REVISTAPORTUGUESADE PSIQUIATRIA ESAÚDEMENTAL
2026; 12(1): 24-39; https://doi.org/10.51338/rppsm.596

REVISÃO SISTEMÁTICA/SYSTEMATIC REVIEW

Acceptance and Commitment Therapy for Smoking Cessation: A Systematic Review

Terapia de Aceitação e Compromisso para a Cessação Tabágica: Uma Revisão Sistemática

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RESUMO
Introdução: O tabagismo tem uma elevada prevalência na população e as taxas de abstinência bem-sucedida são baixas. Esta revisão sistemática pretende analisar a eficácia da terapia de aceitação e compromisso (ACT) – que promove padrões de comportamento em linha com os valores pessoais - na cessação tabágica, tendo em conta medidas de abstinência, aceitação dos *cravings* e a quantidade de tabaco consumido.
Metodologia: Foi realizada uma revisão sistemática da literatura recorrendo às bases de dados PubMed®, EBSCO®, SciELO, SCOPUS® e Web of Science.
Resultados: Os resultados sugerem algum benefício da ACT relativamente a medidas de aceitação dos *cravings* e de uma associação entre o aumento da aceitação dos *cravings* e a abstinência. O benefício da ACT não parece comprovar-se quanto a medidas de abstinência e de quantidade de tabaco consumido (quando não alcançada a abstinência).
Conclusão: Sugere-se a realização de mais estudos para compreender o alcance do benefício da ACT na cessação tabágica.

ABSTRACT
Introduction: Smoking has a high prevalence in the population and successful abstinence rates are low. This systematic review provides an updated review on the efficacy of Acceptance and commitment therapy (ACT) - which helps patients engage in a flexible and persistent pattern of values-oriented behavior - in smoking cessation, taking into account measures of abstinence, acceptance of cravings and the amount of tobacco consumed.
Methods: A systematic literature review was conducted using the PubMed®, EBSCO®, SciELO, SCOPUS® and Web of Science databases.
Results: The results were suggestive of some benefit of ACT regarding measures of craving acceptance and an association between increased craving acceptance and abstinence. The benefit of ACT does not seem to be proven concerning to measures of abstinence and amount of tobacco consumed (when abstinence is not achieved).
Conclusion: It is suggested to conduct further studies to understand the extent of the benefit of ACT in smoking cessation.

Palavras-chave: Cessação do Hábito de Fumar; Terapia de Aceitação e Compromisso

Keywords: Acceptance and Commitment Therapy; Smoking Cessation

Recebido/Received: 2024-09-08
Aceite/Accepted: 2025-04-17
Publicado Online/Published Online: 2025-04-29
Publicado/Published: –

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INTRODUCTION

There are 1.1 billion adult smokers worldwide, with 15% of young adults smoking cigarettes and 4% using nicotine delivery systems or other tobacco products.[1,2] Tobacco use is the leading cause of preventable death, causing nearly 6 million deaths and an economic burden of about half a trillion dollars annually.[2-4] Despite declining since the 1980s, smoking still causes 9% of deaths worldwide and 18% in high-income countries, remaining a leading cause of premature death.[5] For every person who dies as a result of smoking, at least 30 people are living with a serious smoking-related illness.[2] Although most smokers want to quit, only 3%-5% succeed long-term without assistance.[2,5] Thus, there is a huge need for effective, acceptable, and affordable interventions for smoking cessation, capable of reaching the growing population of smokers with a strong potential impact and at the lowest possible cost.[3,6,7] Systematic reviews have supported psychological approaches for enhancing smoking cessation, encompassing motivational methods, counseling provided by healthcare professionals, and leveraging new technological advancements.[2] The standard smoking cessation intervention is counseling, which boosts motivation and social support, provides basic health information about smoking and cessation, teaches coping skills, and helps smokers set a quit date.[8] In addition to these interventions, those focused on acceptance may also be promising. Acceptance and commitment therapy (ACT) is a psychotherapy that grew out of the cognitive and behavioral tradition. ACT is based on the "Relational Frame Theory", which explains language and human cognition. The primary goal of ACT is to increase psychological flexibility, defined as fully engaging with the present moment and adjusting behavior to achieve meaningful goals. This is done by reducing experiential avoidance—suppressing or avoiding unwanted feelings, sensations, thoughts, and other internal events. In ACT, patients learn to embrace and accept challenges, as well as act according to their core values, rather than fighting or avoiding difficulties. ACT showed potential for the treatment of depression, anxiety, substance abuse, psychosis, stress and chronic pain. Although these problems differ in their functions, they all involve individuals trying to reduce or control internal aversive events.[4,5,8,9] Thus, ACT encourages an individual's readiness to embrace physical cravings, emotions, and thoughts while still committing to behavioral changes. In this context, acceptance refers to making room for intense physical sensations, emotions, and thoughts that trigger tobacco consumption, allowing them to come and go. In ACT, commitment involves expressing what holds deep significance for individuals - their values - to motivate and guide particular action plans (e.g., quitting smoking).[8,10] Smokers may find treatment based on ACT acceptable and effective as it targets a unique change mechanism – acceptance – defined as the willingness to experience discomfort or distress to make a significant life change.[11]According to the ACT theoretical model, learning to manage the presence of cravings is preferable to reducing symptoms, as the goal is to change the person's relationship to their symptoms.[2,5] In an ACT program, patients are encouraged to commit to their identified values and to act in accordance with those values. In short, the "acceptance" component of ACT helps individuals identify and accept internal triggers for smoking and not avoid withdrawal symptoms. The "commitment" component emphasizes the articulation between personal values and the commitment to stop smoking.[2,3,5] The objective of this review was to examine the most current evidence on the effectiveness of ACT in smoking cessation, seeking to understand whether, in adults, ACT is effective in increasing craving acceptance, abstinence and reducing the number of cigarettes consumed.

Finally, it should be noted that during the research, no systematic review was found regarding the role of ACT in smoking cessation. Thus, the relevance and contribution of this review to improving scientific knowledge on this topic are highlighted.

