1	71.6 ± 15.7	59.8 ± 14.9	< 0.001
End of intervention (Week 8)	81.7 ± 17.8	78.5 ± 16.9	62.3 ± 15.5	< 0.001
3-month follow-up	79.5 ± 18.2	77.1 ± 17.4	61.8 ± 16.1	< 0.001
6-month follow-up	78.3 ± 18.4	75.6 ± 17.9	60.7 ± 16.3	< 0.001
Change from baseline to 6-	20.1 ± 10.8	15.5 ± 9.6	3.3 ± 4.7	< 0.001
month follow-up				

*Note: Data presented as mean ± standard deviation. P-values for comparisons between groups at each time point using oneway ANOVA with post-hoc tests.

Changes in Self-Efficacy

Changes in self-efficacy scores are presented in the Table 7. There was a significant increase in self-efficacy scores in both intervention groups compared to the

Table 7.	Changes in	Self-Efficacy	v Scores ((SASEQ)
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l' able 7. Changes in Self-Effi	cacy Scores (SASEQ)			
Measurement Time	Individual Intervention (n=50)	Group Intervention (n=50)	Control (n=50)	p-value*
Baseline	8.3 ± 3.7	8.6 ± 3.5	8.2 ± 3.8	0.858
Week 4	11.7 ± 4.1	11.2 ± 3.9	9.0 ± 3.9	0.002
End of intervention (Week 8)	14.2 ± 4.5	13.5 ± 4.2	9.7 ± 4.0	< 0.001
3-month follow-up	13.8 ± 4.6	13.1 ± 4.3	9.5 ± 4.1	< 0.001
6-month follow-up	13.5 ± 4.7	12.8 ± 4.5	9.3 ± 4.2	< 0.001
Change from baseline to 6-	5.2 ± 2.4	4.2 ± 2.3	1.1 ± 1.9	< 0.001

Change from baseline to 6month follow-up

*Note: Data presented as mean ± standard deviation. P-values for comparisons between groups at each time point using oneway ANOVA with post-hoc tests.

Mediation Analysis

Mediation analysis using structural equation modelling (SEM) showed that changes in cognitive dissonance significantly mediated the effect of intervention on 7-day abstinence (Table 8). Changes in

cognitive dissonance explained 42.1% (95% CI: 28.7%-55.4%) of the total effect of individual intervention and 38.7% (95% CI: 25.1%-52.3%) of the total effect of group intervention on 7-day abstinence at 6-month follow-up.

control group (p<0.001). The highest increase was

observed in the individual intervention group, but there

was no significant difference between the two

intervention groups at 6-month follow-up (p=0.415).

Table 8. Mediation	Analysis Results:	Changes in Cogniti	ve Dissonance as a Mediator

Parameter	Individual Intervention	Group Intervention
Intervention \rightarrow Change in Cognitive Dissonance (path a)		
Coefficient (SE)	16.80 (1.63)	12.20 (1.58)
p-value	< 0.001	< 0.001
Change in Cognitive Dissonance \rightarrow 7-Day Abstinence (path b)		
Coefficient (SE)	0.06 (0.01)	0.05 (0.01)
p-value	< 0.001	< 0.001
Direct Relationship Intervention \rightarrow 7-Day Abstinence (path c')		
Coefficient (SE)	0.86 (0.43)	0.74 (0.44)
p-value	0.046	0.089
Total Relationship Intervention \rightarrow 7-Day Abstinence (path c)		
Coefficient (SE)	1.50 (0.51)	1.24 (0.52)
p-value	0.003	0.018
Indirect Effect (through Mediator)		
Coefficient (SE)	0.63 (0.15)	0.48 (0.14)
Bootstrapped 95% CI	0.34 - 0.93	0.21 - 0.75
Proportion of Effect Mediated, % (95% CI)	42.1 (28.7 - 55.4)	38.7 (25.1 - 52.3)

Note: SE = Standard Error; CI = Confidence Interval.

Moderation Analysis

Moderation analysis using logistic regression with interaction terms showed that baseline nicotine dependence level moderated intervention effectiveness (Table 9). Individual and group interventions were more effective for participants with low to moderate nicotine dependence levels, while at high dependence levels, both interventions showed lower effectiveness. No significant moderation effects were found for gender, family income level, or social support.

able 3. Woderating Effect of Webline Dependence Level of 7-Day Abstinence					
Nicotine Dependence Level	Individual Intervention (n=50)	Group Intervention (n=50)	Control (n=50)	p-value*	
7-Day Abstinence by Nicotine I	Dependence Level, n/N (%)				
Low (FTND 0-3)	8/14 (57.1)	7/15 (46.7)	3/14 (21.4)	0.125	
Moderate (FTND 4-6)	10/27 (37.0)	8/25 (32.0)	2/25 (8.0)	0.037	
High (FTND 7-10)	1/9 (11.1)	1/10 (10.0)	1/11 (9.1)	0.984	
Odds Ratio (95% CI) for Individ	lual Intervention × Nicotine Depen	dence Level			
OR (95% CI)	0.28 (0.10-0.81)	-	-	0.018	
Odds Ratio (95% CI) for Group	Intervention × Nicotine Dependend	ce Level			
OR (95% CI)		0.31 (0.11-0.89)	-	0.029	
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Table 9. Moderating Effect of Nicotine Dependence Level on 7-Day Abstinence

