Efficacy of Reconstructive Regressive Therapy in Smoking Cessation: A Randomized Controlled Trial with Biomarkers and Clinical Indicators

Eficacia de la Terapia Regresiva Reconstructiva en la Cesación del Tabaquismo: Un Ensayo Controlado Aleatorizado con Biomarcadores e Indicadores Clínicos

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SUMMARY

Background: *Smoking, a habit that affects an estimated 1.3 billion people worldwide, causes 22.3 % of deaths annually. This study investigates the impact of Regressive Reconstructive Therapy (RRT) on smoking reduction.* **Method:** *A cluster randomized controlled trial evaluating the impact of Reconstructive Regressive Therapy (RRT) versus Cognitive Behavioral Therapy (CBT) on smoking reduction. Participants, 56 adults from Cúcuta, Colombia, aged 18-71 years (mean age 31-39 years) and who usually smoked 10-12 cigarettes per day, were randomly assigned to one of the therapies and underwent assessments and testing throughout the study. Both groups participated in ten 90-minute sessions. Statistical analyses, including ANCOVA and ANOVA MR, were employed. Marginal mean plots visually represented the progression of variables and the effects of therapy.* **Results:** *Participants in the RRT group showed greater resistance to smoking; by the end of the study, weekly cigarette consumption had decreased to 0.67, compared with 7.17 in the CBT group. However, cotinine and carbon monoxide blood*

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levels did not differ significantly between the groups, and, as a secondary outcome, the RRT group showed evidence of improved mental health. **Conclusions:** *The study highlights better outcomes with RRT than with CBT for smoking cessation, an effective alternative intervention.*

Keywords: *Cognitive behavioral therapy, regressive reconstructive therapy, smoking, tobacco.*

RESUMEN

Antecedentes: *El tabaquismo, un hábito que afecta a aproximadamente 1 300 millones de personas en todo el mundo, causa el 22,3 % de las muertes anuales. Este estudio investiga el impacto de la Terapia Regresiva Reconstructiva (TRR) en la reducción del consumo de tabaco.* **Método:** *Ensayo controlado aleatorizado por conglomerados que evaluó el impacto de la Terapia Regresiva Reconstructiva (TRR) frente a la Terapia Cognitivo Conductual (TCC) en la reducción del consumo de tabaco. Los participantes, 56 adultos de Cúcuta (Colombia), de entre 18 y 71 años, con una edad media de 31-39 años, fumaban habitualmente entre 10 y 12 cigarrillos al día, fueron asignados aleatoriamente a una u otra terapia y evaluados y sometidos a pruebas a lo largo del estudio. Ambos grupos participaron en diez sesiones de 90 minutos. Se emplearon análisis estadísticos, incluidos ANCOVA y ANOVA de medidas repetidas (MR). Los gráficos de medias marginales representaron visualmente la progresión de las variables y los efectos de la terapia.* **Resultados:** *Los participantes del grupo TRR mostraron una mayor resistencia al tabaquismo; al final del estudio, el consumo semanal de cigarrillos se redujo a 0,67 en comparación con 7,17 en el grupo TCC. Sin embargo, los niveles de cotinina y monóxido de carbono en sangre no difirieron significativamente entre los grupos y, como resultado secundario, se observó una mejora en la salud mental en el grupo TRR.* **Conclusiones:** *El estudio resalta mejores resultados de la TRR frente a la TCC en la cesación del tabaquismo, lo que constituye una alternativa de intervención eficaz.*

Palabras clave: *Terapia cognitivo conductual, terapia regresiva reconstructiva, tabaquismo, tabaco.*

INTRODUCTION

Smoking is a global health crisis that involves more than 1.3 billion smokers and accounts for 22.3 % of deaths annually, underlining its serious impact on public health and health care systems (1). Smoking is linked to an increased risk of developing more than 25 non-communicable diseases, including chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), diabetes mellitus, hypertension, atherosclerosis, and numerous types of cancer, including cancers of the mouth, throat, larynx, and lungs (2-4). Each year, smoking causes 8 million deaths and a sig-nificant burden of disability, making it a public health priority (5-7).

Since the 1980s, the World Health Organization (WHO) has promoted several initiatives to mitigate the impact of tobacco use, including the Framework Convention on Tobacco Control (FCTC), adopted in 2003 and im-plemented since 2005, as well as MPOWER measures, which include strategies such as tobacco tax increases, plain packaging, and personalized cessation support (8). These measures are important for the prevention of tobacco use, especially in the adolescent population, as the early onset of tobacco use significantly increases the likelihood of developing an addiction in adulthood (9-11).