METHODS

a. Eligibility criteria: inclusion and exclusion criteria

The included studies were restricted to primary investigations in smokers over 18 years of age. There were no restrictions on the number of cigarettes consumed per day or the amount of time as a smoker. Studies in which the intervention explicitly consisted of ACT or ACT combined with another technique were included. Each study should contain acceptance and commitment components. No restrictions were created regarding the type of comparator and only controlled studies were included. It was determined that the primary results would be the acceptance of cravings, abstinence, and the number of cigarettes consumed. It was considered that the measures identified would allow an assessment of the effectiveness of the intervention in the context of smoking cessation and that they were in line with the principles of the ACT. Primary studies that focused only on the identification of factors that mediate the intervention were excluded. Articles in a language other than Portuguese, English or Spanish were excluded.

b. Primary outcomes

it was determined that the primary outcomes would be measures of acceptance of cravings, abstinence, and amount of tobacco consumed.

It was considered that the measures identified would allow an assessment of the effectiveness of the intervention in the clinical context of smoking cessation and that they were in line with the principles of the ACT.

To evaluate the measures of acceptance of cravings, the results of the application of scales would be considered, such as Avoidance and Inflexibility Scale (AIS), Single-item (0-100) urge scale (1-Urge Scale), Magnitude Estimation of Urge (ME) and Questionnaire of Smoking Urges-4 (QSU-4).

To assess abstinence, measures of Point Prevalence Abstinence (PPA), number of cigarettes consumed equal to 0, and/or analytical measures (carbon monoxide [CO] expired, urinary cotinine concentration, concentration of cotinine in saliva) would be considered, in combination or alone.

Finally, to assess the amount of tobacco consumed, measures to reduce (at least) 50% of the expired CO compared to the baseline and the number of cigarettes consumed would be considered.
We chose not to specify a minimum or maximum period of follow-up.

c. Data sources and selection

a literature review was carried out, covering all articles available until April 2022, using the PubMed®, EBSCO®, SciELO, SCOPUS® and Web of Science databases. Reference lists of all included studies and previous relevant reviews were examined to identify further eligible studies.
The article selection process followed the previously presented inclusion and exclusion criteria. The initial eligibility of articles was assessed using the article's title and/or abstract. The resulting articles were subjected to full-text analysis, applying the same inclusion and exclusion criteria. The selection of studies and the review of all articles were performed by the investigators. In case of disagreement, the evaluation was discussed among all the investigators until a consensus was reached.

d. Search strategy and data extraction

the research terms consisted of free text and MESH terms and were developed after careful analysis of the research strategy of other relevant reviews and terms frequently used in the type of studies of interest. They consisted of constructs of "Smoking Cessation", "Acceptance and Commitment Therapy", "Abstinence", "Acceptance of Cravings", "Number of Cigarettes" and "Quitting" edited for PubMed® and adapted for the remaining databases.
Data were extracted onto a pre-prepared form. The information extracted included the study setting, sample characteristics (age, gender, daily tobacco consumption, amount of time as a smoker, attempts to quit smoking, nicotine dependence and acceptance of cravings), intervention details (mode of administration , treatment duration, number of pre- and post-intervention participants), details of the comparator/control group (typology, number of pre- and post-intervention participants and follow-up), duration of follow-up and reported results.

e. Selection process

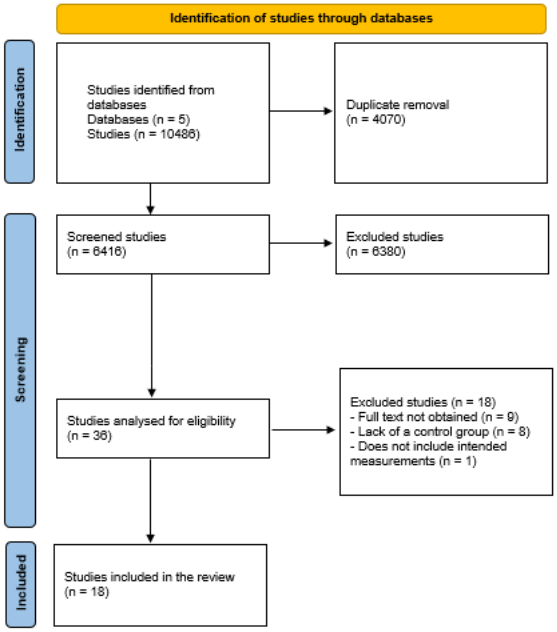

Figure 1. PRISMA algorithm for systematic reviews[12]

f. Quality assessment and coding

the quality assessment of the studies was carried out using the Cochrane Bias Risk Assessment Tool - Risk of Bias 2 (RoB 2).[13] A review of all articles was performed by the investigators. In case of disagreement, the evaluation was discussed among the investigators until a consensus was reached.
The application of the Cochrane Risk of Bias Assessment Tool allowed the assessment of the methodological quality of randomized clinical trials to assess the risk of bias. According to the recommendations, the studies were evaluated in the 5 domains and an overall assessment of the methodological quality of each of these studies was performed. The results of the evaluation of each domain are shown in Table 1. All of the randomized clinical trials evaluated were classified as presenting high risk for methodological bias, except for one which was classified as presenting some risk.[2]

Table 1. Risk of Bias Assessment

	Risk of bias arising from the randomization process	Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Missing outcome data	Risk of bias in measurement or the outcome	Risk of bias in selection of the reported result	Overakk risk of bias
Bricker J, *et al,* 2013[14]	-	+	-	-	-	+
Bricker J, *et al*, 2014[15]	-	+++	+++	-	-	+++
Bricker J, *et al*, 2014[16]	+	+++	+++	-	-	+++
Bricker J, *et al*, 2018[10]	-	+++	-	-	-	+++
Bricker J, *et al*, 2020[17]	-	+++	-	-	-	+++
Davoudi M, et al, 2017[18]	-	+++	-	-	-	+++
Gifford EV, *et al*, 2011[19]	+	+++	-	-	-	+++
Mak YW, *et al*, 2020[20]	-	+++	-	-	+	+++
Mak YW, *et al*, 2021[21]	-	+++	+++	-	-	+++
O'Connor M, *et al*, 2020[2]	-	+++	-	-	-	+++

RESULTS

The database search yielded 10 486 articles. Upon removing duplicates, 6416 articles remained. Out of these, 6380 were excluded based on title and/or abstract during the initial screening. The remaining 36 articles underwent thorough evaluation through full readings to determine their eligibility. Among these, 18 articles met the inclusion criteria, comprising 10 randomized controlled studies (RCTs) and 8 controlled clinical trials. A brief description of the selection process can be found in Fig. 1.

