Mediterranean Journal of Clinical Psychology

ISSN 2282-1619

MJCP

Volume 12, n 3, 2024

Clinical Psychology

The Effect of an Acceptance and Commitment Therapy-Based Intervention on Executive Functioning and Risk of Suicidal Behavior in Adults with Depression

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Abstract

Background: Suicidal behavior (SB) is a global public health issue, particularly due to its significant increase in recent years. Affective disorders, such as depressive disorder (DD), are strongly linked to suicidal ideation (SI), suicide attempts (SA), and completed suicides. Cognitive difficulties are among the hallmark features of DD, forming a part of its nosological definition,specifically, those related to executive functioning. The acceptance and commitment therapy (ACT) has been used as an intervention for different affective disorders, generating significant improvements in symptoms, but also, it strengthens psychological flexibility, attention, working memory and planning in people with various pathologies.To date, few studies in Colombia have investigated the effects of an ACT-based intervention on EF and SB risk in adults with DD.

Methodology: Thirty-two adults diagnosed with depressive disorder were randomly assigned to two groups: Experimental Group (EG) and Active Control Group (ACG). The following assessments were administered: Sociodemographic Survey, Suicidality Scale (SS), Patient Health Questionnaire (PHQ-9), and executive functioning subtests: Wechsler Adult Intelligence Scale (working memory index), and Neuropsi: attention and memory. For the statistical analyses, descriptive statistics were calculated to summarize the sociodemographic variables and the normalized instrument scores for both groups. The Shapiro-Wilk test was used to assess the normality of the distributions, an important step given the small sample size (<50), which influenced the choice of non-parametric methods. Group comparisons were made using the Mann-Whitney U test for independent samples and the Bayesian Wilcoxon signed-rank test.

Results: The variables "Successive Series" and "Working Memory Index" showed statistically significant differences between the two groups, with a Bayesian factor providing anecdotal evidence in favor of the alternative hypothesis. For the remaining variables, Bayesian factors suggested evidence in favor of the null hypothesis, indicating insufficient evidence to confirm differences between the groups in these specific skills.

Conclusions: The results of this study indicate that the effects of an ACT-based intervention are evident in visuospatial working memory, as well as in tasks involving verbal fluency, inhibitory control, and language in the experimental group (EG). For the other cognitive variables, their p-values do not show significant differences. About the clinical variables, while it is not possible to attribute the reduction in suicidality scale scores solely to the effect of the ACT intervention, it can be concluded that both ACT and the intervention in the active control group (ACG) show promising results in reducing the suicide risk in this population.

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Keywords:
ACT; Clinical Psychology; Depression; Executive Functioning; Suicidal Behavior.

Received: 17 November 2024
Accepted: 10 December 2024
Published: 29 December 2024

Citation: Grand Jaramillo, V., Arbelaez Herrera, M. C., Grisales Aguirre, A. M., Landinez Martínez, D. A., Castaño Ramirez, O. M. (2024). The Effect of an Acceptance and Commitment Therapy-Based Intervention on Executive Functioning and Risk of Suicidal Behavior in Adults with Depression. *Mediterranean Journal of Clinical Psychology 12*(3).
https://doi.org/10.13129/2282-1619/mjcp-4504

1. Introduction

Suicidal behavior (SB) is a global public health issue, particularly due to its significant increase in recent years. According to the World Health Organization (2021), nearly 703,000 people die by suicide annually, with a suicide death occurring approximately every 40 seconds worldwide. Moreover, for every 10 complete suicides, there are 20 or more suicide attempts (SA). In 2019, suicide was the fourth leading cause of death globally among individuals aged 19 to 29 (World Health Organization, 2021). In Colombia, between 2015 and 2022, there was a steady rise in suicide deaths, with the exception of a 6.1% decline in 2020 compared to 2019 (DANE, 2023).

Within the study of suicidal risk, one of the most relevant aspects is SA defined as self-inflicted behavior, initiated and carried out by an individual using different methods, without the intervention of others, and without a fatal outcome. Longitudinal studies show that 40% of people who attempt suicide have had previous attempts. It is also known that the risk of suicide increases during the first six months and even during the first year after the attempt (Ministerio de Salud, 2022).

Affective disorders, such as depressive disorder (DD), are strongly linked to suicidal ideation (SI), suicide attempts (SA), and completed suicides. It is characterized by the repetitive presence of sadness and lack of interest in pleasurable activities over a long period of time, affecting different functional spheres. of the individual, such as the relational, academic and work aspect (World Health Organization, 2023). According to Diagnostic and statistical manual of mental disorders (DSM-5), DD is characterized by the presence of symptoms such as: a depressed mood most of the day, loss of interest in daily activities, changes in weight or appetite, insomnia or excessive sleep, psychomotor agitation or retardation, loss of energy, feelings of worthlessness or guilt, difficulties with concentration, recurrent thoughts of death, or suicidal ideation (APA, 2013). It is estimated that among individuals diagnosed with DD, SB is triggered by chronic SI during severe depressive episodes, with up to 50% of global suicides occurring

during such episodes. Additionally, patients with DD are nearly 20 times more likely to die by suicide than the general population (Laoufi et al., 2022; Otte et al., 2016).

Cognitive difficulties are among the hallmark features of DD, forming a part of its nosological definition, manifesting in attentional impairments, memory deficits, executive functioning (EF) challenges, and reductions in processing speed (Riera-Serra et al., 2023). Studies such as Palomares et al. (2023) highlight that there is a bidirectional relationship between EF and DD, and including deficits in working memory, inhibitory control, decision-making, cognitive flexibility, and problem-solving (Ai et al., 2018; Díaz et al., 2022; Marzuk et al., 2005). Specifically, studies have highlighted EF impairments in individuals with a history of SA, with difficulties in executive attention, working memory, cognitive flexibility, decision-making, inhibitory control, emotional regulation, problem-solving, and planning (Fernández-Sevillano et al., 2021; Gorlyn et al., 2013; Hoehne et al., 2015; Huber et al., 2019; Marzuk et al., 2005; Perrain et al., 2021; Richard-Devantoy et al., 2014). Additionally, recent studies suggest that these EF deficits may serve as neurocognitive markers for suicide risk within this population (Riera-Serra et al., 2023).

This indicates that EF alterations are the result of various mechanisms, including neuronal connectivity changes, neuroendocrine imbalances, and alterations in brain regions such as the prefrontal cortex (PFC), which are also influenced by social and psychological factors (Arbeláez et al., 2023; Nejati et al., 2022).

In recent years, numerous psychological and psychiatric interventions have been developed to alleviate DD symptoms associated with SI and SA. Psychotherapeutic interventions offer a comprehensive treatment alternative, often producing effects comparable to pharmacotherapy by modifying complex cognitive and emotional brain processes (Liu et al., 2023; Otte et al., 2016).

Consequently, in recent years, growing evidence has supported contextual therapies, spurred by the need for effective treatments for individuals diagnosed with DD and at risk of SB. Within this context, it is pertinent to explore whether Acceptance and Commitment Therapy (ACT) demonstrates promise in improving EF and reducing SB risk. ACT has been employed as an intervention to enhance psychological flexibility, attention, working memory, and planning in individuals with various pathologies, yielding significant improvements in subjective well-being and goal-directed action control (Yaselyani, 2021).