*Note: FTND = Fagerström Test for Nicotine Dependence; OR = Odds Ratio; CI = Confidence Interval. P-values for interaction effect in logistic regression model

Cost-Effectiveness Analysis

Table 10 shows the results of cost-effectiveness analysis. The total cost of running the individual intervention (IDR 40,850,000) was higher compared to the group intervention (IDR 30,000,000), primarily due to differences in service provision costs. Although the individual intervention produced a slightly higher proportion of abstinence, the group intervention had a better cost-effectiveness ratio, costing IDR 1,875,000 per abstinence achieved compared to IDR 2,150,000 for the individual intervention.

 Table 10. Cost-Effectiveness Analysis

Component	Individual Intervention	Group Intervention	Control
Costs (in Indonesian Rupiah)			
Intervention provider honoraria	24,000,000	12,000,000	8,000,000
Intervention materials	3,750,000	5,000,000	3,000,000
Biochemical verification	5,000,000	5,000,000	5,000,000
Room and equipment	3,100,000	3,500,000	2,800,000
Staff training	2,500,000	2,500,000	1,800,000
Overhead	2,500,000	2,000,000	1,500,000
Total costs	40,850,000	30,000,000	22,100,000
Effectiveness			
Number of 7-day abstinence	19	16	6
Cost-Effectiveness Ratio			
Cost per abstinence (IDR)	2,150,000	1,875,000	3,683,333
Incremental Cost-Effectiveness Ratio (ICER)			
ICER vs. control (IDR)	1,442,308	1,040,000	-
ICER individual vs. group intervention (IDR)	3,616,667	-	-

Discussions

This study aimed to assess the effectiveness of cognitive dissonance therapies in individual and group formats for encouraging smoking cessation among university students, and to reveal the psychological mechanisms behind the effectiveness of these interventions. Results showed that both intervention formats were significantly more effective than the control condition; changes in cognitive dissonance served as a key mediator and nicotine dependent level as a significant moderator of intervention efficacy.

Effectiveness of Cognitive Dissonance Interventions

The outcome that cognitive dissonance interventions—both individual and group formats significantly increased smoking abstinence in comparison to the control group supports the theoretical premise that activating and resolving cognitive dissonance can facilitate behavior change (Cooper, 2007; Festinger, 1957). At 6-month follow-up, the 7-day abstinence rates for individual (38.0%) and group interventions (32.0%) in this study are comparable to findings from recent meta-analyses by Livingstone-Banks et al. (2023) suggesting 30-40% abstinence rates for psychological interventions targeting young adult smokers. Various mechanisms clarify the effectiveness of cognitive dissonance treatments in this study. First, the dissonance induction component of the hypocrisy paradigm efficiently increased participants' awareness of differences between their knowledge of smoking dangers and their actual smoking behavior. Stone & Fernandez (2008) claim this strategy works as it causes dissonance via cognitive processes including selfawareness. Second, the intervention offered positive behavioral change instead of rationalization as a way to reduce dissonance, which McGrath (2017) contends usually becomes the default strategy.

absence of significant differences in The effectiveness between individual and group therapies suggests that both formats might be equally successful means of applying cognitive dissonance concepts. Ramo et al. (2018) reached the same finding; they too discovered no significant differences between individual and group formats in smoking cessation programs for young individuals. According to Westmaas et al. (2010), in the context of smoking cessation both have advantages and disadvantages that might balance one another. Although the group structure offers social support and peer approval that might be equally significant, the individual method offers greater adaptability and flexibility in addressing particular personal challenges. Given Indonesia's strong collectivistic propensity, these findings are fairly noteworthy. Padmawati et al. (2018) claim that social norms and group support are major influences on health-related decisions in Indonesia. The results of this study thus underline the potential of group-based tactics that meet Indonesian cultural standards by showing how well the group format works. Kreuter et al. (2003) claim that universal therapies are less effective than culturally tailored ones.

Changing Mechanisms Cognitive Dissonance's Mediating Role

The mediation study in this article provides empirical evidence indicating that differences in cognitive dissonance significantly mediate the effect of intervention on smoking cessation, accounting for 42.1% of the individual intervention effect and 38.7% of the group intervention effect. This finding validates cognitive dissonance theory as a valid conceptual tool for understanding and fostering health behavior change (Harmon-Jones & Mills, 2019). Psychological discomfort of cognitive dissonance could, as Fotuhi et al. (2013) demonstrate, be a powerful driver for behavioral change, especially when individuals are guided to resolve dissonance by methods of behavioral change.