The reasons for excluding were, in 9 cases, not obtaining them, in 8 cases the absence of a comparator or non-ACT control group and, finally, 1 case that only analyzed mediators of intervention.

a. CHARACTERISTICS OF THE INCLUDED STUDIES

The combined total sample of included articles was 7431 participants. Twelve studies took place in the United States of America,[10,14-17,19,22-26] two in Hong Kong,[20,21] one in Iran,[18] one in Ireland,[2] one in Spain[27] and one in Cyprus.[28] Thirteen articles recruited participants from the community,[2,10,14--17,19,22-25,27,28] one study recruited participants from a hospital,[18] one study recruited participants from multidisciplinary pain management centres,[26] one study recruited participants from primary health care[20] one study recruited participants institutionalized in a mental health rehabilitation community[21] and one study recruited participants from the Kaiser Permanente Washington health system.[9]All participants were adults, most of them female.

Seven articles were identified that evaluated face-to-face interventions,[9,18,19,21,22,25,27] four dedicated to interventions through a website,[10,14,23,24] two related to interventions via telephone call,[15,26] two referring to interventions through a smartphone application,[16,17] one relating to an intervention guided by an avatar,[28] one which evaluated a face-to-face intervention combined with telephone contact[20] and, finally, one article that evaluated both a face-to-face intervention and a face-to-face intervention combined with intervention through a smartphone application.[2] Seventeen (94.44%) of the 18 articles had an active comparator.[2,9,10,14-27] The characteristics of the 18 included studies are summarized in Table 2.

Table 2. Sample Characteristics

References	Participants	Typology	Intervention	Comparator	Measurements and scales
Bricker J, *et al*, 2013[14]	Sample: Age (M[SD]): Intervention 44.8 (13.6), Comparator 45.3 (13.1) Percentage of women: Intervention 59%, Comparator 65% Smokers of more than half a pack a day: Intervention 76%, Comparator 80% Nicotine dependents: Intervention 46%, Comparator 49% Smokers for 10 years or more: Intervention 81%, Comparator 79% Attempted to quit smoking in the last 12 months (M[SD]): Intervention 1.5 (2.6), Comparator 1.4 (2.1) Acceptance of cravings (baseline) (M[SD]): Intervention 2.52 (0.57), Comparator 2.46 (0.52) Setting: American individuals recruited through the media	Website	ACT-based website (self--paced 8-part program) N = 111; completed FU: 60	USCPG--based website N = 111; completed FU: 59	Acceptance of cravings: adaptation of the AIS scale at 3m Abstinence: 30-days PPA at 3m Amount of tobacco consumed: - Assessment schedule: baseline, 3m
Bricker J, *et al*, 2014[15]	Sample: Age (M[SD]): Intervention 39.6 (9.5), Comparator 38.6 (10.2) Percentage of women: Intervention 66%, Comparator 73% Smokers of more than half a pack a day: Intervention 58%, Comparator 71% Nicotine dependents: Intervention 73%, Comparator 68% Smokers for 10 years or more: Intervention 75%, Comparator 76% Attempts to quit smoking in the last 12 months: Intervention 48%, Comparator 42% Acceptance of cravings (baseline) (M[SD]): Intervention 1.84 (0.43), Comparator 1.86 (0.52) Setting: Uninsured individuals who contacted the South Carolina State Quitline	Advice via telephone contact	5 ACT phone sessions + 2 weeks of NRT N = 59; completed FU 3m: 40; completed FU 6m: 43; completed intervention: 28	5 CBT phone sessions + 2 weeks of NRT N = 62; completed FU 3m: 40; completed FU 6m: 38; completed intervention: 3	Acceptance of cravings: AIS subscale of 9 items at 3m Abstinence: 30-days PPA at 6m Amount of tobacco consumed: - Assessment schedule: baseline, 3m and 6m
Bricker J, *et al*, 2014[16]	Sample: Age (M[SD]): Intervention 41.5 (12.0), Comparator 41.6 (13.9) Percentage of women: Intervention 53%, Comparator 51% Smokers of at least 1 pack per day: Intervention 28%, Comparator 21% Nicotine dependence - FTND (M[SD]): Intervention 4.9 (2.5), Comparator 4.7 (2.4) Smokers for 10 years or more: Intervention 72%, Comparator 77% Attempted to quit smoking in the last 12 months (M[SD]): Intervention 4.0 (5.4), Comparator 3.0 (2.0) Acceptance of cravings (baseline) (M[SD]): Intervention 1.87 (0.36), Comparator 1.94 (0.43) Setting: American individuals recruited through the media (Internet, TV, radio, newspapers etc.)	Smartphone application	ACT-based application (self--paced program) N = 98; completed FU: 80	Application based on USCPG N = 98; completed FU: 84	Acceptance of cravings: AIS subscale of 9 items at 2m Abstinence: 30-days PPA at 2m Amount of tobacco consumed: - Assessment schedule: baseline, 2m