In this context, several studies have described that various aspects of psychological inflexibility, such as experiential avoidance, cognitive fusion, and repetitive negative thinking, are considered transdiagnostic risk factors for emotional symptomatology and suicide risk (Sierra & Ortiz, 2022). Specifically, cognitive fusion and repetitive negative thinking explain the tendency to

experience persistent and intrusive thoughts about past experiences, hindering the search for solutions. For its part, experiential avoidance explains suicidal behavior and refers to the process of avoiding distressing thoughts, feelings, or experiences (Sierra et al., 2023).

To date, few studies in Colombia have investigated the effects of an ACT-based intervention on EF and SB risk in adults with DD. The outcomes of this research are aimed at preventing and reducing suicide rates in the country by providing intervention strategies that address both affective and neuropsychological dimensions through ACT, a trending model within contextual therapies. This represents an opportunity to enhance the quality of life in high-risk populations and provide an alternative treatment approach that could benefit patients, families, and mental health services across the country.

Thus, the investigation of the psychological, cognitive, and neurological factors associated with SB contributes to the development of more comprehensive treatment approaches. EF improvements and enhanced interpersonal efficacy have been identified as protective factors against SB (Arbeláez et al., 2023).

Based on these considerations, the objective of this research is to determine the effect of an intervention based on acceptance and commitment therapy on executive functioning and the risk of suicidal behavior in adults with depression, compared to an active control group.

The hypotheses of this research are:

Null Hypothesis (H_0): The risk of suicidal behavior is lower in the experimental group compared to the active control group following the ACT-based intervention.

Alternative Hypothesis (H_1): Executive functioning test performance is better in the experimental group compared to the active control group following the ACT-based intervention.

2. Materials and Methods

This study is classified as applied research with a quantitative approach and employs an experimental design with an active control group (ACG) that received a standard intervention at a mental health clinic and an experimental group (EG) exposed to therapy based on Acceptance and Commitment Therapy. The sample consisted of 32 participants.

Participants were randomly assigned to intervention groups, initially labeled by color codes: one group was labeled blue, and the other red. Random assignment to these colors was performed using the software Research Randomizer (https://www.randomizer.org) by the research team. Subsequently, an independent external collaborator assigned the interventions (EG or ACG) to the blue or red group. Participants were blinded to the group assignments and the study

hypothesis. Neither the EG nor ACG participants were aware of the expected outcomes of their respective interventions.

2.1 Statistical analyses

A number of statistical analyses were carried out to assess the study objectives. First, descriptive statistics were calculated to summarize socio-demographic characteristics and normalized instrument scores for both the experimental group (EG) and the active control group (ACG). Measures of central tendency, dispersion, and distribution were reported for numerical variables, while frequencies and percentages were used for categorical variables. This provided a comprehensive understanding of each group's characteristics. The Shapiro-Wilk test was used to assess the normality of distributions, an important step given the small sample size (<50), which influenced the choice of non-parametric methods. Group comparisons were made using the Mann-Whitney U test for independent samples and the Bayesian Wilcoxon signed-rank test for pre-test-post-test analysis (Jeon et al., 2017; Sánchez, 2023). A Cauchy prior (r = 1) was used in the Bayesian framework to balance sensitivity and specificity, with Bayes factors interpreted using the Jeffreys scale (Jeffreys, 1961), where values between 1 and 3 indicate anecdotal evidence in favor of the alternative hypothesis, values between 3 and 10 indicate moderate evidence, values between 10 and 30 indicate strong evidence, and values between 30 and 100 indicate very strong evidence (see Table 1).

All statistical analyses were conducted using JASP version 0.18.3, an open-source statistical software (JASP Team, 2024). Bayesian statistics provide the advantage of testing hypotheses with credibility probabilities, allowing researchers to determine whether a lack of statistical significance is due to insufficient data or if it provides evidence against the existence of a relationship between variables. This approach also evaluates the probable level of evidence supporting significant results, offering enhanced precision in comparative analyses (Ramos-Vera, 2021).

Table 1. Interpretation Values for Bayes Factor

1 - 3	Weak	Alternative hypothesis
3 - 10	Moderate	Alternative hypothesis
10 -30	Strong	Alternative hypothesis
30 - 100	Very strong	Alternative hypothesis

Note: Authors elaborations

Finally, to determine whether the significant differences between the pre-test and post-test were solely due to the intervention strategy or if other factors might predict these differences, a permutation test was conducted. First, an Ordinary Least Squares (OLS) regression model was fitted to obtain the observed coefficient of the independent variable (e.g., years of disorder progression, history of suicidal behavior, etc.). To construct a null distribution, the dependent variable (post-test score) was randomly permuted 10,000 times, with its values reorganized randomly in each iteration while keeping the independent variable fixed. In each permutation, the OLS regression model was re-fitted to calculate the coefficient of the independent variable in the permuted model. Finally, the p-value was calculated as the proportion of coefficients in the permuted distribution that were equal to or greater in absolute value than the observed coefficient in the original model. This approach was chosen due to potential violations of parametric assumptions (e.g., normality) and the small sample size (DiCiccio & Romano, 2017).

These statistical methods were chosen to maximize reliability and interpretability, addressing potential limitations (e.g., sample size, normality) and aligning with the study's goal of comparing group dynamics and intervention effects.

2.2 Participants

A total of 32 patients from a psychiatric clinic in Manizales, Colombia, diagnosed with major depressive disorder or a severe depressive episode, exhibiting suicidal ideation or suicide attempts. The mean (M) age of the sample was 35.59 years (SD = 11.662 years). The participants selected for the study met the following inclusion criteria: a) Patients aged 18 to 59; b) A clinical history indicating a diagnosis of a depressive episode without psychotic symptoms; c) Hospitalization due to a suicide attempt or suicidal ideation, as per clinical history; d) Minimum education level of primary school; e) Internet access at home; f) Signed informed consent. Also, the exclusion criteria were: a) Intellectual disability, as indicated by clinical history; b) Severe neurological diseases (e.g., epilepsy, brain tumor, stroke, severe traumatic brain injury), as indicated by clinical history; c) Depressive episodes within a bipolar disorder; d) History of substance use disorder within the past year; and e) Current participation in electroconvulsive therapy (ECT).

2.3 Procedure

2.3.1 Phase I: Eligibility Criteria

Participants were selected based on their clinical history, ensuring they met the inclusion criteria. Initial contact was made with the participants to explain the purpose of the study, and informed consent was obtained. Participants were then randomly assigned to one of the intervention groups.

2.3.2 Phase II: Pre-test

A pilot test was conducted, beginning with a sociodemographic survey to describe participant variables. Depression severity was determined through a review of clinical history and assessed using the Patient Health Questionnaire (PHQ-9). Suicidal risk was evaluated using the Suicidality Scale (SS). To assess executive functioning (EF), particularly working memory, inhibitory control, and cognitive flexibility, subtests from the Neuropsi: Attention and Memory battery were administered. The Working Memory Index (WMI) from the Wechsler Adult Intelligence Scale (WAIS) was also applied.

2.3.3 Phase III: Assignment to Experimental or Active Control Group

Participants were randomized using a stratified randomization process based on variables that could influence outcomes, such as sex, age, and clinical severity. Research Randomizer software was used for this purpose. Participants were randomly assigned to one of two groups: Experimental Group and Active Control Group. Participants in the EG received an intervention based on Acceptance and Commitment Therapy (ACT), which consisted of three weekly sessions lasting approximately 45 to 60 minutes, following the protocol described by Pankey and Hayes (2003). Participants in the ACG received usual care at the San Juan de Dios Psychiatric Clinic in Manizales.