In Latin America, about 75 % of smokers initiate smoking between the ages of 14 and 17, demonstrating a direct correlation between nicotine addiction, time of use, and daily quantity of cigarettes (12). In addition, environmental factors such as the taste, smell, and physical sensations associated with smoking reinforce addictive behavior, transforming it into an automatic habit that is difficult to overcome (8,13,14). Thus, tobacco addiction is the result of the combined effects of nicotine and other toxic substances released during cigarette combustion, such as polycyclic aromatic hydrocarbons, which, upon entering the bloodstream, activate the reward pathways of the central nervous system, generating feelings of euphoria that reinforce consumption (15). However, these effects are transient, creating a recurrent urge to smoke (10,16,17). This addiction is not limited to physical dependence, but also includes a strong psychological dependence, influenced by social, behavioral, and cultural factors that consolidate the habit (18).

Over time, studies have shown that chronic tobacco use impairs fundamental skills such as coping, stress regulation, learning, and emotional self-regulation. Thus, abstinence from tobacco

use presents significant challenges, as it causes intense symptoms manifested by cravings, dysphoria, sleep disturbances, irritability, anxiety, concentration problems, and appetite disturbances (19). To address these difficulties, traditional treatments include nicotine therapies, drug therapies, and psychological strategies such as cognitive-behavioral therapy (CBT), and although these treatments are available, the rates of smoking, mortality, and morbidity associated with smoking continue to be worrying (15,19-21). However, in parallel to conventional treatments, alternative therapies have attracted increasing interest, as they are seen as complementary tools in tobacco control (2,6).

Interventions such as hypnosis, acupuncture, and mindfulness meditation have shown promising results in addressing the physical and psychological aspects of addiction (22-24), helping smokers to manage emotional factors such as stress, anxiety, and other key elements in the quitting process (25-28). In the face of these difficulties, traditional treatments comprise nicotine therapies, drug therapies, and psychological strategies such as cognitive behavioral therapy (CBT), and although these treatments are available, the numbers of smoking, mortality, and morbidity associated with smoking remain preoccupying (17,19,29-35).

The integration of these strategies into treatment programs could offer more holistic and effective approaches, contributing significantly to reducing the public health impact of smoking. Among them, Reconstructive Regressive Therapy (RRT) is a psychotherapeutic approach that integrates emotional regression, autobiographical memory work, and deep cognitive reconstruction to help individuals identify and transform early-formed emotional patterns, beliefs, and behaviors that continue to influence their present life. RRT is a therapeutic method designed to access and explore past experiences, especially from childhood, that shaped core emotional and cognitive patterns, with the goal of reconstructing the meaning of those experiences and fostering healthier psychological responses in the present. In this context, the main objective of the current research was to determine how Reconstructive Regressive Therapy (RRT) influences the reduction in the number of cigarettes smoked daily, and for this purpose, the specific objectives were:

a) To quantify the initial consumption of the participants and b) To compare the effectiveness of RRT versus cognitive behavioral therapy (CBT) ("Supplemental Material for Feasibility, Tolerability, and Potential Advantages of a Dyadic Financial Incentive Treatment for Smoking Cessation Among Dual-Smoker Couples: A Pilot Study," 2022).

METHOD

The study was designed as a double-blind randomized clinical trial to ensure validity and minimize bias. Random assignment of participants to intervention groups reduced the risk of bias, while blinding ensured that neither participants nor investigators were aware of group assignment (36). To determine the appropriate sample size, G*Power 3.1.9.7 (37) was used, assuming a 95 % confidence level, 95 % statistical power, and an effect size of 0.25. This calculation indicated a need for 56 participants, which ensures a robust statistical analysis (Figure 1).

1. Subjects

A total of 180 regular smokers aged 18 or older residing in Cúcuta and its surroundings were evaluated. From this group, 72 candidates were selected who met the inclusion criteria: moderate or high nicotine de-pendence, assessment using the Cigarette Dependence Scale (CDS-12) instruments and the Glover-Nilsson test, motivation to quit smoking according to the Richmond Test, and an adequate level of psychological well-being as measured by the General Health Ques-tionnaire (GHQ-12 (38). People with severe mental disorders, active use of psychoactive substances or al-coholism, a history of previous smoking cessation treatment, pregnancy, or minors were excluded (39).

Participant recruitment was conducted through in-person contacts, social networks, and local referrals. As part of the initial process, participants completed a demographic form and underwent serum cotinine testing and psychological assessments. Cotinine is the primary metabolite produced when the body breaks down nicotine. Because cotinine

is chemically stable and has a longer half-life than nicotine, it is the gold-standard biomarker for assessing tobacco use or exposure. Once selected, they were randomly assigned to two groups of 36 people each and participated in 10 weekly sessions. In the final phase of the study, five carbon monoxide measurements were taken (at weeks 8, 11, 12, 13, and 14) and serum cotinine tests and psychological assessments were repeated (36,40,41).