References	Participants	Typology	Intervention	Comparator	Measurements and scales
Bricker J, *et al*, 2018[10]	Sample: Age (M[SD]): Intervention 46.2 (13.4), Comparator 46.1 (13.3) Percentage of women: Intervention 79%, Comparator 79% Smokers of more than half a pack a day: Intervention 79%, Comparator 79% Smokers of more than 1 pack per day: Intervention 33%, Comparator 33% Nicotine dependence - FTND (M[SD]): Intervention 5.6 (2.2), Comparator 5.6 (2.2) Smokers for 10 years or more: Intervention 80%, Comparator 80% Attempts to quit smoking in the last 12 months (M[SD]): Intervention 1.6 (5.3), Comparator 1.6 (4.6) Acceptance of cravings (baseline) (M[SD]): Intervention 2.93 (0.47), Comparator 2.93 (0.48) Setting: American individuals recruited through the media or referred by friends/family	Website	ACT-based website (4-part program) N = 1319; completed FU: 1141	USCPG--based website N = 1318; completed FU: 1168	Acceptance of cravings: AIS 9-item subscale at 3m Abstinence: 30-days PPA at 12m Amount of tobacco consumed: - Assessment schedule: baseline, 12m
Bricker J, *et al*, 2020[17]	Sample: Age (M[SD]): Intervention 38.2 (10.8), Comparator 38.3 (8.0) Percentage of women: Intervention 70.6%, Comparator 70.2% Smokers of at least half a pack per day: Intervention 73.4%, Comparator 75.9% Smokers of at least 1 pack per day: Intervention 20.5%, Comparator 19.9% Nicotine dependence - FTND (M[SD]): Intervention 5.8 (2.1), Comparator 5.9 (2.0) Smokers for 10 years or more: Intervention 83.2%, Comparator 83.2% Attempted to quit smoking in the last 12 months (M[SD]): Intervention 1.3 (3.8), Comparator 1.5 (7.0) Setting: American individuals recruited through Facebook, a survey sampling company, search engine results and referred by friends/family	Smartphone app	ACT-based application (promotes trigger acceptance; 8 levels of intervention) N = 1214; completed FU 3m: 1043; completed FU 6m: 1058; completed FU 12m: 1040	USCPG--based application (promotes trigger avoidance; 4 content sections) N = 1201; completed FU 3m: 1050; completed FU 6m: 1078; completed FU 12m: 1067	Acceptance of cravings: - Abstinence: 30-days PPA and 7-days PPA at 3, 6 and 12m Amount of tobacco consumed: - Assessment schedule: baseline, 3m, 6m, 12m
Davoudi M, *et al*, 2017[18]	Sample: Age (M[SD]): Intervention 29.4 (5.7), Comparator 30.6 (5.3) Percentage of women: Intervention 0%, Comparator 0% Number of cigarettes smoked per day (M[SD]): Intervention 15.4 (3.6), Comparator 16.1(3.3) Number of years as a smoker (M[SD]): Intervention 7.6 (3.9), Comparator 8.1 (4.2) Setting: male smokers with anxiety and/or depression referred to Kargarnejad Teaching Psychiatric Hospital, Iran	Presential	8 individual 90min ACT sessions N = 35; completed FU: 34	8 individual 90min routine psychological counseling sessions N = 35; completed FU: 33	Acceptance of cravings: - Abstinence: CO expired (smoking if >6ppm) 1w and 8w Amount of tobacco consumed: - Assessment schedule: baseline, 1w, 6w

References	Participants	Typology	Intervention	Comparator	Measurements and scales
Gifford EV, *et al*, 2004[22]	Sample: Age (M[SD]): 43 (11.68) Percentage of women: 59% Number of cigarettes smoked per day (M[SD]): 21.4 (7.05) Attempted to quit smoking in the last 24 months (M[SD]): 4.0 (6.86) Setting: individuals from the community recruited through newspaper, radio, medical referrals or agencies and flyers	Presential	7 weeks ACT – 7 weekly 50 min individual sessions and 7 weekly 90 min group sessions N = 38; completed FU 6m: 65; completed tx: 65	7 weeks of NRT with basic group counseling and psycho-education session at baseline, with clinic visits at least weekly N = 38;	Acceptance of cravings: AIS Abstinence: CO expired Amount of tobacco consumed: - Assessment schedule: baseline, after tx, 6m, 12m
Gifford EV, *et al*, 2011[19]	Sample: Age (M[SD]): Intervention 45.75 (12.84), Comparator 46.16 (12.28) Percentage of women: 58.7% in the total of the 2 groups Nicotine dependence - FTND (M[SD]): Intervention 5.22 (1.69), Comparator 5.32 (1.66) Number of cigarettes smoked per day (M[SD]): Intervention 24.01 (8.64), Comparator 24.23 (9.35) Attempts to quit smoking in the last 24 months (M[SD]): Intervention 1.92 (2.03), Comparator 2.32 (4.43) Setting: Individuals from the community recruited through a television news channel, newspaper and radio advertisements, referrals from doctors and agencies, and advertisements in community groups	Presential	10 weeks of Bupropion (150 mg id 3 days then 150 mg bid) + functional analytic psychotherapy and ACT (1 individual session and 1 group session per week) N=130; completed FU after tx: 122; completed FU 6m: 88; completed FU 12m: 80; completed tx: 77	10 weeks of Bupropion (150 mg id 3 days then 150 mg bid) N=173; completed FU after tx: 90; completed FU 6m: 65; completed FU 12m: 57 completed tx: 90	Acceptance of cravings:- Abstinence: 7-days PPA after tx, confirmed with expired CO Amount of tobacco consumed: - Assessment schedule: baseline, after tx, 6m, 12m
Heffner JL, *et al*, 2020[23]	Sample: Age (M[SD]): Intervention 47.7 (10.4), Comparator 50.2 (11.3) Percentage of women: Intervention 32%, Comparator 58% Nicotine dependence - FTND (M[SD]): Intervention 6.3 (2.1), Comparator 6.2 (2.2) Number of cigarettes smoked per day (M[SD]): Intervention 20.6 (8.4), Comparator 17.6 (7.9) Acceptance of cravings (baseline) (M[SD]): Intervention 2.9 (0.4), Comparator 2.9 (0.4) Setting: Type I or Type II BAD smokers recruited through 4 American websites	Website + NRT	ACT-based website (4-part program over 10 weeks) + NRT (8 weeks) N = 25; completed FU after tx: 19; completed FU 1m: 21	Website based on USCPG (for 10 weeks) + NRT (8 weeks) N = 26; completed FU after tx: 18; completed FU 1m: 20	Acceptance of cravings: AIS variation at baseline and after tx Abstinence: 7-days PPA after tx and 1m (confirmed with expired CO) Amount of tobacco consumed: expired CO (baseline, after tx and 1m) - 50% reduction Assessment schedule: baseline, after tx, 1m