2.3.4 Phase IV: Follow-up or Post-test

The same instruments used in the pre-test were re-administered after the intervention to both the EG and ACG to evaluate the outcomes. Depression severity was reassessed using the PHQ-9, and suicidal risk was re-evaluated with the Suicidality Scale (SS). Subtests were also used to assess EF, focusing on working memory, inhibition, and cognitive flexibility.

2.4 Instruments

2.4.1 Sociodemographic Interview

This semi-structured interview provides an in-depth view of participants' social and demographic characteristics, aiming to anticipate potential future variations. Population characterizations offer reliable insights into current living conditions within a society or specific community, addressing broad and interconnected topics (Gallo Restrepo et al., 2014).

2.4.2 Suicidality Scale (SS)

The 8-item Suicide Scale, licensed under a Creative Commons license, is derived from the Suicidal Affect-Behavior-Cognition Scale (SABCS), a validated, highly predictive, theory-based scale. It was developed to predict suicide risk and validated in Colombia through a prospective, cross-sectional study involving psychiatric patients and healthy community members. Validation and assessment of the psychometric properties of the scale were conducted in Colombia in a

prospective, cross-sectional study, with a mixed sample of psychiatric patients and healthy community members (N = 313, 132 women, aged 18–65 years). Multiple models (e.g., bifactor analysis, IRT) examined unidimensionality, internal consistency, and validity. Instrument bias was tested by sex, age, and psychiatric diagnosis. All models show strong fit and low error for SS. Internal consistency was high (ω = .96). Clinical suicide risk decisions correlated strongly with SS assessments (r = .84); however, there was significant variation in suicidality across each clinical risk level (Arenas Dávila & Pastrana Arias, 2023).

2.4.3 Patient Health Questionnaire-9 (PHQ-9)

The PHQ-9 is a screening tool that measures the presence and severity of depressive symptoms, using the Mini Neuropsychiatric Interview (MINI) as the reference criterion. It is organized in an adjectival scale that evaluates the presence of symptoms during the last two weeks ("not at all", "several days", "more than half the days", "almost every day"), with a score from 0 to 3, for a total score ranging from 0 to 27. The internal consistency and convergent and criterion validity of the PHQ-9 were calculated by analyzing the receiver operating characteristics (ROC) and the area under the curve (AUC). 243 patients participated, 184 (75.7%) were female. The average age was 34.05 (median 31 and SD = 12.47). Cronbach's α was 0.80 and McDonald's ω, 0.81. The optimal cut-off point of the PHQ-9 was ≥ 7: sensitivity 90.38 (95% CI: 81.41-99.36); specificity 81.68 (95% CI: 75.93-87.42); PPV 57.32 (95% CI: 46.00-68.63); NPV 96.89 (95% CI: 93.90-99.88); Youden index 0.72 (95% CI: 0.62-0.82; LR+ 4.93 (95% CI: 3.61-6.74); LR- 0.12 (95% CI: 0.005-0.270). In conclusion, the Colombian version of the PHQ-9 is a valid and reliable tool for screening for depression in primary care in Bucaramanga, Colombia, with a cut-off point of ≥7 (Cassiani-Miranda et al., 2021).

2.4.4 Wechsler Adult Intelligence Scale (WAIS) – Working Memory Index (WMI)

The WAIS assesses working memory abilities, which refer to the capacity to retain information in short-term storage and manipulate it to achieve a pre-set goal. Subtests include Digit Span (forward, backward, and sequencing) and Arithmetic.

2.4.5 Neuropsi: Attention and Memory

The Neuropsi neuropsychological evaluation, developed by Feggy Ostrosky Solís, Alfredo Ardila, and Mónica Rosselli (1994), comprises simple, short items, a set of cards, and a registration protocol. It provides cognitive profiles based on the participant's schooling and age, scoring correct responses (1 point) or incorrect ones (0 points), with a maximum score of 130. Validation was conducted with a clinical group diagnosed with depression, lupus, schizophrenia, dementia, alcoholism, and brain damage, achieving 95% accuracy (Ostrosky-Solis et al., 1998). Tests used for each cognitive domain include:

- Working Memory: (a) Digit backward span, (b) Corsi block span backward.
- Inhibitory Control: (a) Digit forward span, (b) Corsi block span forward, (c) Visual detection, (d) Successive series, (e) Stroop task.
- Cognitive Flexibility: (a) Semantic verbal fluency (animal naming), (b) Phonological verbal fluency, (c) Non-verbal fluency.

Participants in the EG received three individual sessions of ACT, a third-generation cognitive-behavioral therapy aimed at enhancing psychological flexibility by helping individuals accept inevitable private events and focus their energy on committed actions. Research shows ACT's efficacy in treating a range of psychiatric problems, including depression (Soriano & Salas, 2006).

In this intervention, the EG followed ACT's core principles: i) Clarification of values, ii) self as context, iii) cognitive defusion, and iv) acceptance, according to the depression model proposed by Hayes (2019). The intervention was tailored to individual patient needs, without adhering strictly to a rigid protocol, following the integrative model (Suck, 2020). This model addresses depression etiology, cognitive strategies, emotional work, coherent narratives, interpersonal pattern modification, resource identification, behavioral changes, and psychoeducation (Cooper et al., 2015). This approach assumes that interventions should be adapted to individual differences since each patient's symptomatology reflects unique needs generated by their life experiences. The intervention is described in Table 2.

Table 2. *ACT-Based Intervention*

SESSION	THERAPEUTIC OBJECTIVES	SESSION STRUCTURE AN TECHNIQUES
Session 1: Clarification of values and committed action	1. Help the patient move towards a valued direction 2. Psychoeducation on treatment adherence and trigger identification 3. Identify avoidance patterns 4. Identify personal resources in life history 5. Identify depression etiology.	Therapeutic framing using two climbers' metaphor. Semi-structured interview. Avoidance patterns identified through life history narratives and the garden metaphor. Value clarification via therapeutic dialogue.

Session 2: Creative hopelessness	1. Redefine inefficient labels or meanings about self, others, or the world 2. Encourage patients to distinguish between experience and identity.	Therapeutic dialogue focusing on self as context and self as content, associated with the patient's life story. Chessboard metaphor. Visualization and cognitive defusion exercise (Hayes, 2019). Prescription: Implement a thought diary.
Session 3: Acceptance and committed action	1. Strengthen goal-oriented actions 2. Provide mindfulness tools to reinforce cognitive distancing.	Review thought diary and perform opposite action exercises (Hayes, 2019). Computer metaphor. Body Scan practice (Kabat-Zinn, 2003)

2.5 Description of the Standard Intervention

The intervention applied to the Active Control Group (ACG) at the San Juan de Dios Clinic follows a biomedical model. In this model, patients are assessed by a psychiatrist, who provides a diagnosis based on DSM-5 criteria. Upon diagnosing depression, a pharmacological treatment plan is prescribed according to individual patient characteristics. The psychiatrist also employs empathic listening, aiming to establish an effective doctor-patient relationship. When necessary, patients are referred to a psychologist for additional support, which primarily involves empathic listening. Furthermore, patients participate in group sessions that include recreational activities, physical exercise, and self-awareness exercises led by a psychologist, occupational therapist, or physical trainer.