The randomization process involved an initial reduction of the group from 180 candidates to 77 after applying the inclusion and exclusion criteria. Of these, 5 were excluded by random draw, leaving 72 participants (Figure 1. Random allocation of participants). The double-blind design meant that participants knew only whether they belonged to Group A or Group B, while the evaluators did not have access to the allocated treatments.

2. Measures

To assess the results, several tools were used: the Glover-Nilsson test, used to analyse gestural, social and psychological dependence; the Cigarette Dependence Scale (CDS-12), to measure physical addiction to smoking; the Richmond Test, to assess motivation to quit smoking; and the General Health Questionnaire (GHQ-12), to assess participants' general psychological well-being (27) (Table 1).
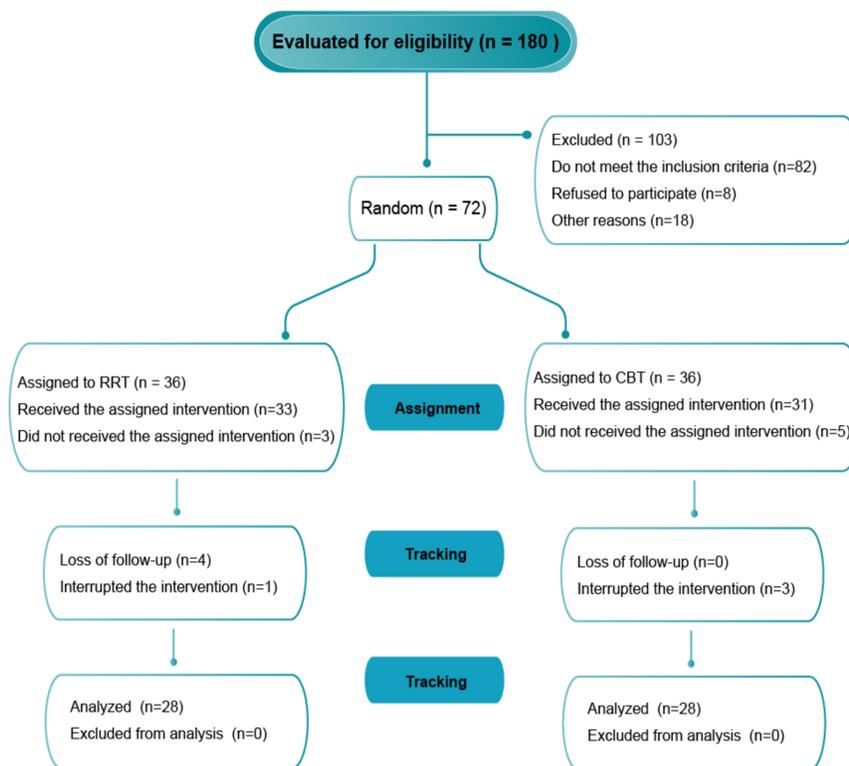
Figure 1. Research phase and randomisation of participants.
Note: To preserve internal validity, double blinding was carried out, and physical or communication proximity between participants was avoided. Similarly, to address threats to external validity, random selection was used to ensure that subjects did not receive extraneous treatments, and post-test measurements were conducted in a timely manner.

Table 1. Psychometric properties of measurement instruments.

Instrument	Author	Psychometric Properties	Dimensions
Glöver Nilsson Test (42)	Glover, Nilsson, Westin, Glover, Laflin and Persson	Cronbach's alpha of 0.76	Psychological, gestural and social dependence on cigarettes
Cigarette Dependence Scale (CDS-12) (39)	Jean-Francois Etter	Cronbach's Alpha of 0.84	Physical dependence on cigarettes
Richmond Test (27)	McConnaughy, Prochaska and Velicer	Cronbach's alpha of 0.80	Level of motivation for quitting smoking
General Health Questionnaire Scale 12 (GHQ-12) (43)	Goldberg	Cronbach's alpha of 0.92	Psychopathological problems without psychotic symptoms

3. Experimental Session

Therapeutic interventions were divided between the two groups. Group A (controlled) received Cognitive Behavioral Therapy (CBT), considering the standard for smoking cessation. Group B (experimental) participated in sessions of Regressive Reconstructive Therapy (RRT), an innovative intervention focused on the exploration and re-signification of past experiences. Both therapies consisted of 10 weekly 90-minute sessions, specifically designed according to the principles of each approach (Figure 2 and Table 2, CBT/RRT treatment sessions).

