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Impact of Ecotherapy on Emotional Dysregulation among College Students Engaging in Non-Suicidal Self-Injury

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ABSTRACT

Non-suicidal self-injury (NSSI) is an emerging mental health concern among young adults, frequently associated with emotional dysregulation. This study evaluated the impact of ecotherapy, a nature-based therapeutic intervention—on emotional dysregulation among college students engaging in NSSI. A quasi-experimental pre-test–post-test–follow-up design was adopted. From an initial screening of 3,500 students, 1,383 were identified with NSSI characteristics. Sixty students aged 19–25 years, with a history of NSSI for at least six months, were randomly assigned to an ecotherapy intervention group (n = 30) or an art therapy group (n = 30). This paper reports only on the ecotherapy group. Emotional dysregulation was measured using the Difficulties in Emotion Regulation Scale (DERS) at baseline, post-intervention, and 6-month follow-up. Results from one-way repeated measures ANOVA indicated a significant reduction in emotional dysregulation scores in the ecotherapy group across time points ($p < .001$), with improvements sustained at follow-up. Effect size analysis (Cohen's $d = 0.65$) demonstrated medium-to-large clinical significance. Qualitative feedback suggested that ecotherapy enhanced emotional awareness, provided relief from psychological distress, and fostered healthier coping mechanisms. The findings suggest that ecotherapy is an effective, culturally sensitive intervention for addressing emotional dysregulation among young adults with NSSI. This contributes to evidence for nature-based interventions as scalable, non-stigmatising alternatives to conventional psychotherapy in low-resource and collectivistic cultural settings.

Keywords:
Ecotherapy, Emotional Dysregulation, Non-Suicidal Self-Injury, College Students, Alternative Therapies

Introduction

Non-suicidal self-injury (NSSI) refers to the deliberate destruction of one's body tissue without suicidal intent (Klonsky, 2007). It is a growing public health issue among young adults, particularly in South Asian contexts where prevalence is increasing and clinical resources are limited. Emotional dysregulation is consistently identified as a key risk factor for NSSI (Nock, 2009). College students experiencing difficulties in modulating negative affect often engage in maladaptive coping behaviors, with self-injury serving as a short-term relief mechanism.

Conventional therapies such as Cognitive Behavioral Therapy (CBT) and Dialectical Behavior Therapy (DBT) are effective in addressing NSSI, yet they face barriers of stigma, cost, and cultural adaptation challenges in India (Bhatia & Goyal, 2018). Ecotherapy, which emphasises human interaction with natural environments as a means of healing (Buzzell & Chalquist, 2009), offers an alternative, accessible, and culturally resonant therapeutic pathway.

Empirical research has demonstrated ecotherapy's benefits for mood regulation, resilience, and overall well-being (Bratman et al., 2019). However, its impact on emotional dysregulation, specifically in the context of NSSI, remains underexplored. Thus, there is a pressing need for alternative interventions that are both accessible and culturally resonant.

Nature-based therapeutic models, also known as ecotherapy, are therapeutic methods that focus on human interaction with natural environments as a form of psychological healing and have been receiving growing scholarly and clinical interest (Naor and Mayseless, 2021). Ecotherapy is built on the concept of natural environments allowing emotional healing, and thus comprises of walking mindfully, gardening, and grounding practices. There is an increasing amount of empirical research that nature-related activities help to regulate mood, increase resilience, alleviate stress, and boost happiness (Leavell et al., 2019). These results are quite consistent with the treatment requirements of people with emotional dysregulation.

With all its potential, little is known about the ecotherapy application to the group of participants in NSSI. The majority of research on the ecotherapy topic is generalised in its approach toward depression, anxiety, and stress disorders, and the importance of ecotherapy in self-injury behavior remains an untapped gap in research (Williams et al., 2020). Among the Indian population, who have long-standing cultural ties to nature and experience mental health stigma, ecotherapy can provide a novel non-stigmatising low-cost intervention that could be especially appropriate in the case of college students. The current research fills this gap by focusing only on the efficacy of ecotherapy in alleviating emotional dysregulation in Indian college students with a history of NSSI. By placing ecotherapy in the context of this population, the study will focus on supporting the design of scalable, culturally adaptive interventions that improve emotional well-being and lessen the use of maladaptive coping strategies.