2.6 Outcomes

Two psychologists conducted assessments at two time points: before and after the three ACT interventions.

2.7 Primary Outcomes

Suicidal Behavior Risk (SB): SB is a progressive sequence of events, often referred to as the 'suicidal process,' which can begin with suicidal thoughts and ideas, develop into plans, and ultimately lead to one or more suicide attempts of increasing lethality, though not necessarily resulting in death (Ministerio de Salud y Protección Social, 2018). The concept of SB

encompasses a spectrum of behaviors, including suicidal ideation (SI), planning, and incomplete suicide attempts (ICS), many of which do not lead to death (World Health Organization, 2013). The 8-item Suicidality Scale (SS) will be used to measure significant variations in suicidality across different levels of clinical risk.

Executive Functioning (EF): EF refers to high-level cognitive processes that regulate human cognition. It involves three core components: inhibition, updating, and shifting. Inhibition is the ability to suppress dominant or impulsive responses, updating refers to modifying information in working memory as new learning occurs, and shifting denotes the capacity to switch between tasks or cognitive strategies—an essential aspect of executive control (Miyake & Friedman, 2017). EF will be assessed through working memory, inhibition, and cognitive flexibility tests. The Working Memory Index from the Wechsler Intelligence Scale for Adults and tasks from the Neuropsi neuropsychological battery (Attention and Memory) will be used.

Depressive Disorder (DD): DD is a mood disorder affecting approximately 5% of the global adult population. It is characterized by persistent sadness and a lack of interest in pleasurable activities over an extended period, impacting various functional spheres such as relationships, academic performance, and occupational functioning (World Health Organization, 2023). Among individuals with DD, SB is often triggered by chronic SI experienced during severe depressive episodes, contributing to the fact that up to 50% of annual suicides worldwide occur during depressive episodes. Moreover, individuals with DD are nearly 20 times more likely to die by suicide compared to the general population (Laoufi et al., 2022; Otte et al., 2016).

2.8 Sample Size

The sample size was calculated using G*Power 3.1 (Faul et al., 2009) with a confidence level of $\alpha = 5\%$, power = 90%, and two measurements (usual mental health care vs ACT-based intervention). A total sample size of N = 32 was required to detect a significant effect, with an estimated 10% dropout rate.

3. Results

To explore the proposed hypotheses, the analysis focused on comparing key variables between groups, assessing changes from pre-test to post-test, and assessing whether significant differences could be attributed to the intervention strategy. The following tables and figures summarise the main findings and provide a detailed perspective on the observed patterns and statistical evidence.

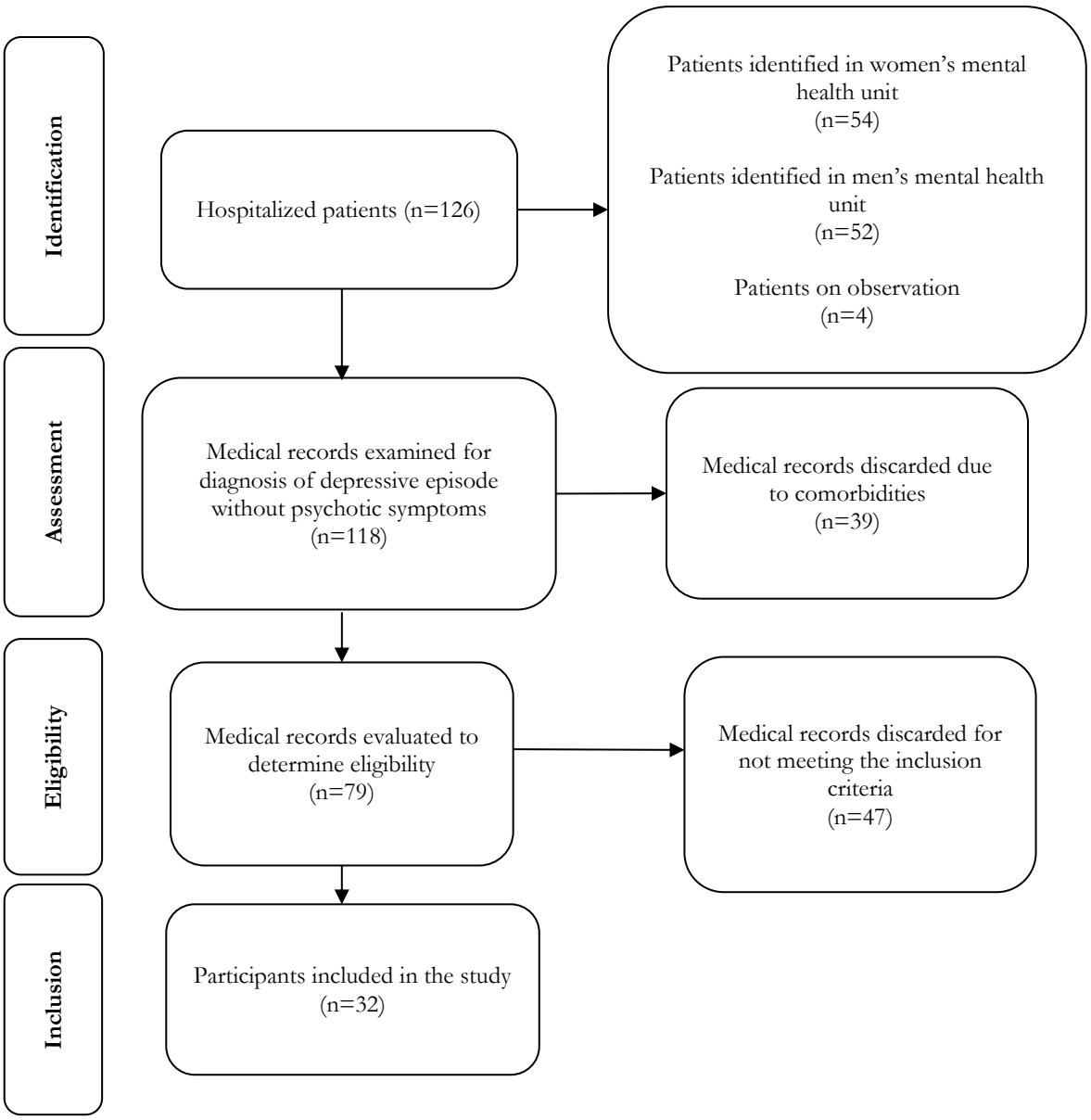

Figure 1. PRISMA flowchart showing the methodology of participant selection

The figure 1 illustrates the selection process for participants included in a study, following the PRISMA framework to present the flow through the stages of identification, assessment, eligibility, and inclusion. Initially, 126 hospitalized patients were identified as potential candidates for the study. These individuals were drawn from three sources: 54 patients from the women's mental health unit, 52 patients from the men's mental health unit, and 4 patients under observation. In the assessment phase, 118 medical records were examined to confirm a diagnosis of a depressive episode without psychotic symptoms. During this step, 39 medical records were excluded due to comorbidities that did not meet the study's focus. The remaining 79 records underwent further evaluation during the eligibility phase, where 47 were excluded for not meeting the predefined inclusion criteria. Finally, 32 participants were included in the

study for further analysis. This figure highlights the rigorous and systematic methodology used to ensure the final sample was consistent with the study's objectives and inclusion criteria, demonstrating a thorough and transparent selection process.