4. Validation of intervention protocols by experts.

To ensure the effectiveness of the intervention protocols, experts in the field were consulted. Three specialists rigorously evaluated each therapeutic program using Lawshe's validation criteria, with particular attention to clarity, relevance, theoretical underpinning, and systematization. After an exhaustive review, it was concluded that the protocols were sound and did not require modification (3,44,45).
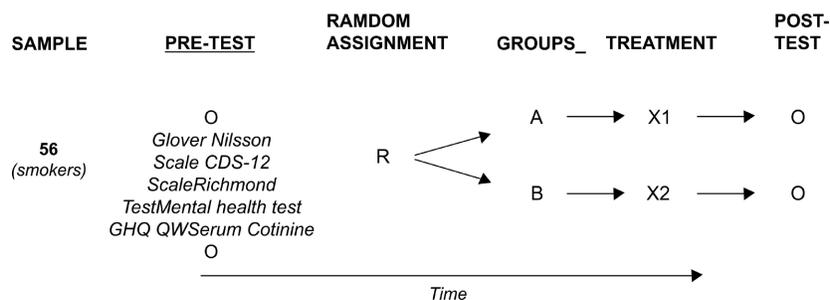

Figure 2. *General outline of experimental design.*
R: Random assignment. A: Control group. B: Experimental group. X1: Baseline intervention. X2: Experimental intervention.

Table 2. Treatment sessions (TCC / TRR).

Group	Meeting,	Thematic
	Session 1	Initial general interview and motivational interview.
	Session 2	Review of consumption by self-reporting, education of risks and consequences, and planning of pleasant activities.
	Session 3	Review of consumption by self-recording, analysis, and review of pleasant activities.
	Session 4	Review consumption by self-report, plan stimulus control guidelines.
	Session 5	Review consumption by self-report, functional analysis feedback, abstinence analysis if appropriate.
Control (TCC)	Session 6	Review consumption by self-report, conduct weekly analysis, and promote intra- and interpersonal resources.
	Session 7	Review consumption via self-report and reinforcement of positive aspects.
	Session 8	Review consumption by self-report, weekly analysis, maintenance of abstinence, and reinforcement as appropriate.
	Session 9	Review use via self-report, conduct weekly analyses, promote problem-solving, and promote relapse prevention.
	Session 10	Review consumption by self-report, psychological dishabituation with exposure to conditioned stimuli, and final feedback.
Experimental (TRR)		
	Session 1	General guidelines, clinical history, and statistical data
	Session 2	Consumption measurement and clinical history
	Session 3	Intrabody scenario
	Session 4	Critical point scenario
	Session 5	Guided cancer visualization
	Session 6	Desert guided visualization
	Session 7	Sacred Mountain Scenario
	Session 8	Scenario to address a specific patient issue
	Session 9	Treasure Map Scenario
	Session 10	Terrace Scenario (closing)

5. *Ethical considerations.*

This study was conducted in strict compliance with current ethical regulations, guaranteeing voluntary participation and informed consent of all participants. The research was approved by the Scientific Committee of the Universidad Simón Bolívar (code C1032010821) and was conducted in accordance with universal ethical principles, including the Psychologist's Code of Ethics, the Nuremberg Code, the UNESCO Declaration of Bioethics, and the Declaration of Helsinki (46). These ethical frameworks ensured the protection of human rights throughout the process.

The study practices were aligned with Resolution 8430 of 1993 (18), which requires compliance with scientific standards to ensure participants' safety and well-being through the intervention of qualified personnel. Likewise, the confidentiality of individuals' health data was respected, in accordance with Resolution 2378 of 2008 (47), which regulates Research Ethics Committees (RECs) and promotes good practices supported by international organizations.

6. *Statistical analysis*

First, an exploratory analysis was performed to assess the normality of the variables (Shapiro-Wilk test and box plots) and to identify outliers, without finding relevant inconsistencies. Then, the assumptions for the analysis of covariance (ANCOVA) were checked, treating group as a between-subjects factor and including baseline scores and sociodemographic characteristics as covariates to mitigate confounding.

Repeated measures analysis of variance (ANOVA) assumptions were evaluated, with longitudinal measurements as within-subjects

variables and treatment type as a between-subjects factor. Socio-demographic covariates were also considered to obtain accurate estimates.

The absence of multivariate outliers was confirmed by standardized residuals, Cook's distances, and leverage values. Normality and homoscedasticity were verified with the Shapiro-Wilk test, quantile plots, and Levene's test. Interaction between the group and covariates ensured equal regression slopes, and linearity was assessed with scatter plots.