Literature Review

Non suicidal self-injury refers to deliberate, self-inflicted damage to body tissue without suicidal intent. This behaviour is common in late adolescence and emerging adulthood and is associated with functional impairment in areas such as academic and social functioning. Wolff et al. (2019) concluded in a systematic review and meta-analysis that greater emotion regulation difficulties are reliably associated with increased odds of non-suicidal self-injury across clinical and non-clinical samples. Specific DERS domains, particularly impulse control difficulties and limited access to regulation strategies, show stronger associations with repeated self-injury.

Emotion Dysregulation as a Proximal Risk Mechanism

Affect regulation models propose that non-suicidal self-injury functions, in many cases, to reduce aversive affective states. These models identify measurable emotion regulation capacities such as awareness, clarity, acceptance, impulse

control, goal directed behaviour and access to strategies as proximal determinants of adaptive responding. These capacities are most commonly measured using the Difficulties in Emotion Regulation Scale. Wolff et al. (2019) synthesised decades of work showing that global emotion dysregulation indices predict non-suicidal self-injury. They also reported that particular DERS subdomains are more strongly linked to frequency and repetition of non-suicidal self-injury than are broad symptom measures.

Primary studies clarify correlational pathways but are often cross sectional. Calvete et al. (2022) found that lower dispositional mindfulness and higher emotion dysregulation scores were associated with non-suicidal self-injury in psychiatric and community samples. They reported that emotion dysregulation statistically mediates the association between mindfulness and non-suicidal self-injury. Lan et al. (2022) reported that in adolescent samples, sleep quality and social support operate as mediators or moderators of the association between emotion regulation capacity and non-suicidal self-injury. Lan et al. used cross sectional data, and therefore causal or trajectory claims cannot be drawn from that study alone. These findings delineate plausible pathways such as mindfulness, sleep and social support that warrant longitudinal and intervention tests.

Complementary Maintenance Mechanisms: Experiential Avoidance and Interoception

Experiential avoidance refers to the tendency to suppress, escape or otherwise avoid internal experience. This construct co-occurs with emotion regulation deficits and correlates with ongoing non-suicidal self-injury. Integrative models and undergraduate samples show that experiential avoidance, together with limited strategy access and emotional distress, distinguishes persistent non-suicidal self-injury from desisted behaviour. Interoceptive dysfunction refers to reduced accuracy or awareness of internal bodily states. This dysfunction is repeatedly reported to be more common among people with histories of self-injury and to relate to greater severity of self-injurious and suicidal behaviour. Interoceptive deficits plausibly reduce detection and toleration of affective arousal. Reduced tolerance may increase reliance on externally generated regulation such as self-injury. These constructs represent plausible maintenance mechanisms and candidate mediators for intervention.

Ecotherapy and Putative Regulation Mechanisms

Ecotherapy and nature based interventions intentionally integrate natural environments into therapeutic activity. Interdisciplinary reviews and meta-analysis indicate that nature exposure and such interventions are associated with reductions in physiological stress markers and improvements in mood. They are also associated with reductions in rumination and gains in directed attention capacity. Bratman et al. (2019) synthesised ecosystem service and psychological literatures and identified pathways such as stress reduction, attention restoration and social and physical activity by which nature exposure may benefit

mental health. Twohig-Bennett and Jones (2018) analysed greenspace exposure and reported small but consistent reductions in markers such as salivary cortisol and heart rate. They also reported improvements in several mental health indicators. Shanahan et al. (2019) presented a taxonomy showing that outcomes of nature-based interventions are moderated by intervention intent, duration and social facilitation.

Experimental evidence shows mechanistic links relevant to emotion regulation. Bratman et al. (2015) randomised healthy adults to a 90-minute walk in a natural versus an urban environment. They reported lower self-reported rumination and reduced sub-genual prefrontal activation after the nature walk, an effect consistent with reduced habitual negative self-focus. Berman et al. (2008) and subsequent work show that brief interactions with nature improve directed attention. Attention restoration theory explains how this cognitive capacity supports top down regulation of affective responses. These findings suggest that nature based interventions plausibly target proximal processes such as rumination and attention. These processes are implicated in affect driven impulsive behaviour such as non-suicidal self-injury.