3.1 Sample Description

Thirty-two patients diagnosed with depressive disorder or depressive episode, accompanied by suicidal ideation or previous suicide attempts, participated in this study. The mean age of the sample was 35.59 years (SD = 11.662 years). Within the experimental group, the mean age was 36.19 years (SD = 10.96 years), while in the active control group, it was 35 years (SD = 12.65 years). In terms of sex, 71.9% of the participants were female (23 participants), with the remaining 28.1% being male. In the EG, females predominated, representing 81.3% (13 women), while males constituted only 18.8% (3 participants). Conversely, the ACG exhibited a more balanced distribution, with 62.5% female (10 participants) and 37.5% male (6 participants).

Regarding education level (in years of schooling), 13 years was the most common. In terms of socioeconomic status, 84% of the participants were from strata 0 to 3. The sample was also characterized by the duration of disorder progression, which was dichotomized into two categories: one year or less, and more than one year. In the EG, the majority (56.3%) had experienced the disorder for one year or less, while 43.8% had lived with it for more than one year. In contrast, the ACG displayed a different distribution, with 68.8% having had the disorder for more than one year, and only 31.3% for one year or less. The number of hospitalizations for mental health issues was also analyzed. In the EG, most participants (62.5%) had been hospitalized once or less, while 37.5% had experienced more than one hospitalization. The ACG showed more balanced results, with 56.3% hospitalized once or less and 43.8% having more than one hospitalization.

In terms of suicide attempt history, all participants in the EG (100%) had one or fewer attempts, indicating uniformity in this regard, with 43.8% presenting only suicidal ideation. In contrast, in the ACG, only 31.3% of participants had one or fewer attempts, while the majority (68.8%) had more than one attempt. The most common methods of suicide attempts included cutting the arms and wrists, and drug overdose.

3.2 Group Comparisons – Experimental and Active Control Groups – Pre-test

A comparison of variables between the EG and ACG is presented in Table 3.

Table 3. Bayesian estimation of variables by group – Pre-test

Variables	Experimental Group				Control Group				U	*p*	BF10
	Mean	Median	Mode	SD	Mean	Median	Mode	SD			
PHQ-9	19,00	19,00	25,00	5,73	19,88	20,50	9,00	5,67	116,000	0,664	0,313
Suicidality Scale	19,88	20,50	9,00	5,67	32,81	31,50	27,00	8,89	25,00	<0,001	33,450
Working Memory Index	89,94	88,50	79,00	10,93	82,00	82,00	82,00	9,74	188,000	0,024	1,350
Forward Corsi Block	8,19	8,00	8,00	3,06	6,69	7,50	8,00	1,96	178,000	0,051	0,847
Backward Corsi Block	7,19	6,50	5,00	3,08	6,44	7,00	7,00	3,35	141,500	0,618	0,289
Visual Detection	9,56	9,00	8,00	3,14	11,13	12,00	12,00	3,03	85,500	0,110	0,565
Successive Series	9,13	10,00	12,00	3,16	7,13	6,00	5,00	3,10	182,500	0,033	1,163
Semantic Verbal Fluency	9,44	9,50	11,00	2,28	10,13	9,00	7,00	2,78	117,500	0,704	0,331
Phonological Verbal Fluency	10,69	10,00	7,00	3,30	11,25	10,00	10,00	4,11	122,500	0,849	0,261
Non-Verbal Fluency	7,81	8,00	5,00	2,56	8,94	9,00	9,00	2,46	95,000	0,217	0,456
Stroop Test	10,06	11,00	12,00	2,77	9,75	11,00	12,00	2,70	135,500	0,776	0,279

In table 3, it can be observed that both the experimental group and active control group display consistent values for central tendency measures, particularly the mean, although there are greater variations in the mode (e.g., PHQ-9 has a mode of 25 in the EG compared to 9 in the ACG). The standard deviations are relatively similar between the groups for each variable, indicating a comparable level of dispersion in the scores across groups.

Regarding the Bayesian factor, very strong evidence was found in favour of the alternative hypothesis for the Suicidality Scale, suggesting significant differences between the groups (BF_{10} = 33.450). Meanwhile, the WMI variable indicates anecdotal evidence supporting the alternative hypothesis (BF_{10} = 1.350), similar to the successive series variable (BF_{10} = 1.163). The remaining Bayesian factors suggest moderate evidence in favour of the null hypothesis, indicating that there are likely no significant differences between the groups.

3.3 Comparisons within the Experimental Group – Pre-test and Post-test

The next comparison identified variables that showed significant changes between the pre-test and post-test within the EG. The results are presented in Table 4.

Table 4. Bayesian estimation of variables and comparison within the experimental group

Variables	Pre-test				Post-test				U	*p*	BF10
	Mean	Median	Mode	SD	Mean	Median	Mode	SD			
PHQ-9	19,00	19,00	25,00	5,73	10,44	8,00	6,00	5,61	136,000	<0,001	4148,905
Suicidality Scale	19,88	20,50	9,00	5,67	16,50	13,50	12,00	10,32	85,000	0,393	0,224
Working Memory Index	89,94	88,50	79,00	10,93	92,63	89,00	89,00	11,89	14,500	0,059	3,511
Forward Corsi Block	8,19	8,00	8,00	3,06	9,25	8,00	8,00	2,91	10,500	0,169	0,444
Backward Corsi Block	7,19	6,50	5,00	3,08	9,13	8,50	7,00	3,14	7,500	0,025	15,945
Visual Detection	9,56	9,00	8,00	3,14	10,50	10,50	10,00	3,52	32,000	0,116	0,519
Successive Series	9,13	10,00	12,00	3,16	10,56	12,00	12,00	2,42	7,000	0,139	0,632
Verbal Fluency	9,44	9,50	11,00	2,28	10,75	12,00	12,00	2,77	22,000	0,017	6,756
Phonological Verbal Fluency	10,69	10,00	7,00	3,30	11,25	11,00	11,00	3,86	43,500	0,588	0,228
Non-Verbal Fluency	7,81	8,00	5,00	2,56	9,06	9,00	9,00	3,68	22,000	0,049	2,142
Stroop Test	10,06	11,00	12,00	2,77	11,19	12,00	12,00	2,76	5,000	0,143	0,841

The PHQ-9 questionnaire showed significant differences between assessments, with a mean of 10.44 (SD = 5.61) in the post-test compared to a mean of 19.00 (SD = 5.73) in the pre-test, along with a reduced median and lower dispersion in the post-test. Statistical significance was observed ($p < 0.001$; $BF_{10} = 4148.905$), indicating overwhelming evidence for the alternative hypothesis.

For the Backward Corsi Block higher values were observed in the post-test, consolidating a statistically significant difference ($p = 0.025$), supported by a strong Bayesian factor ($BF_{10} = 15.945$), suggesting strong evidence for the alternative hypothesis.

For the "Suicidality Scale," despite a notable reduction in the mean and median scores in the post-test, the results did not reach statistical significance ($p = 0.393$), and the BF_{10} was low (0.224), suggesting insufficient evidence for a meaningful change. A similar trend is seen in the "Semantic Verbal Fluency" variable, which showed higher values in the post-test, with significance supported by a p-value of 0.017 and a Bayes factor ($BF_{10} = 6.756$), indicating moderate evidence in favour of the alternative hypothesis.

For the remaining variables, both the p-values associated with the Mann-Whitney U statistic comparing groups and the Bayes factors suggest that the evidence is insufficient to confirm differences between the pre-test and post-test within the experimental group.