Assumption of sphericity was assessed with Mauchly's test, and equality of variance-covariance matrices with Box's M-test. After confirming the assumptions, ANCOVA and repeated-measures ANOVA were conducted as specified in the design.

Results were presented as means and standard errors, with significance reported using F-statistics. Effect size, expressed as η^2, was interpreted as small ($\eta^2 \geq 0.01$), moderate ($\eta^2 \geq 0.06$), or large ($\eta^2 \geq 0.16$). Analyses were performed in RStudio Statistical Software version 4.2.2, with a significance threshold of $p < 0.05$.

RESULTS

Sociodemographic characteristics of participants before the assessment (pre-test or baseline)

The research sample consisted of 56 individuals, randomly and evenly distributed between the CBT and RRT groups. Of these participants, 30.35 % (17 individuals) were female, and 69.64 % (39 individuals) were male. Their ages ranged from 18 to 71 years, with a mean age of 31.39 years and a standard deviation of 12.02. This age range showed a coefficient of variability in participant age. This age range indicated a coefficient of variation (CV) of 38.29 %. For smoking initiation, the mean age was 18.21 years, with a standard deviation of 5.31 (CV=29.16 %), and the minimum and maximum starting ages were 13 and 40 years, respectively (Table 3). The study also showed considerable variation in daily cigarette consumption among participants. On average, individuals smoked 8.29 cigarettes per day, with a standard deviation of 6.17, which translates into a CV of 74.43 %.

Daily cigarette consumption ranged from 1 to 30 cigarettes. Other socio-demographic data, such as economic status, educational level, disability status, history of previous quit attempts, specific smoking triggers, alcohol consumption along with smoking, frequency of tobacco use, and use of other psychoactive substances (Table 3).

Evaluating the impact of regressive reconstructive therapy: Findings from ANCOVA analysis.

The efficacy of Regressive Reconstructive Therapy (RRT) was evaluated using two robust statistical approaches: analysis of covariance (ANCOVA) and repeated-measures analysis of variance (ANOVA MR). The ANCOVA was used to identify significant differences in post-test scores between groups after adjusting for discrepancies in pre-intervention measurements. MR ANOVA facilitated the analysis of longitudinal changes over time in the different groups.

The study's results showed notable variations across the psychological constructs assessed. Among these, the increase in motivation to quit smoking among participants in the RRT group stands out. This group reached a mean of 10.26 points, significantly higher than the 7.85 points of the Cognitive Behavioral Therapy (CBT) group (F=33.41, p<0.001, η^2=0.45), indicating a more robust resolve to counteract smoking-related urges in individuals undergoing RRT. In addition, a substantial decrease in psychological, social, and gestural dependence was observed, which was closely associated with a significant reduction in physical dependence. In terms of general mental health, participants in the RRT group reported lower scores (indicating better outcomes), with an average of 2.16 points compared to 3.85 in the CBT group, reflecting a substantial and statistically significant difference (F=8.07, p=0.007, η^2=0.16) (Table 3).

Table 4 presents the ANCOVA results for the quantitative variables, indicating the remarkable effectiveness of RRT in reducing cigarette consumption. The mean weekly cigarette consumption in the RRT group decreased to only 0.67, in stark contrast to the CBT group's mean of 7.17, demonstrating a large effect (F=14.91, p<0.001, η^2=0.27). However, it is important

Table 3. Sociodemographic characteristics of participants before the intervention, pretest, or baseline.

Feature	Categories	Total n (%) o M (DE)	CBT n (%) o M (DE)	RRT n (%) o M (DE)	t o χ^2 (p)
Age	Not applicable	31.39 (12.01)	33.89 (10.90)	28.89 (12.74)	1.58 (.120)
Age of onset of use	Not applicable	18.21 (5.31)	19.00 (6.62)	17.43 (3.50)	1.11 (.272)
Sex of partic-ipant	Female	17 (30.36)	12 (21.43)	5 (8.93)	4.14 (.042)
	Male	39 (69.64)	16 (28.57)	23 (41.07)	
Socioeconomic stratum	Stratum 1	16 (28.57)	8 (14.29)	8 (14.29)	
	Stratum 2	24 (42.86)	14 (25.00)	10 (17.86)	
	Stratum 3 or higher	16 (28.57)	6 (10.71)	10 (17.86)	1.67 (.435)
Academic level	Basic or middle school education	31 (55.36)	14 (25.00)	17 (30.36)	
	Higher education	25 (44.64)	14 (25.00)	11 (19.64)	0.65 (0.420)
Presence of any disability	Yes	5 (8.93)	3 (5.36)	2 (3.57)	0.22 (0.639)
	No	51 (91.07)	25 (44.64)	26 (46.43)	
A place that encourages consumption	At home	12 (21.43)	4 (7.14)	8 (14.29)	
	At work, social gatherings, or in the street	21 (37.5)	9 (16.07)	12 (21.43)	3.89 (0.143)
	In other places or situations	23 (41.07)	15 (26.79)	8 (14.29)	
Alcohol consumption	Yes	40 (71.43)	20 (35.71)	20 (35.71)	0.001 (1.000)
	No	16 (28.57)	8 (14.29)	8 (14.29)	
Frequency of alcohol consumption	Never	32 (57.14)	8 (14.29)	24 (42.86)	
	Rarely	13 (23.21)	11 (19.64)	2 (3.57)	18.69 (<0.001)
	Occasionally	11 (19.64)	9 (16.07)	2 (3.57)	