These results help to better define the mechanical pathways of smoking cessation initiatives. Heydari et al. (2014) claim that changes in ideas related to smoking habit are major long-term predictors of smoking cessation success. Their study on change processes in smoking cessation programs revealed that before behavioral changes, beliefs and cognitive changes about smoking emerge first. Our findings back up these results and imply that cognitive dissonance could be an important treatment emphasis.

The identical percentages of mediation effect between individual (42.1%) and group (38.7%) formats imply that both intervention formats run via similar psychological processes. McKimmie et al. (2009) study backs this up by showing that, although process dynamics differ, cognitive dissonance processes could function well in both individual and group environments. The outcome is that smoking cessation programs might be designed to handle cognitive dissonance regardless of their delivery approach, therefore providing program implementation flexibility based on resources and contextual preferences.

Moderating Factors: The Role of Nicotine Dependence

The finding that degree of nicotine dependence influences treatment effectiveness helps to understand factors influencing responses to smoking cessation initiatives. University students with low to moderate nicotine dependency found cognitive dissonance treatments to be more effective than those with high dependence. This finding corroborates the greater body of studies connecting rising nicotine dependence to worse outcomes in efforts to stop smoking (Vangeli et al., 2011).

Different perspectives clarify the moderating nicotine dependence. influence of From neurobiological standpoint, Benowitz et al. (2020) claim that rising nicotine dependency is accompanied with increasingly severe neuroadaptive changes in brain areas linked to reward and motivation, hence complicating the process of overcoming using just psychological treatments. From a psychological point of view, Baker et al. (2007) suggest that smokers with high reliance experience more severe withdrawal symptoms, which might interfere with the cognitive processes necessary for dissonance-driven behavioral change.

This outcome suggests that cognitive dissonance therapies might be most effective when targeted at smokers with low to moderate dependence levels, including as students who have just started smoking. Professional practice advice on tobacco dependency therapy (Fiore et al., 2008), supports a mixed approach including psychosocial treatments and medications for heavy users.

Cost Efficiency: Advantages of the Group Format

According to the cost-effectiveness study in this paper, the group format was more cost-effective, costing IDR 1,875,000 per abstinence reached versus IDR 2,150,000 for the individual format, even although the individual format had slightly higher abstinence rates. Especially in resource-limited environments like developing countries, this outcome has significant practical implications. The cost efficiency of the group format matches findings from a comprehensive analysis by Martín Cantera et al. (2015) investigating the costeffectiveness of many smoking cessation techniques. They found that group treatments are usually more costeffective than individual ones, particularly when labor costs are high in comparison to other expenses.

Given the limited resources many Indonesian higher education institutions have for health initiatives. this outcome is noteworthy. Mostly, the implementation of tobacco control programs on Indonesian campuses relies on cost effectiveness (Ayuningtyas et al., 2021; Padmawati et al., 2018; Prabandari, 2013). The group approach not only offers efficiency in resource use but also may reach more students at once, hence broadening program reach. Wee et al. (2011) emphasize even further that group therapy in collectivistic societies might have the additional effect of strengthening social norms promoting positive behaviors. Group-based approaches could harness social network impacts in campus communities, therefore perhaps producing more widespread effects outside of direct program involvement.

Conclusion

These results consequently almost motivate the addition of cognitive dissonance-based therapiesespecially in group format-into campus smoking cessation programs. The group format is a practical option for large-scale deployment in resource-limited environments as it not only offers comparable effectiveness to the individual format but also more cost efficiency. Often neglected in earlier research, the direct comparison between individual and group formats provides informative analysis of how smoking cessation programs should be enhanced. The closeness in effectiveness between both forms offers program implementation flexibility, hence allowing variations based on local preferences, resource availability, and cultural background. Given the continuing high smoking incidence among young people, this research offers an evidence-based approach to address this urgent public health issue in the Indonesian context. Group format cognitive dissonance-based treatments provide a very inexpensive, effective, and culturally appropriate approach to reduce smoking habit among Indonesian university students, hence aiding more general efforts to improve the health and well-being of Indonesia's young population.

Acknowledgments

Place acknowledgments, including information on grants received, before the references, in a separate section, and not as a footnote on the title page

Author Contributions

For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, X.X. and Y.Y.; methodology, X.X.; software, X.X.; validation,

X.X., Y.Y. and Z.Z.; formal analysis, X.X.; investigation, X.X.; resources, X.X.; data curation, X.X.; writing—original draft preparation, X.X.; writing—review and editing, X.X.; visualization, X.X.; supervision, X.X.; project administration, X.X.; funding acquisition, Y.Y. All authors have read and agreed to the published version of the manuscript." Please turn to the <u>CRediT taxonomy</u> for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

Funding

Please add: "This research received no external funding" or "This research was funded by NAME OF FUNDER, grant number XXX" and "The APC was funded by XXX". Check carefully that the details given are accurate and use the standard spelling of funding agency names at https://search.crossref.org/funding. Any errors may affect your future funding.

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