References	Participants	Typology	Intervention	Comparator	Measurements and scales
Hernández--López M, *et al*, 2009[27]	Sample: Age (M): Intervention 39.4, Comparator 45.87 Percentage of women: 64% in the total of the 2 groups Nicotine dependence (FTND) and previous abstinence attempts without statistically significant differences between the 2 groups. Setting: CBT: recruited through advertisements with contacts from the psychology service of the Spanish Association Against Cancer and in local newspapers; ACT: through advertisements with contacts for the psychology research service of the University of Almeria, in the Almeria City Hall, in a national bank and in a national network of commercial stores	Presential	ACT (7 weekly group sessions, each lasting 90min) N = 43; completed tx (at least 5 sessions): 27; completed FU 3m: 25: completed FU 6m: 23; completed FU 12m: 24	CBT (7 weekly group sessions lasting 90min each) N = 38; completed tx (at least 5 sessions): 29; completed FU 3m: 21; completed FU 6m: 19; completed FU 12m: 19	Acceptance of cravings: - Abstinence: 24h PPA after tx, 7-days PPA at 3m and 6m, 30-days PPA at 12m (confirmed with expired CO - ppm less than or equal to 5) Amount of tobacco consumed: - Assessment schedule: baseline, after tx, 3m, 6m, 12m
Jones HA, *et al,* 2015[24]	Sample: Age (M[SD]): Intervention 43.6 (14.5), Comparator 43.2 (12.2) Percentage of women: Intervention 51%, Comparator 57% Smokers of more than half a pack a day: Intervention 74%, Comparator 79% Nicotine dependents: Intervention 43%, Comparator 47% Smokers for 10 years or more: Intervention 77%, Comparator 77% Attempts to quit smoking in the last 12 months (M[SD]): Intervention 1.5 (2.8), Comparator 1.3 (2.0) Acceptance of cravings (baseline) (M[SD]): Intervention 2.42 (0.58), Comparator 2.45 (0.53) Setting: Depressed smokers recruited through radio and television, multimedia content websites, Internet advertisements, social media and emails to health organizations and employers	Website	ACT-based website (8-module program) N = 47; completed FU 3m: 20	Website based on USCPG N = 47; completed FU 3m: 25	Acceptance of cravings: AIS Abstinence: 30-days PPA at 3m Amount of tobacco consumed: - Assessment schedule: baseline, 3m
Karekla M, *et al*, 2021[28]	Sample: Age (M[SD]): Intervention 22.50 (2.56), Comparator 22.31 (2.73) Percentage of women: Intervention 64.30%, Comparator 65.70% Smokers of more than half a pack a day: Intervention 44.3%, Comparator 44.8% Nicotine Dependence - FTND (M[SD]): Intervention 3.19 (2.09), Comparator 2.91 (2.02) Number of cigarettes smoked per day (M[SD]): Intervention 9.69 (6.55), Comparator 8.89 (7.72) Setting: University students recruited from 3 universities in Cyprus, through flyers placed in cafeterias and advertisements in classrooms	Intervenção guiada por avatar	ACT-based digital intervention guided by an avatar (6 sessions of 25 min) N = 49; completed the final questionnaire: 27	Waiting list type control N = 35; completed the final questionnaire and were offered tx: 28	Acceptance of cravings: - Abstinence: 7-days PPA after tx Amount of tobacco consumed: number of cigarettes smoked per day Assessment schedule: baseline, after tx

References	Participants	Typology	Intervention	Comparator	Measurements and scales
Litvin EB, *et al*, 2012[25]	Sample: Percentage of women: 50%. Age (M): 36.84 Nicotine dependence - FTND (M): 5.33 Number of cigarettes smoked per day (M): 20.10 Years as a smoker (M): 18.53 All participants smoked at least half a pack a day, had expired CO values of at least 8 ppm, and had at least 1 previous attempt to quit smoking and an intention to do so within the next 6 months. Setting: Participants recruited from the community	Presential – single session	Brief presentation on acceptance-based coping followed by exposure to tobacco-related stimuli, in order to generate thoughts and desires to smoke N = 54; completed FU 3d: 68.5%	Brief presentation on suppression--based coping followed by exposure to tobacco--related stimuli, in order to generate thoughts and desires to smoke N = 54; completed FU 3d: 72.2% Presentation of a neutral journal article followed by exposure to tobacco--related stimuli in order to generate thoughts and desires to smoke N = 54; completed FU 3d: 68.5%	Acceptance of cravings: QSU--4, 1-Urge, ME Abstinence:- Amount of tobacco consumed: total number of cigarettes smoked since the intervention Assessment schedule: baseline, 3min after exposure to stimuli, 3min after suspension of pre-instructed coping, 3d
Lombardero A, 2017[26]	Sample: Age (M[SD]): Intervention 49 (13.1), Comparator 47 (12.4) Percentage of women: Intervention 62.5%, Comparator 62.0% Number of cigarettes smoked per day (M[SD]): Intervention 13.3 (8.1), Comparator 16.4 (10.2) 66% considered quitting smoking in the next 6 months. Setting: Participants recruited from 2 Missoula multidisciplinary pain management centers	Intervention through telephone contact	ACT-based phone sessions weekly for 5 weeks N=24; analyzed: 24	Standard care in primary care (referral to Montana Tobacco Quitline, which provides 5 weekly sessions and NRT) N=21; analyzed: 20	Acceptance of cravings: - Abstinence: number of cigarettes smoked Amount of tobacco consumed: number of cigarettes smoked in the last 24 hours, in the last 7 days and in the last 30 days Assessment schedule: baseline, after tx, 3m

References	Participants	Typology	Intervention	Comparator	Measurements and scales
Mak YW, *et al*, 2020[20]	Sample: Age (M[SD]): Intervention 47.94 (14.37), Comparator 44.85 (12.97) Percentage of women: Intervention 24.3%, Comparator 32.4% Smokers of more than half a pack per day: Intervention 64.2%, Comparator 67.1% High nicotine dependence: Intervention 42.9%, Comparator 32.4% Years as a smoker (M[SD]): Intervention 19.06 (6.61), Comparator 18.10 (4.87) History of attempts to quit smoking: Intervention 68.6%, Comparator 62.2% Setting: Participants recruited from 6 primary health care centers in Hong Kong	Presential + telephone contact	Brief advice and self-help material + initial session and 2 mobile sessions 1 week after the initial session and 1 month after the initial session (all ACT based) N=70; completed FU 3m: 46; completed FU 6m: 35; completed FU 12m: 35; analyzed: 70	Brief advice and self-help material N=74; completed FU 3m: 45; completed FU 6m: 39; completed FU 12m: 31; analyzed: 74	Acceptance of cravings: AIS Abstinence: 7-days PPA (confirmed by expired CO and urinary cotinine analysis) Amount of tobacco consumed: number of cigarettes consumed Assessment schedule: baseline, 3m, 6m, 12m
Mak YW, *et al*, 2021[21]	Sample: Age (M[SD]): Intervention 49.7 (11.3), Comparator 50.0 (12.0) Percentage of women: Intervention 9.2%, Comparator 12.0% Nicotine dependence - FTND (M[SD]): Intervention 3.7 (2.1), Comparator 4.2 (2.4) Years as a smoker (M[SD]): Intervention 27.6 (13.5), Comparator 28.3 (13.6) Number of cigarettes smoked per day (M[SD]): Intervention 11.2 (7.7), Comparator 13.5 (9.7) History of attempts to quit smoking: Intervention 46.2%, Comparator 41.5% AIS (M[SD]): Intervention 41.18(1.21), Comparator 38.51(1.21) Setting: Individuals diagnosed with Schizophrenia institutionalized in one of 51 residential mental health rehabilitation communities in Hong Kong	Presential	10 weekly, face-to-face and individual 30min ACT sessions N=65	10 weekly, face-to-face and individual sessions of 5-10min of social support (smoking session, experiential avoidance and emotional regulation) N =65	Acceptance of cravings: AIS at 3m, 6m and 12m Abstinence: 7-days PPA at 6m and 12m (both confirmed with expired CO [<6ppm] and urinary cotinine levels [≤115ng/mL]); Amount of tobacco consumed: reduction of at least 50% in the number of cigarettes consumed compared to baseline, at 6m and 12m Assessment schedule: baseline, 3m, 6m, 12m