3.4 Comparisons within the Active Control Group – Pre-test and Post-test

Below is a comparison of the pre-test and post-test within the active control group, with results shown in Table 5.

Table 5. Bayesian estimation of variables and comparison of pre-test and post-test within the active control group

Variables	Pre-test				Pos-test				U	*p*	BF10
	Mean	Median	Mode	SD	Mean	Median	Mode	SD			
PHQ-9	19,88	20,50	9,00	5,67	14,63	12,00	7,00	8,23	106,000	0,009	13,040
Suicidality Scale	32,81	31,50	27,00	8,89	22,19	20,50	12,00	11,39	130,000	0,001	188,495
Working Memory Index	82,00	82,00	82,00	9,74	84,13	85,00	85,00	11,33	15,000	0,059	1,824
Forward Corsi Block	6,69	7,50	8,00	1,96	7,81	8,00	8,00	1,97	0,000	0,021	5,084
Backward Corsi Block	6,44	7,00	7,00	3,35	7,25	7,00	7,00	2,54	13,500	0,304	0,443
Visual Detection	11,13	12,00	12,00	3,03	12,19	13,00	14,00	2,32	13,500	0,046	2,430
Successive Series	7,13	6,00	5,00	3,10	7,75	6,00	5,00	3,34	10,000	0,539	0,285
Semantic Verbal Fluency	10,13	9,00	7,00	2,78	11,00	11,00	9,00	3,29	26,000	0,092	0,927
Phonological Verbal Fluency	11,25	10,00	10,00	4,11	11,00	9,50	9,00	4,18	31,500	0,275	0,376
Non-Verbal Fluency	8,94	9,00	9,00	2,46	9,50	9,50	9,00	2,63	19,000	0,113	0,922
Stroop Test	9,75	11,00	12,00	2,70	11,13	12,00	12,00	1,41	4,000	0,032	4,017

From this table, it can be observed that the "Suicidality Scale" shows a significant improvement, with the mean decreasing from 32.81 (SD = 8.89) to 22.19 (SD = 11.39) and the median from 31.50 to 20.50. This change is statistically significant (p = 0.001) and is supported by an extremely high BF_{10} of 188.495, indicating very strong evidence of a reduction in suicidality levels within the ACG. On the other hand, there is a notable reduction in the PHQ-9 questionnaire mean from 19.88 (SD = 5.67) to 14.63 (SD = 8.23) and in the median from 20.50 to 12.00 between the pre-test and post-test. The significant change (p = 0.009), along with a BF_{10} of 13.040, suggests strong evidence in favour of the alternative hypothesis, indicating statistically significant differences.

For the variable Forward Corsi Block, the median remained constant, but the mean increased from 6.69 (SD = 1.96) in the pre-test to 7.25 (SD = 2.54) in the post-test, reflecting an improvement in this ability. This result is statistically significant (p = 0.021) and supported by a BF_{10} of 5.084, providing moderate evidence for the alternative hypothesis.

It is also observed that for "Visual Detection," the results show a significant improvement in post-test scores compared to pre-test within the ACG, supported by both statistical significance and a Bayes factor, indicating anecdotal evidence for a true effect.

Regarding the "Stroop Test," an improvement in the mean from 9.75 to 11.13 and in the median from 11.00 to 12.00 was observed. This change is significant (p = 0.032) with a BF_{10} of 4.017,

indicating moderate evidence for the alternative hypothesis, suggesting that participants in the ACG improved their performance on the Stroop task during the post-test.

3.5 Comparisons by Experimental Group and Active Control Group – Post-Test

After analyzing the baseline performance of the groups (EG and ACG) during the first application of the instruments (pre-test), the same comparison was conducted following the intervention phase. These results are displayed in Table 6.

In this table, it is highlighted that the variables "Successive Series" and "Working Memory Index" present statistically significant differences between the two groups, EG and ACG, with higher values observed in the EG. These differences are supported by the p-values from the Mann-Whitney U statistic (p = 0.013 and p = 0.035, respectively), along with Bayes factors that provide anecdotal evidence in favour of the alternative hypothesis (BF_{10} = 2.152 for Successive Series and BF_{10} = 1.652 for Working Memory Index). For the other variables, their p-values do not support significant differences, and the Bayes factors suggest anecdotal evidence in favour of the null hypothesis.

Table 6. *Bayesian Estimation of Variables and Comparison by Group – Post-Test*

Variables	Experimental Group				Active Control Group				U	*p*	BF10
	Mean	Median	Mode	SD	Mean	Median	Mode	SD			
PHQ-9	10,44	8,00	6,00	5,61	14,63	12,00	7,00	8,23	86,000	0,117	0,860
Suicidality Scale	16,50	13,50	12,00	10,32	22,19	20,50	12,00	11,39	86,500	0,151	0,635
Working Memory Index	92,63	89,00	89,00	11,89	84,13	85,00	85,00	11,33	184,000	0,035	1,652
Forward Corsi Block	9,25	8,00	8,00	2,91	7,81	8,00	8,00	1,97	162,500	0,183	0,505
Backward Corsi Block	9,13	8,50	7,00	3,14	7,25	7,00	7,00	2,54	178,500	0,052	0,965
Visual Detection	10,50	10,50	10,00	3,52	12,19	13,00	14,00	2,32	94,500	0,208	0,432
Successive Series	10,56	12,00	12,00	2,42	7,75	6,00	5,00	3,34	193,000	0,013	2,152
Semantic Verbal Fluency	10,75	12,00	12,00	2,77	11,00	11,00	9,00	3,29	118,500	0,732	0,276
Phonological Verbal Fluency	11,25	11,00	11,00	3,86	11,00	9,50	9,00	4,18	141,000	0,636	0,267
Non-Verbal Fluency	9,06	9,00	9,00	3,68	9,50	9,50	9,00	2,63	108,000	0,460	0,307
Stroop Test	11,19	12,00	12,00	2,76	11,13	12,00	12,00	1,41	157,000	0,157	0,402

Based on the results from Table 6, we first observe that the PHQ-9 questionnaire showed significant differences between the groups, indicating that in the post-test, the mean was 10.44 (SD = 5.61), compared to a mean of 19.00 (SD = 5.73) during the first application for the EG, and a mean of 14.63 (SD = 8.23) in the post-test compared to a mean of 19.88 (SD = 5.67) in the ACG. Statistically significant differences were noted between the two groups (p < 0.001; BF_{10}= 4148.905), indicating overwhelming evidence supporting the alternative hypothesis.

For the variable Backward corsi Block, higher values were observed in the second application, favoring the EG, which consolidated a statistically significant difference (p = 0.025), supported by a Bayes factor of 15.945, suggesting strong evidence in favor of the alternative hypothesis.

Additionally, "Semantic Verbal Fluency" exhibited significant improvements ($p = 0.017$) with an increase in post-test medians, and a BF_{10} of 6.756 supporting moderate evidence. For the other variables, both the p-values associated with the Mann-Whitney U statistic and the Bayes factors indicate insufficient evidence to confirm differences between the pre-test and post-test in the GE.

In these comparisons, the OLS model concluded that the significant difference between pre-test and post-test scores for the Visual Detection variable could be explained not only by the intervention effect of the ACG but also by the independent variable of disorder duration (Est = 0.1484; $p = 0.009$; $R^2 = 0.482$; $F = 13.03$; $p = 0.0028$). A similar finding occurred with the Stroop variable, for which the OLS model indicated that disorder duration had a significant effect on the pre-test to post-test variation in the ACG (Est = 0.1586; $p = 0.006$; $R^2 = 0.429$; $F = 10.5$; $p = 0.006$).