t: t-Student statistic. χ^2: Chi-Square statistic. p: bilateral significance.
a It includes the nine grades taught from primary to secondary school. b It includes professional, technical, technological, university, specialization, master's, or doctoral studies.

to note that no significant differences were found in cotinine (F=1.39, p=0.247, η^2=0.03) or carbon monoxide (F=3.14, p=0.084, η^2=0.07) levels, indicating that there are external factors, such as exposure to second-hand smoke or environmental pollution, that could somehow affect the measurements, even when there is a marked decrease in smoking.

Evaluating the impact of regressive reconstructive therapy using ANOVA MR

As shown in Table 4, significant longitudinal changes were observed across all variables, indicating statistically significant differences between the pre-test and post-test phases. The only exceptions were, once again, cotinine and carbon monoxide levels. A marked increase in motivation to quit smoking was observed, from
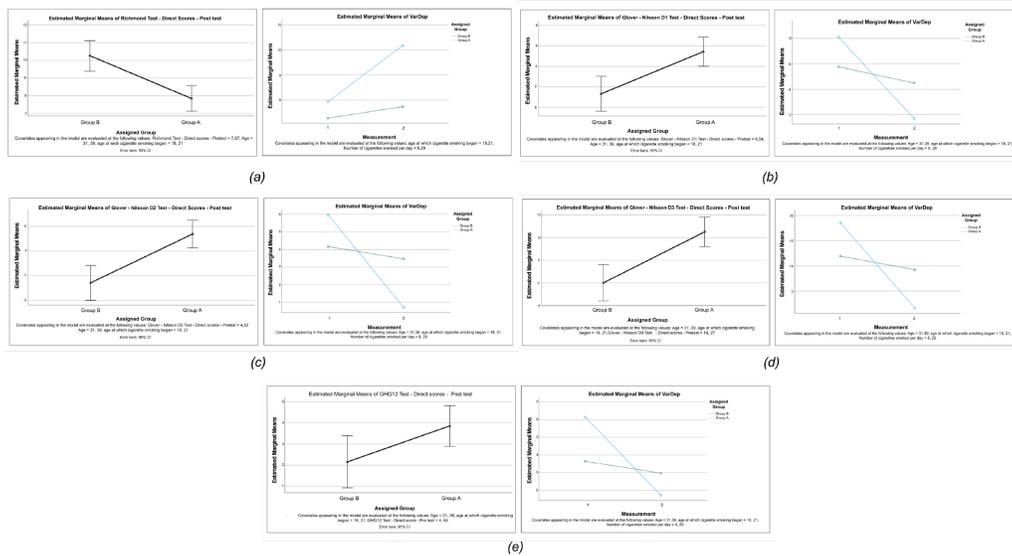
Figure 3. Effect on motivation to quit smoking as measured by the Richmond test (a); effect on psychological (b), social (c) and gestural (d) dependence as measured by the GN-SBQ; effect on mental health as measured by the GHQ-12 (e). Differences in post-intervention (post-test) scores between groups A (CBT) and B (RRT). Differences in smoking cessation motivation scores before and after the intervention, by therapy type.

RRT participants than among others. This pattern is held for other psychological constructs, such as social and gestural dependence, mental health, and tobacco dependence, as detailed in Figure 3. Effect on psychological (b), social (c), and gestural (d) dependence as measured by the GN-SBQ and Effect on mental health as measured by the GHQ-1(e).

Regarding cigarette consumption, Figure 4 shows significant variation in this parameter during the 10th week of the study. This variable was monitored throughout the 10-week study. Consequently, a significant positive slope was observed between the means of groups B (RRT) and A (CBT), suggesting that, at the end of the study, participants in the cognitive behavioral therapy group smoked more cigarettes per week. On the other hand, Figure 4 shows a considerable decrease in this indicator in both groups, with the reduction more pronounced in participants undergoing RRT.