Gaps in the Ecotherapy

Despite reasonable systematic links, the literature does not yet provide high quality causal evidence that nature-based interventions produce sustained, domain specific improvements in the emotion regulation processes that maintain non suicidal self-injury. Systematic and narrative reviews note high heterogeneity in intervention content, variable outcome selection and measurement timing, limited representation of high-risk clinical samples and a scarcity of randomised trials with active clinical comparators. Published work does not identify randomised controlled trials that recruited participants for current non-suicidal self-injury and used validated emotion regulation instruments as prespecified mediators or primary outcomes. Therefore, evidence does not support claims that ecotherapy yields sustained DERS domain improvement in self-injuring populations.

Robust Meta analytic and primary evidence links domain specific emotion regulation deficits, experiential avoidance and interoceptive dysfunction to non-suicidal self-injury (Wolff et al., 2019; Duffy et al., 2021; Calvete et al., 2022). Experimental evidence also shows that nature exposure reduces rumination and restores attention (Bratman et al., 2015; Berman et al., 2008). The next step is a rigorously designed randomised trial in a college sample at high risk of non-suicidal self-injury. Such a trial should recruit students with current self-injury or elevated risk, compare a structured nature based intervention with an active clinical comparator, and prespecify DERS subscales and interoceptive measures as mediators. Outcomes should be measured at post treatment and at six month or longer follow up. Fidelity should also be reported. Demonstrating that changes in DERS subscales or interoceptive indices mediate reductions in non-suicidal self-injury would provide stronger causal evidence. Such evidence would support claims that nature

based interventions can modify proximal mechanisms that sustain non-suicidal self-injury.

Methods

Research Design

A quasi-experimental pre-test, post-test, and follow-up design was employed. This design was selected because it allows for the measurement of changes over time. It also makes possible a comparison of results across different assessment stages. The design is advantageous in intervention based studies where randomisation into treatment and control groups may not be fully feasible or ethical (Miller et al., 2019). It provides a way to monitor progress, relapse, or sustained effects. This is especially important in behaviours such as non-suicidal self-injury where long term follow up is critical.

Participants and Sampling

From a pool of 3,500 students, 1,383 met criteria for non-suicidal self-injury based on initial screening. Sixty students aged 19 to 25 years were randomly assigned into ecotherapy and art therapy groups. The ecotherapy group included 30 students, and the art therapy group also included 30 students. The present report focuses only on the ecotherapy group. Random assignment enhanced the internal validity of the study by reducing selection bias. It also ensured comparability between groups. The sample size of 60 was considered appropriate in light of available resources and ethical considerations. The number was modest but sufficient for meaningful statistical analysis and for in depth qualitative exploration.

Inclusion and Exclusion Criteria

Inclusion criteria required age between 19 and 25, a history of non-suicidal self-injury for at least six months, and a minimum cut off on the Deliberate Self-Harm Inventory. Exclusion criteria ruled out active suicidal ideation, unstable psychiatric illness, and current psychotherapy. These criteria ensured that participants had a consistent behavioural profile relevant to the study. They also protected individuals who might require more intensive clinical care. The use of both inclusion and exclusion parameters strengthened methodological rigour by focusing on a clearly defined sample.

Intervention Procedures

The ecotherapy intervention comprised eight weekly sessions of 60 minutes each. Activities included mindful walks, grounding exercises with trees, and horticultural engagement. The structured format of the intervention promoted emotional regulation and reduced impulsivity. It also provided a safe space for participants to reconnect with nature as a therapeutic resource. Each session was delivered by trained facilitators who followed a standardised protocol. This ensured consistency across participants.

Ecotherapy was selected over other therapeutic approaches because it integrates physical, emotional, and cognitive aspects of healing (Arisoy, 2023). The method differs from conventional talk therapies because it relies on direct interaction with the natural environment. Such interaction has been shown to reduce stress and enhance wellbeing. This approach was

relevant for young adults experiencing non-suicidal self-injury because it combined experiential and reflective engagement.

Data Collection and Measures

Assessments were conducted at baseline, immediately after the intervention, and at six month follow up. The Difficulties in Emotion Regulation Scale was used as the primary measure. The scale showed high psychometric reliability and aligned with the study's focus on emotional regulation as a core mechanism underlying non-suicidal self injury. Semi structured qualitative interviews were also conducted with participants. These interviews captured subjective experiences and provided deeper insights into the effectiveness of the intervention. The mixed method approach strengthened the study by combining statistical evidence with personal narratives. This combination enriched the interpretation of outcomes.