For the EG, the application of the OLS model allowed us to conclude that the significant variations between the pre-test and post-test were primarily due to the intervention, rather than factors such as disorder duration, history of suicidal behavior, hospitalizations for mental health, or family history of suicidal behavior.

4. Discussion

The goal of this research was to determine the effect of an ACT-based intervention on executive function and the risk of suicidal behavior in adults with depression, compared to an Active Control Group. Clinical and cognitive variables were measured in a sample of Thirty-two patients diagnosed with depressive disorder or depressive episode, accompanied by suicidal ideation or previous suicide attempts.

The effect of ACT on EF has been analyzed in various studies. In larger samples, ACT therapy in patients with depression has been shown to generate significant improvements, not only in reducing depressive symptoms but also in increasing cognitive flexibility (Pots et al., 2016).

In this study, due to the small sample size, the data were subjected to Bayesian analysis, as this method provides greater certainty about the validity of the effect compared to traditional approaches and allows for the use of small samples without compromising data accuracy. This approach also enables the specification of a priori parameters if there is prior knowledge (Rendón-Macías et al., 2018). It is important to note that the limited number of participants was determined by the inclusion and exclusion criteria, which led to an exploration of hypotheses previously described in studies concerning the reduced number of male participants compared to females.

In this context, the WHO (2021) reported that the age-adjusted suicide rate among men is more than three times that of women (Arbeláez et al., 2023). However, this study presents particular data concerning gender. Both groups predominantly comprised female participants, explaining the higher adherence of women with DD to psychiatric treatment compared to men. This aligns with the reduced number of male patients accessing mental health services. Studies suggest that men may exhibit a more passive attitude toward their mental health due to societal pressures associated with hegemonic masculinity roles, leading them to internalize their suffering (Martinez-Mendia et al., 2024). Nonetheless, these cultural beliefs have weakened following the mental health crisis that emerged in 2020 due to the COVID-19 pandemic, where mental health care has become a priority, regardless of gender (Freiberger et al., 2023; Martinez-Mendia et al., 2024).

Another explanation for the low number of male participants is the high comorbidity of substance use disorders in men presenting with depressive episodes, leading to their exclusion from the study. Men are more prone to substance use disorders and tend to start using substances at an earlier age than women (Russell et al., 2008; Stone et al., 2012).

In line with this research, various studies have reported gender differences in EF, specifically in inhibitory control, a factor that influences less planned behavior and increases the likelihood of impulsive responses, including risk-taking behaviors, self-harm, or suicidal behavior (Fernández-Sevillano et al., 2021). Similar results were found in the present study, where male participants at baseline reported a higher number of prior suicidal behaviors and higher scores on the suicidality and PHQ-9 scales compared to females, corroborating prior studies of higher SB risk in men. However, cognitive variables associated with inhibitory control presented some differences.

Firstly, all male participants evaluated at baseline reported normal performance on the Stroop test, while greater variability was found in females, with four participants showing moderate to severe impairments. Similar results were found in the Visual Detection subtest. In contrast, the Successive Series and Forward Corsi Block subtests showed greater variability, with most participants exhibiting mild to moderate impairments, suggesting no significant differences between men and women in this EF subdomain. Previous studies describe better visuospatial working memory performance in men, while women perform better in verbal working memory tasks (Jansen & Heil, 2010; Miller & Halpern, 2014; Voyer et al., 2017).

Given the predominantly female sample, these results must be interpreted with caution. Future research should evaluate inhibitory control in samples with equal gender representation to obtain more accurate results.

In the context of EF impairments during acute depressive episodes, researchers agree that these impairments hinder cognitive flexibility, decision-making, and the reduction of rumination, which are risk factors for suicide. Commonly affected EF domains include working memory, planning, and verbal fluency (Snyder, 2013). One study reported that decision-making, inhibitory control, selective attention, and working memory were the most deteriorated domains in patients with depression and suicide attempts (Lalovic et al., 2022), correlating with decreased functionality and quality of life. Additionally, impaired cognitive inhibition has been linked to impulsivity and difficulties resisting suicidal urges, supporting the hypothesis that EF deficits, particularly in decision-making and inhibitory control, may serve as neurocognitive markers of suicide risk in this population (Riera-Serra et al., 2023).

In the pre-test, the experimental group exhibited moderate correlations between visual detection and the working memory index (WMI) (0.548*), and phonological verbal fluency showed a strong correlation with WMI (0.663**). This suggests that performance in inhibitory control and cognitive flexibility is associated with working memory in the EG. In the active control group , non-verbal fluency significantly correlated with WMI (0.711**), indicating a strong relationship between cognitive flexibility and working memory in this group.

These findings suggest that certain cognitive skills are more related to working memory across both groups, while correlations between depressive symptoms and suicidality are lower and less consistent. Notably, the EG performed better in working memory ($p = 0.023$) and successive series ($p = 0.039$), whereas the ACG exhibited higher suicidality levels ($p = 0.001$) and PHQ-9 scores, indicating greater depressive symptom severity.

In the EG, 25% of participants had a history of more than one suicidal behavior, compared to 43.7% in the ACG. This difference in working memory and inhibitory control may be related to the severity of depressive symptoms and SB risk. Educational level and disorder duration are also factors influencing cognitive performance.

In this context, it was observed that the EG has higher education levels, with 43.8% having completed 14 years of education. In the ACG, the distribution of education is more varied. The category of 13 years of education is the most frequent, representing 37.5% of the group, so the relationship between educational level and performance in EF tests cannot be overlooked.

It has been hypothesized that the longer the evolution of depressive symptoms, the greater the progressive deterioration of cognitive functioning (Biringer et al., 2007). Therefore, it is important to specify that in the EG, 43.8% of participants have had the disorder for more than one year, and 37.5% have had more than one hospitalization. In contrast, in the ACG, 68.8% have had the disorder for more than one year, and 43.8% have had more than one

hospitalization, indicating a clinical difference between the groups concerning the years of diagnosis progression and the number of mental health hospitalizations, which may relate to cognitive performance. Accordingly, the results should be understood in light of these differences.

Following the comparison of variables between both groups in the first application of the instruments (pre-test), the same comparative analysis was conducted in the second application (post-test).

Firstly, it was found that the successive series variable and the working memory index variable show statistically significant differences between the two groups, EG and ACG. These differences are supported by the p-value of the Mann-Whitney U statistic ($p = 0.013$ and $p = 0.035$, respectively), presenting a Bayesian factor with anecdotal evidence in favor of the alternative hypothesis (BF10 = 2.152 and 0.035). This implies an improvement in performance on inhibitory control and working memory tests for both groups. However, higher values were observed in the EG. In relation to this result, ACT utilizes mindfulness as one of its primary techniques, as mindfulness meditation can impact brain function and enhance cognitive performance; studies have shown that mindfulness can change neuronal activity, aiding working memory and psychological flexibility (Tighe et al., 2018).

Furthermore, for the cube progression variable, the EG shows higher values in the second application, which consolidates a statistically significant difference ($p = 0.025$), supported by a Bayesian factor of 15.945, suggesting strong evidence in favor of the alternative hypothesis. In the ACG, the mean increased from 6.69 in the pre-test to 7.81 in the post-test, reflecting an improvement in this capacity. This implies better performance on visuospatial working memory tests, which is related to an increased ability to retain and manipulate visual information and coordinate motor actions with visual elements (Cowan et al., 2022).