References	Participants	Typology	Intervention	Comparator	Measurements and scales
McClure JB, *et al*, 2020[9]	Sample: Age (M[SD]): Intervention 51.8 (12.0), Comparator 50.8 (12.2) Percentage of women: Intervention 52.7%, Comparator 52.7% Nicotine dependence - FTND (M[SD]): Intervention 4.9 (2.0), Comparator 4.8 (2.0) Attempts to quit smoking in the last 12 months (M[SD]): Intervention 1.8 (4.3), Comparator 2.1 (7.9) Acceptance of cravings (baseline) (M[SD]): Intervention 2.1 (0.4), Comparator 2.2 (0.4) All participants had been smokers for at least 1 year, smoked at least half a pack a day and intended to quit within the next 30 days. Setting: Participants recruited from the Kaiser Permanente Washington health system	Presential + NRT	5 weekly 90min group sessions of ACT + 8 weeks of NRT N=224; completed FU 1s: 188; completed FU 6m: 164; completed FU 12m: 173	5 weekly 90min group sessions of CBT + 8 weeks of NRT N=226; completed FU 1s: 197; completed FU 6m: 184; completed FU 12m: 176	Acceptance of cravings: AIS Abstinence: 30-days PPA at 6m and 12m, 7-days PPA at 12m (confirmed by saliva cotinine concentration [<15 ng/mL]); 7-days PPA at 1w Amount of tobacco consumed: - Assessment schedule: baseline, 1w, 6m, 12m
O'Connor M, *et al*, 2020[2]	Sample: Age (M[SD]): ACT 35.08 (8.72), Combined 34.08 (10.14), Comparator 38.80 (10.37) Percentage of women: ACT 50.00%, Combined 46.00%, Comparator 62.00% Nicotine dependence - FTND (M[SD]): ACT 4.88 (2.11), Combined 4.64 (2.22), Comparator 4.70 (1.96) Number of cigarettes smoked per day (M[SD]): ACT 16.66 (6.00), Combined 16.78 (6.51), Comparator 17.10 (10.26) Years as a smoker (M[SD]): ACT 17.08 (8.26), Combined 16.60 (10.40), Comparator 20.52 (9.11) Acceptance of cravings (AIS) (M[SD]): ACT 2.98 (0.41), Combined 3.02 (0.30), Comparator 2.95 (0.44) Setting: Patients recruited from the community through advertisements on social media and other online sources, posters, radio advertisements and "word-of-mouth" information.	Presential VS presential + smartphone app	6 weekly (90min) ACT--based group sessions N=50; completed assessment after tx: 43; completed FU 6m: 47 6 weekly (90 min) ACT--based group sessions + access to ACT-based application up to 6m N=50; completed assessment after tx: 47; completed FU 6 m: 44	6 weekly group sessions (90min) of behavioral support N=50; completed assessment after tx: 43; completed FU 6m: 41	Acceptance of cravings: AIS Abstinence: 7-days PPA after tx and at 6m (confirmed by expired CO [<10ppm]). Amount of tobacco consumed: average number of cigarettes smoked daily Assessment schedule: baseline, after tx, 6m

1-Urge, single-item (0-100) urge scale; ACT, acceptance and commitment therapy; AIS, Avoidance and Inflexibility Scale; BAD, bipolar affective disorder; CBT, cognitive behavioral therapy; CO, carbon monoxide; d, day(s); FTND, Fagerström Test for Nicotine Dependence; FU, follow-up; m, month(s); M, mean; ME, magnitude estimation of urge; min, minute(s); N, sample size; NRT, nicotine replacement therapy; PPA, point prevalence abstinence; ppm, parts per million; SD, standard deviation; Tx, treatment; QSU-4, Questionnaire of Smoking Urges-4; USCPG, United States clinical practice guidelines; w, week(s).

b. Effects of interventions - acceptance of cravings

most articles (66.67%) evaluated measures of acceptance of cravings.[2,9,10,14-16,20-25] The AIS scale was used in all studies, except for one that used the QSU-4, 1-Urge and ME scales.[25] Some of the studies that used the AIS scale (36.36%) identified improvements in the acceptance of cravings in the post-treatment and follow-up, with statistically significant differences in favor of the ACT intervention compared to active comparators (website based on the United States clinical practice guidelines [USCPG],[10,14] cognitive behavioral therapy [CBT][15] and USCPG-based smartphone application[16]).