Data Analysis

Statistical analyses included descriptive statistics, one way repeated measures ANOVA, and effect size calculations. These methods allowed for the detection of within group changes over time. They also provided estimates of the magnitude of the intervention's impact. The repeated measures ANOVA was suitable because it accounted for correlations between repeated assessments on the same participants. Effect sizes contextualised statistical significance by showing the practical importance of findings. Qualitative data were analysed thematically. This analysis identified recurring patterns related to emotional regulation, coping strategies, and the perceived role of ecotherapy in reducing non-suicidal self-injury. The integration of qualitative and quantitative results enhanced the validity of conclusions.

Results

Quantitative Findings

Table 1 presents the demographic characteristics of the ecotherapy participants which reflects a balanced sample in terms of gender, with equal representation of males and females (50% each). The majority of participants were younger students aged 19–21 years (60%), while 40% were aged 22–25. Academic status indicates that two-thirds (66.7%) were undergraduates, with the remaining one-third being postgraduates (33.3%). This distribution highlights that the intervention predominantly targeted younger undergraduates, a group more vulnerable to NSSI behaviors due to transitional stressors and identity formation challenges, while still capturing perspectives across both age ranges and educational levels.

Table 1: Demographic characteristics of Population

Characteristic	n	%
Age 19–21	18	60.0
Age 22–25	12	40.0
Male	15	50.0
Female	15	50.0
Undergraduate	20	66.7
Postgraduate	10	33.3

The descriptive statistics show a marked reduction in emotional dysregulation scores across time points (Table 2). At baseline, the mean

Difficulties in Emotion Regulation Scale (DERS) score was high (105.3), indicating significant emotion regulation difficulties. Following the ecotherapy intervention, scores dropped substantially to 91.7, reflecting improved emotional regulation. At the six-month follow-up, scores remained relatively stable at 93.1, suggesting sustained benefits over time. The relatively small increase from post-test to follow-up implies that the therapeutic effects of ecotherapy were maintained, highlighting its potential as a long-term supportive intervention for managing emotional dysregulation among students with NSSI.

Table 2: Descriptive statistics of emotional dysregulation scores (DERS)

Time Point	Mean	SD
Pre-test	105.3	12.4
Post-test	91.7	11.2
6-month Follow-up	93.1	11.5

The repeated measures ANOVA results demonstrate a statistically significant effect of time on emotional dysregulation scores ($F = 14.72$, $p < .001$) (Table 3). This finding confirms that changes in DERS scores across the three time points such as pre-test, post-test, and follow-up were not due to chance. The significant reduction indicates that ecotherapy had a meaningful impact in improving emotional regulation among participants. Importantly, the significance across time points validates the intervention's effectiveness, providing empirical evidence that structured exposure to nature-based therapeutic activities can lead to measurable psychological improvements in populations vulnerable to maladaptive coping mechanisms such as NSSI.

Table 3: ANOVA

Source	df	F	p
Time (Pre, Post, Follow-up)	2, 58	14.72	< .001

Effect size analyses provide further insight into the magnitude of change. The comparison between pre-test and post-test (Cohen's $d = 0.72$, partial $\eta^2 = 0.18$, $p < .001$) indicates a large and clinically meaningful reduction in emotional dysregulation. The pre-test versus follow-up comparison ($d = 0.65$, $p < .01$) shows that improvements remained substantial and statistically significant over time (Table 4). By contrast, post-test versus follow-up differences were negligible ($d = 0.12$, ns), suggesting stability of the gains rather than further change. Overall, the effect size results underscore that ecotherapy produced robust, lasting improvements in emotional regulation among participants.

Table 4: Effect Size Calculations

Comparison	Cohen's d	Partial η^2	Significance
Pre-test vs Post-test	0.72	0.18	$p < .001$
Pre-test vs Follow-up	0.65	0.15	$p < .01$
Post-test vs Follow-up	0.12	0.01	ns

Qualitative Findings

Thematic analysis of participant feedback indicated three dominant themes which include

emotional awareness, stress Reduction, and coping without harm Table 5 summarises these themes with representative participant quotes.