This effect occurred in the first five weeks of treatment, after which the number of cigarettes consumed remained relatively constant (Figure 4h). It should be noted that there was no significant effect on blood cotinine levels or carbon monoxide concentrations (Figure 4i). It also shows that the two groups exhibited similar behavior, with the only difference being the deviations observed at the start of the study.

DISCUSSION

The study aimed to determine the impact of Reconstructive Regressive Therapy (RRT) on reducing the number of cigarettes smoked daily. The results showed relevant demographic differences between the intervention groups. In the Cognitive Behavioral Therapy (CBT) group, participants were older (33.89 years) than in the RRT group (28.89 years), a significant finding given that younger participants in the RRT group demonstrated greater resistance to smoking urges. This result contrasts with previous studies suggesting that people in their 30s and 50s, due to their increasing health concerns, have higher adherence and success in smoking cessation treatments (25,31).
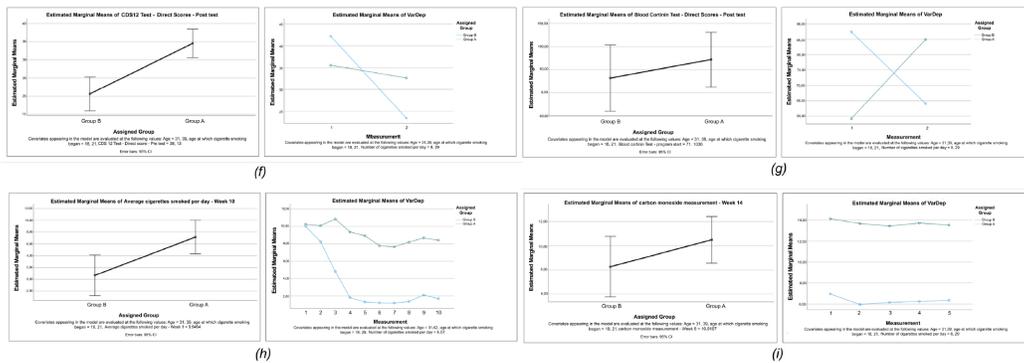
Figure 4. Effect on cigarette dependence as measured by CSD-12 (f); Effect on blood cotinine (g); Effect on number of cigarettes smoked (h); Effect on carbon monoxide level (i). Differences in post-intervention (post-test) scores between groups A (CBT) and B (RRT). Differences in smoking cessation motivation scores before and after the intervention, by therapy type.

In addition, the RRT group showed a significant increase in motivation to quit (10.26 vs. 7.85 points in CBT), suggesting a greater ability to resist the urge to smoke, also associated with improvements in mental health. These finding challenges previous studies suggesting that older smokers from disadvantaged backgrounds face complex barriers to quitting (11). Evidence indicate that people who quit smoking experience a reduction in anxiety, depression, and stress, resulting in an increase in positive affect and psychological quality of life (26). In this regard, it is essential to use interventions such as RRT and other psychological therapies that increase self-efficacy to quit, change perceptions about the risks of smoking, and address previous experiences of unsuccessful attempts (48).

Psychological factors (49) such as perceived stress, urges to smoke, social constraints to smoking, and personal motivations are key determinants of smoking cessation (50). These factors were reflected in the results of the TRR intervention, which showed a significant reduction in psychological, social, and gestural dependence, as indicated by pre and post-test scores on the GN-SBQ (p< 0.001).

Reducing daily cigarette consumption is directly related to an increase in motivation and likelihood of quitting smoking. Pharmacological and behavioral interventions, such as Nicotine Replacement Therapy (NRT), varenicline and behavioral support, have been shown to be effective in recent studies (23,24,28,30). However, in this study, NRT significantly reduced cigarette consumption from 10.12 to 5.05 per week (F=6.69, p<0.001, η^2=0.63), evidencing its efficacy over a shorter period. In other words, the decrease in consumption occurred during the first three weeks of the intervention, after which participants entered a phase of stable consumption.

The results also revealed significant diffe-rences in the effectiveness of the interventions in reducing cigarette consumption (51). RRT achieved a dramatic decrease in weekly consumption, with a mean of 0.67 cigarettes versus 7.17 in the CBT group, reflecting a large effect size (F=14.91, p<0.001, η^2=0.27). Although CBT reduced the proportion of smokers consuming more than 10 cigarettes per day from 23.33 % to 6.66 %, the reduction was more limited in the BHE group, which showed only a 10 % decrease. The effect sizes observed for CBT ($\eta^2 = 0.587$ and $\eta^2 = 0.746$ across different post-treatment time points) highlight its efficacy in mitigating the psychological challenges associated with smoking cessation (40). These findings highlight the superiority of RRT in reducing absolute consumption, while CBT is shown to be more effective in addressing behavioral and psychological aspects of smoking.