There was a study that used the AIS scale that identified a significant increase in the acceptance of cravings in the combined group (ACT group sessions in combination with ACT-based smartphone application) after treatment (p=0.001) and at 6 months of follow-up (p=0.009) when compared to the baseline. Acceptance of cravings in the combined group was not significantly different from that of the ACT group (ACT group sessions) after treatment (p=0.47); but was greater than that of the behavioral support group (p=0.04). At 6 months of follow-up, acceptance of cravings by the combined group was not significantly different from that of the ACT group (p=0.55) or the behavioral support group (p=0.63). Acceptance of cravings in the ACT group was not significantly different from the behavioral support group after treatment (p=0.18) or at 6-month follow-up (p=0.28).[2]

An RCT that used social support in the control group, when applying the AIS scale, obtained different results at different times of evaluation, and did not observe significant differences in the acceptance of cravings between the ACT group and the control group at 3 months of follow-up (p=0.17) but found significant differences in favor of the ACT intervention at 6 months (p=0.02) and 12 months (p=0.04) of follow-up.[21] Three studies that used the AIS scale also found that increased acceptance of cravings was strongly associated with abstinence.[9,14,22] The only study that applied the QSU-4, 1-Urge, and ME scales, 3 minutes after exposure to tobacco-related stimuli (with the aim of generating thoughts and a desire to smoke), found a statistically significant difference (p<0.05) in the acceptance of cravings measured by the 1-Urge scale between the acceptance group (previously subjected to a presentation on acceptance-based coping) and the suppression group (previously subjected to a presentation on suppression-based coping). At the same evaluation timing, there were no statistically significant differences between the 3 groups (acceptance, suppression, and control [presentation of a neutral journal article]) applying the QSU-4 scale, but using the ME scale, there was a statistically significant difference between the acceptance group and the control group (p<0.05).[25] Three studies found no significant differences in favor of the ACT intervention versus active comparators (USCPG-based website[23,24] and brief counseling and self-help material[19]) in measures of craving acceptance.

c. Abstinence

All articles evaluated abstinence measures, except one.[25] For this evaluation, 7 studies were based on PPA measurements alone, [10,14-17,24,28] 5 on PPA measurements with confirmation through the measurement of expired CO,[2,19.20,23,27] two in the measure of expired CO alone,[18,22] one only through the report of the number of cigarettes smoked,[26] one in measures of PPA with confirmation through the measure of expired CO and concentration of urinary cotinine[21] and one in PPA measurements confirmed by measuring the concentration of cotinine in saliva.[9] Thus, it is noteworthy that the studies used different definitions of abstinence, valuing different periods without tobacco consumption for this classification.

A part of the studies (23.53%) identified significant differences in favor of the ACT intervention compared to the comparators (3 active: smartphone application based on USCPG,[17] routine psychological follow-up,[18] and CBT[27] and 1 type waiting list[28] in post-treatment and follow-up abstinence measures.

A study of group intervention in combination with individual ACT, compared with nicotine replacement therapy (NRT) in combination with basic group counseling and psychoeducation, reported no significant differences between the two groups after treatment and at 6-month follow-up on abstinence measures. However, in this same study, there was a statistically significant difference between the two groups in favor of the ACT intervention at 12 months of follow-up (p=0.04) concerning abstinence.[22] An RCT that compared a group undergoing ACT intervention in combination with functional analytic psychotherapy and bupropion with a control group observed no differences between the groups with regard to assessed abstinence at 6 months of follow-up, but found significant differences in this outcome in favor of the ACT intervention after treatment (p<0.001) and at 12-month follow-up (p=0.04).[19]Another article reported statistically significant differences in terms of abstinence in favor of the ACT intervention in combination with NRT when compared with CBT in combination with NRT at the 1-week post-treatment follow-up assessment (p=0.0001) but this difference was not observed at follow-up at 6 (p=0.1) and 12 months (p=0.44 and p=0.31).[9] Most studies (58.82%) did not observe significant differences in favor of the ACT intervention compared to active comparators (website based on USCPG,[10,14,23,24] smartphone application based on USCPG,[16] CBT,[17] usual care in primary care,[26] brief counseling and self-help material,[20] social support,[21] and behavioral support[2]), in abstinence measures.

d. Amount of tobacco consumed

Only 7 articles (38.89%) evaluated the amount of tobacco consumed after the intervention, when abstinence was not achieved.[2,20,21,23,25,26,28] For this, 1 study used the measurement of expired CO (assessing a 50% reduction from baseline),[23] 4 of the number of cigarettes smoked per day after the intervention,[2,20,26,28] 1 of the total number of cigarettes smoked since the intervention[25] and 1 article evaluated a reduction of at least 50% in the number of cigarettes smoked from baseline.[21] Only 1 article (14.29%) identified statistically significant differences in favor of the ACT intervention compared to the non-active comparator (waiting list type control) with regard to the amount of tobacco consumed after the intervention, in case it was not

achieved the abstinence.[28] A study that compared 3 groups undergoing different interventions (1 group subjected to group ACT sessions in combination with ACT-based smartphone application, another group subjected only to group ACT sessions and a last group subjected to behavioral support), observed that non-abstinent participants in the combineded group reported a significant reduction in the number of cigarettes smoked per day after the intervention (p=0.001) and at 6 months (p=0.001) from baseline. Likewise, non-abstinent participants in the combined group reported significantly fewer cigarettes smoked per day after the intervention compared to the behavioral support (p=0.01) and ACT (p=0.02) groups. However, at 6-month follow-up, the number of cigarettes smoked per day by non-abstinent participants in the combined group was not significantly different from the behavioral support (p=0.76) or ACT (p=0.93) groups. The number of cigarettes smoked per day by non-abstinent participants in the ACT group and the behavioral support group was not significantly different after treatment (p=0.92) or at 6-month follow-up (p=0.69).[2] Most articles (71.43%) did not observe significant differences in favor of the ACT intervention compared to active comparators (USCPG-based website,[23] a presentation on suppression-based coping,[25] a neutral journal article presentation,[25] usual treatment in primary care[26], brief counseling and self-help material[20] and social support[21]) regarding the amount of tobacco consumed after the intervention when abstinence was not achieved.

DISCUSSION

Different treatments have been applied in order to promote smoking cessation, with different intervention models. Systematic reviews have supported psychological interventions in promoting smoking cessation and, with regard to psychotherapies, cognitive behavioral therapy has been the most applied.[2] ACT has shown promise for the treatment of depression, anxiety, substance abuse, psychosis, stress and chronic pain, which highlights the flexibility of the ACT model.[4,5,8,9] Applied to smoking cessation, the focus of ACT is on increasing a smoker's willingness to accept the physical, emotional, and mental states that accompany smoking cessation, while committing to engaging in behavioral changes based on their values.[3] The results of the analyzed studies allow us to assess the existence of some benefit from ACT with regard to measures of acceptance of cravings, which is not surprising considering that acceptance is the target of this psychotherapy. It also seems to exist an association between increased acceptance of cravings and abstinence. Despite these findings, the benefit of ACT does not seem to be proven for measures of abstinence and the amount of tobacco consumed in the absence of abstinence.