Emotional Awareness emerged as a central theme, with participants reporting an enhanced ability to recognise and label their emotions rather than resorting to self-injurious behavior. The statement, *"I could finally recognise when I was angry instead of hurting myself,"* illustrates how ecotherapy enabled students to pause, identify their affective state, and process emotions consciously. This aligns with emotion regulation theory, which emphasises the importance of awareness as a precursor to adaptive coping. By cultivating mindfulness through nature-based practices, participants developed greater insight into their internal experiences.

Stress Reduction was another key theme, reflecting nature's restorative effect on psychological well-being. Students described activities such as mindful walking and engaging with green spaces as calming and therapeutic, with one participant noting, *"Walking in the garden calmed my mind more than I expected."* This resonates with Attention Restoration Theory, which posits that natural environments reduce mental fatigue and restore cognitive and emotional balance. The findings suggest that ecotherapy provided immediate relief from intrusive thoughts and emotional turbulence, thereby reducing vulnerability to NSSI triggers.

Finally, the theme of Coping without Harm highlighted a shift in behavioral responses to distress. Participants described consciously substituting harmful urges with ecotherapy activities, as exemplified in the quote, *"When I felt like cutting, I sat near the tree instead. It worked."* This indicates the development of healthier, non-destructive coping mechanisms that not only provided comfort but also reinforced resilience over time. These themes illustrate ecotherapy's capacity to enhance self-awareness, alleviate stress, and promote adaptive coping, positioning it as a culturally sensitive and sustainable intervention for reducing emotional dysregulation in young adults with NSSI.

Table 5: Themes generated from Participants' Quote

Theme	Representative Quote
Emotional Awareness	"I could finally recognise when I was angry instead of hurting myself."
Stress Reduction	"Walking in the garden calmed my mind more than I expected."
Coping without Harm	"When I felt like cutting, I sat near the tree instead. It worked."

Discussions

The current research article indicates that ecotherapy is an effective intervention to minimise emotional dysregulation in college students with non-suicidal self-injury (NSSI). Quantitative and qualitative evidence points to a similar conclusion, which is that structured interaction with nature helps young adults to better regulate their emotions, thus decreasing the risk of developing maladaptive coping strategies like self-injury. The results could be of great importance to the Indian context where mental

health stigma and the lack of clinical resources have led to the need to implement a simple and culturally sustainable intervention.

Quantitatively, the researcher's found statistically and clinically significant post-test vs. pre-test differences in Difficulties in Emotion Regulation Scale (DERS) scores, and the improvements were mostly maintained at the six-month follow-up. Emotion regulation difficulties reported at the baseline were similar to a study by Schmidt Gomez (2024), where emotional dysregulation was the key risk factor that resulted in NSSI. Ecotherapy score reductions were meaningful after eight weeks of therapy, with only a slight rise at follow-up, which did not remove meaningfully the benefit of ecotherapy. Calculations of effect sizes also emphasised the effectiveness of the intervention, as pre- to post-test changes in effect size showed large clinical significance (Cohen d = 0.72), whereas the pre-test to follow-up comparisons indicated moderate-to-large and long-lasting improvement (d = 0.65).

The insignificant change in post-test performance and follow-up performance indicates that the positive results of ecotherapy are not only short-term but also long-term. This observation is similar to previous studies indicating that nature-based interventions may be durable in their psychological effects. According to Corazon et al. (2018), nature-assisted therapy demonstrated the achievement of consistent stress and emotional functioning results in both short and long-term follow-up. Conversely, Rios-Rodriguez et al. (2024) noted that the frequent contact with the natural environments played a critical role in preserving emotional control during the course of time. It is important to note that sustainability of the impacts of this specific population is vital when applying NSSI in a population where self-injury is predominantly of chronic and relapsing type (Weedage et al., 2025). Treatments that improve not just short-term dysregulation, but also long-term resilience are essential in helping decrease the cyclic nature of self-injury and build healthier coping skills.