At the same time, semantic verbal fluency exhibited significant improvements ($p = 0.017$) with an increase in post-test medians, and a BF10 = 6.756 that supports evidence of a significant effect, implying better performance in this cognitive flexibility task for the EG. In relation to this finding, a recent study observed that ACT makes it possible to increase cognitive flexibility, a skill associated with the ability to adapt as a prerequisite for increasing psychological flexibility, which allows individuals to respond effectively to different life challenges (Grant & Cassidy, 2022).

Concerning clinical variables, the PHQ-9 scale showed important differences between the groups, noting that in the post-test, the EG had a mean of 10.44, contrasting with 19.00 in the first application. In contrast, for the ACG, this scale indicates a notable reduction in the mean from 19.88 to 12.00 and in the median from 20.50 to 12.00 between the pre-test and post-test.

This suggests strong evidence in favor of the alternative hypothesis of statistically significant differences, observing that both groups showed improvement in depressive symptomatology.

For the suicidality scale, in the EG, despite a noticeable reduction in the mean and median post-test, the results did not reach statistical significance ($p = 0.393$), and the BF10 was low (0.224), suggesting a lack of robust evidence for change. In contrast, the ACG shows a statistically significant improvement ($p = 0.001$), supported by an extremely high BF10 of 188.495, indicating very strong evidence of a reduction in suicidality levels in this group. This indicates that the intervention conducted in the ACG shows promising results for reducing the risk of suicidal behavior.

In relation to the above, the observed pattern is that the effects of an ACT-based intervention are present for visuospatial working memory and for tasks of verbal fluency, inhibitory control, and language in the EG. Regarding this result, a longitudinal study related to cognitive function in DD described that improvement in mood is associated with improvements in verbal memory, verbal fluency, and psychomotor speed, while attention and EF remain affected even after treatment for depressive symptoms (Douglas & Porter, 2009).

Another study sought to identify possible associations between visuospatial performance and verbal working memory in a group of patients with depression. The results allowed concluding that better performance in verbal working memory and the visuospatial coordination test correlated with a lower intensity of depressive symptoms (measured by the Hamilton Depression Scale) after 8 weeks of pharmacological treatment with antidepressants (selective serotonin reuptake inhibitors) (Talarowska et al., 2013). This suggests that improvement in depressive symptoms may be related to adequate adherence to pharmacological treatment, facilitating better cognitive performance, specifically in EF.

5. Conclusions

The results of this study indicate the effects of an ACT-based intervention are present for visuospatial working memory and for tasks of verbal fluency, inhibitory control, and language in the EG. For the other cognitive variables, their p-values do not show significant differences.

While the reduction in depressive symptomatology in both groups cannot be excluded as factors contributing to the decrease in scores on the suicidality scale, the findings regarding the reduction in suicide risk do not indicate that the changes were solely due to the intervention conducted in the EG, as there are differences in baseline characteristics between the two groups and a significant decrease in suicidality levels is observed for the ACG. Additionally, although the reduction in depressive symptoms in both groups cannot be explained solely by the effect of ACT, it may be related to the presence of external variables observed during the study.

In this same vein, while it is not possible to attribute the decrease in scores on the suicidality scale solely to the effect of the ACT intervention, it can be concluded that both this and the intervention conducted in the ACG show promising results regarding the reduction of suicide risk in this population, allowing for a reduction in suicide rates at the regional level and greater personal, family, and social well-being among patients. Nevertheless, it is necessary to continue implementing comprehensive interventions to further decrease scores on this scale

On the other hand, it was identified that participants who showed a significant decrease in the scores on the suicidality scale had a wide support network, compared to some participants who reported having poor or no support network. Various studies have linked greater social support with a lower likelihood of suicide attempts throughout life (Gonçalves et al., 2014; Otsuka et al., 2019). Others add that a poor or nonexistent support network influences perceived stress levels and, therefore, leads to maladaptive coping styles (Lin et al., 2020). This reiterates that strengthening support networks at the family and social levels is a central aspect of the comprehensive psychological treatment of patients with DD.

Finally, this study highlights the importance of developing interdisciplinary treatments that include not only psychology and psychiatry professionals but also those in the field of neuropsychology, aiming to generate changes in the re-signification of beliefs, coping styles, emotional regulation, and problem-solving while also strengthening cognitive skills, thereby contributing to the improvement of patients' quality of life in an integrated manner.

6. Future directions

For future studies, there should be greater control over baseline sample characteristics regarding the duration of the disorder in participants, number of hospitalizations, and educational level, establishing more precise selection criteria to obtain homogeneous samples, thus providing more accurate data about the effect size of the intervention conducted. Nevertheless, this may lead to smaller samples, in which case the results should be interpreted cautiously, considering that small sample sizes are less generalizable (Silva, 2000).

Additionally, some studies raise relevant objections regarding the relationship between improvement in depressive symptomatology and cognitive function, as the follow-up conducted in these patients has been at intervals of less than 12 months, and the diagnoses have been heterogeneous within the studied samples (Biringer et al., 2007). Therefore, it is recommended to conduct studies where it can be demonstrated whether the effects of interventions persist over a more extended period and that a more homogeneous sample is available.

Although there is scientific evidence regarding the effectiveness of ACT in reducing suicide risk and preventing future suicide attempts in small samples, long-term follow-up studies are needed

to evaluate the effectiveness of ACT in suicide prevention (Ducasse et al., 2018). The studies conducted so far have limited generalizability because they have been carried out on small samples, and there is inconsistency in the findings when replicated.

Finally, it should be taken into account that the literature shows variations in the implementation and duration of ACT-based treatments, suggesting that larger samples, adequate control groups, and a systematic approach to randomization are needed to establish a consensus regarding the instruments and outcomes to be used in future studies.

Ethical approval

Ethical approval for this study was granted by the University of Manizales. Approved on April 9, 2024, through Act No. CBE03_2024. As this was an experimental investigation, random selection methods were employed to ensure an unbiased allocation of participants. The study was classified as minimal risk, following the guidelines established in Resolution 008430 of October 4, 1993. Participation was voluntary, with no financial compensation provided. The informed consent form was properly completed, and the study adhered to the ethical standards outlined by Colombian law (Law 1090 of 2006), which include confidentiality, respect, integrity, and anonymity. Additionally, the ethics committee of the San Juan de Dios Psychiatric Clinic in Manizales authorized the study, allowing access to clinical records for determining eligibility criteria, administration of informed consent, and other procedures necessary for conducting the research.

Informed Consent Statement

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

Data Availability Statement

Data are available upon request due to ethical/privacy restrictions.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any potential conflict of interest.

Authors' Contribution

VGJ: Data collection, analysis and interpretation of results, all authors reviewed the results and approved the final version of the manuscript. MCA: Data collection, analysis and interpretation of results, all authors reviewed the results and approved the final version of the manuscript. DLM: Draft manuscript preparation, data collection, analysis and interpretation of results, all authors reviewed the results and approved the final version of the manuscript. AMJ: Analysis and interpretation of the results, all authors reviewed the results and approved the final version

of the manuscript. OMC: Preparation of manuscript draft, data collection, all authors reviewed the results and approved the final version of the manuscript.

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