Regarding biomarkers, participants in the RRT group showed a significant reduction in carbon monoxide (CO) levels, with a mean of 7.04 ppm compared with 14.79 ppm in the control group. This finding is consistent with the results of a meta-analysis of Nicotine Replacement Therapy (NRT), although in that analysis the overall decrease in CO was not statistically significant (-0.58 ppm), except in studies with NRT pre-loading, where a reduction of -2.54 ppm was reported (35). This study, by focusing on measurements between weeks 8 and 14, showed a more pronounced effect on NRT. In addition, the post-test results indicated greater motivation to resist the urge to smoke in the experimental group, an aspect not examined in the meta-analysis mentioned above. The methodological differences and the behavioral approach of the present study reinforce the efficacy of RRT not only in reducing CO but also in promoting psychological changes associated with smoking cessation (52).

On the other hand, comparing RRT and CBT smoking cessation interventions, no significant differences were found in blood nicotine levels or carbon monoxide measurements between the groups. Some participants who successfully quit smoking mentioned that exposure to high levels of CO_2 or being in enclosed spaces with smokers were external factors that may have played a role. It is important to note that the term 'exposure to tobacco smoke as assessed by serum cotinine concentration' is a simplification, as cotinine measurements reflect exposure to any nicotine-containing product, not just tobacco smoke (53). In fact, a global study indicated that 62.9 % of the population is exposed to second-hand smoke, which may influence decision-making and reinforce addictive behaviors (8,54).

The results of this study should be interpreted with caution due to several limitations. First, the sample comes from a single geographic area, specifically Cúcuta, Colombia, which may limit the generalizability of the findings to other populations. Furthermore, although an adequate sample size was calculated a priori with 95 % confidence and 95 % power, the observed effect was relatively small (0.25). Another factor to consider is the unequal gender distribution, with higher male than female participation (55). To improve the validity and applicability of the results, it is recommended that future research include larger, more diverse samples, including participants from different geographical and cultural backgrounds (56). This would allow for more representative results applicable to a wider population.

CONCLUSIONS

This is the first study to demonstrate the effectiveness of Regressive Reconstructive Therapy (RRT) as a psychological treatment compared to the widely used Cognitive Behavioral Therapy (CBT) for smoking reduction. The results provide strong evidence that RRT can be an effective alternative to CBT in the treatment of tobacco dependence. Participants adhered to treatment protocols, attending all scheduled sessions on time and participating in follow-up assessments, including carbon monoxide level measurements and post-treatment evaluations. This high adherence allowed for a comprehensive comparison of the effects of both therapies.

The findings suggest that RRT was more effective than CBT in several key respects, particularly regarding motivation to quit and ability to resist the urge to smoke. Participants in the experimental group showed higher levels of motivation and greater ability to resist urges than those in the control group. The results also indicated a significant reduction in daily cigarette consumption in the RRT-treated group. This effect was particularly noticeable during the first three weeks of intervention, followed by a stabilization phase in consumption in the subsequent weeks. However, future research should examine the long-term psychological effects of RRT to fully understand its impact.

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SUPPORTING INFORMATION CAPTIONS

ANCOVA: Analysis Of Covariance

ANOVA MR: Analysis Of Variance Of Repeated Measures

CDS-12: Cigarette Dependence Scale

CEI: Research Ethics Committees

CERS: City, Environment and Healthy Rurality

CO2: Carbon Dioxide

FCTC: Framework Convention on Tobacco Control

EAC: Coronary Artery Disease

COPD: chronic obstructive pulmonary disease

GHQ-12: General Health Questionnaire

GN-SBQ: Glover Nilsson Smoking Behavioral Questionnaire

WHO: World Health Organization

PPM: parts per million

SPSS: Statistical Package for the Social Sciences

CBT: Cognitive Behavioral Therapy

RRT: Regressive Reconstructive Therapy

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Carrillo-Sierra, Sandra-Milena; Cárdenas-Cáceres, Lorena; Cadrazco-Urquijo, John-Anderson; Bermúdez, Valmore; Rivera-Porras, Diego (2024), "Randomised Controlled Trial: Regressive Reconstructive Versus Cognitive Behavioural Therapy for Cigarette Smoking Reduction", Simon Bolivar University, V1, doi: 10.17632/b4pffw7ym6.1

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