The least evaluated category was the amount of tobacco consumed, in cases where abstinence was not achieved. However, the author anticipated that more studies would include this outcome as a result of their analyses, as it is an intervention with therapeutic goals. However, it is worth remembering that the reduction of symptoms does not represent the primary objective of ACT, appearing as a "side effect" of this intervention and, therefore, it is understandable that it was not one of the most evaluated measures.

When it comes to the amount ot tobacco consumed, the majority (71.43%) did not identify a significant benefit in favor of the ACT intervention compared to comparators (all of them active).[20,21,23,25,26] Most of the included articles evaluated measures of acceptance of cravings. Compared to the other measures, this one presented the least diversity in the scales used (only one study used different scales from the AIS[25] – which was adopted by all the others), which allowed a better comparison of results. A considerable part of the articles (36.36%) identified statistically significant improvements in the acceptance of cravings in favor of the ACT intervention compared to active comparators, at all evaluation moments.[10,14-16] Two studies reported different results at different moments of evaluation, regarding the acceptance of cravings.[2,21] The only study that applied several scales simultaneously to evaluate this outcome obtained statistically significant results in favor of the ACT intervention: 1) in relation to an intervention based on coping through suppression using the 1-Urge scale; 2) in relation to the control group using the ME scale; however, this study did not find differences between the 3 groups when applying the QSU-4 scale.[25] It should be noted that, regarding this outcome, three studies found a strong association between increased acceptance of cravings and abstinence.[9,14,22] Of all included studies, only 1 did not cover abstinence measures in their analysis.[25] Most studies (58.82%) found no significant differences in favor of the ACT intervention compared to active comparators in measures of abstinence.[2,10,14-16,20-24,26] Three studies reported different results at different evaluation times regarding this outcome.[9,19,22] Statistically significant differences in favor of the ACT intervention compared to the comparators, regarding abstinence (regardless of the evaluation moment), were found in 23.53% of the studies.[17,18,27,28] This outcome showed considerable diversity in the measurement methods used, which made an adequate comparison of results difficult.

It is important to highlight the diversity of ACT intervention typologies applied in the analyzed studies, highlighting the methodologies supported by new technologies (digital/online modalities), for their eventual and potential cost-benefit advantages and promotion of the democratization of access to specialized interventions, regardless of geographical constraints.[29,30,31]

This review has several limitations. First, it is necessary to consider the limitations of the primary studies included and their implications. Only 18 articles were included in this review, some of which with small sample sizes, which conditioned a small number of the combined population (7431 participants). Not all included studies were RCTs, which compromised the quality of the analysis developed. The research itself was limited to five databases, which limited the universe of available literature, compromising the number of studies included.

Clinical heterogeneity, in terms of intervention typologies (e.g. group, self-help, individual sessions), time of exposure to the intervention and the type of population (different age

groups, amount of tobacco consumed, smoking cessation attempts etc.), is another limitation to this review.

Another limitation of this review is the fact that the methodology of some of the articles included is not presented clearly and leads to doubts as to its adequate design and execution. Also, most of the randomized clinical trials evaluated were classified as presenting high risk for methodological bias.

We also point out that some studies may be influenced by incentive-caused bias (which alerts us to the impact of incentives on behavior and cognition change), as their participants received monetary incentives for completing follow-up assessments.[10,14-16,23-25] Thus, there may be a greater desire from these participants to demonstrate the effectiveness of the study, conditioning its results.

The results of this review can be relevant for healthcare professionals, providing information about a specific therapy that could be considered and integrated into clinical practice to help patients quit smoking. This study can also be useful for public health policies, encouraging the inclusion of this approach in government-funded smoking cessation programs or health insurance policies.

Practical implications may involve integrating ACT into smoking cessation programs, training healthcare professionals to implement this approach, and developing clinical guidelines that consider this therapy as a valid option.

This review also highlights aspects that need further investigation, guiding future research on the comparative effectiveness of different therapeutic approaches in smoking cessation, the mechanisms underlying acceptance and commitment therapy, or the application of this therapy in different populations.

However, it is important to emphasize that the results review should be interpreted cautiously, considering the quality of the included studies and the heterogeneity of the results.

CONCLUSION

According to the results of this review, ACT shows benefits regarding measures of craving acceptance. This fact is further corroborated by the association between increased acceptance of cravings and abstinence. However, this benefit of ACT does not seem to be proven with regard to measures of abstinence and amount of tobacco consumed (when abstinence is not achieved).

However, we conclude that the studies with methodological weaknesses, predominantly with a high risk of bias, can influence the quality of the results obtained. Many do not contribute with analyzses of active comparators or with significant sample sizes, which would have been an asset to clarify the benefit of ACT in smoking cessation. We suggest that further studies be conducted, with better study designs, larger sample sizes and active comparators, are needed to better understand the extent of the benefit of ACT in smoking cessation and which patient population it is best suited to.

RESPONSABILIDADES ÉTICAS

Conflitos de Interesse: Os autores declaram a inexistência de conflitos de interesse.
Apoio Financeiro: Este trabalho não recebeu qualquer subsídio, bolsa ou financiamento.
Proveniência e Revisão por Pares: Não solicitado; revisão externa por pares.

ETHICAL DISCLOSURES

Conflicts of Interest: The authors have no conflicts of interest to declare.
Financial Support: This work has not received any contribution grant or scholarship.
Provenance and Peer Review: Not commissioned; externally peer-reviewed.

DECLARAÇÃO DE CONTRIBUIÇÃO

SM: Conceptualização, investigação, escrita - projeto original, escrita - revisão e edição
SR: Conceptualização, metodologia, supervisão
MP e IFV: Investigação, escrita, revisão e edição
DB: Escrita, revisão e edição, supervisão
Todos os autores aprovaram a versão final a ser publicada.

CONTRIBUTORSHIP STATEMENT

SM: Conceptualization, investigation, writing - original draf, writing - review & editing
SR: Conceptualization, methodology, supervision
MP and IFV: Investigation, writing, review & editing
DB: Writing, review & editing, supervision
All authors approved the final version to be published.

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