The statistical results were further elaborated by the qualitative results. Based on the feedback provided by participants, three key themes came out: emotional awareness, stress reduction, and harmless coping. Participants said that they were increasingly conscious of their emotional conditions, and some said that they were now able to name their emotional states, including anger or sadness instead of reacting by injuring themselves. This is congruent with the emotion regulation theory that emphasises the awareness as a precondition of adaptation coping (Trudel-Fitzgerald, et al., 2024). The theme of stress remediation also showed the restorative effects of nature, which is also aligned with Attention Restoration Theory, which assumes that natural environments restore exhausted cognitive and emotional resources (Joye & Dewitte, 2018). Lastly, coping without harm also represented the use of safer substitutes to self-harm, as students spoke of purposeful decisions to find comfort in ecotherapy activities rather than through finding ways to destroy themselves. This body of

evidence leads to the conclusion that ecotherapy is not just a short-term treatment, but it instills abilities and behaviors that are long-lasting and aids in resilience.

These results are in line with Bratman et al. (2019), who have similarly highlighted the significance of natural settings in emotional recovery, although the present study takes that argument a step further to explain its applicability to one of the most at-risk populations. Significantly, ecotherapy offers benefits compared to more traditional psychotherapeutic frameworks like CBT and DBT, which, even though proven to be effective, are not widely used in collectivistic cultures because of stigma, affordability, and the belief that psychotherapy is a very clinical or Westernized solution (Bhatia and Goyal, 2018). On the other hand, ecotherapy is based on the cultural knowledge about nature, spirituality and holistic health, and it helps to make ecotherapy approachable and acceptable among young adults in India.

The results are used to expand existing knowledge in a number of significant ways. Though previous research had proven ecotherapy to be an effective method of reducing depressive, anxiety, and stress symptoms, there was still minimal information regarding the effect of ecotherapy on NSSI populations (Klioumis et al., 2025). This study will provide a much-needed literature gap by applying ecotherapy to a student population with a history of self-injury. Further, it outlines the role of ecotherapy in not only treating general affective well-being but complex emotional dysregulation patterns underlying self-harming behaviors.

The study has considerable clinical and population health implications. First, as an ecotherapy intervention, it is saleable, and low-cost and may be incorporated into college wellness programs or community mental health programs. Since NSSI is a highly prevalent condition in young adults, and specialised mental health services are few, ecotherapy can be implemented as the prophylactic and supportive intervention and lessen the load on already stretched health systems (Flies et al., 2024). Second, the focus on non-stigmatising practices in the intervention helps break those cultural barriers that usually prevent students to seek help. Framing therapy as time spent in nature can invite increased participation in collectivistic environments where disclosing issues of psychological trouble may be discouraged.

However, the results are encouraging; however, they need to be taken with a grain of salt. The small and homogeneous sample of the study participants, which is a group of college students, restricts the generalisability of the research results. These results should be validated and generalised by further larger and more diverse samples in future studies. Furthermore, the benefits were observed six months later, and the positive effects of ecotherapy would be followed over the years, as NSSI is a chronic one (Wang et al., 2025). It would also be helpful to compare ecotherapy with other types of therapeutic modalities, including art therapy or mindfulness-based interventions.

Conclusion

This study provides preliminary mixed-methods evidence that an eight-week ecotherapy programme can reduce self-reported emotional dysregulation among college students with a history of NSSI. The results indicate medium-to-large effect sizes at post-test and sustained improvements at six-month follow-up. Qualitative data support the quantitative results. Participants described increased emotional awareness, immediate stress reduction, and adoption of non-harmful coping strategies. Strengths of the study include the use of a validated emotion-regulation measure (DERS), repeated measurement with follow-up, standardised delivery, and integration of participant narratives.

However, several limitations constrain inference. The reported analysis focuses only on the ecotherapy arm despite randomised assignment. This focus limits comparative conclusions. The modest and homogeneous sample reduces generalisability. The outcomes rely on self-report, and NSSI frequency and objective physiological indices were not reported as primary endpoints. These constraints mean that causal claims about ecotherapy specifically reducing NSSI cannot be confidently made.

For practice, ecotherapy appears promising as an acceptable and low-cost adjunct for college wellbeing programmes. This is particularly relevant in contexts where stigma and resource constraints limit access to conventional therapy. For research, the next step is a sufficiently powered randomised trial that compares ecotherapy to an active clinical comparator. Such a study should pre-specify DERS subscales and behavioral NSSI outcomes, include objective mediators such as attention or interoception, and ensure follow-up of at least 12 months to test durability and mechanisms of effect.

Limitations and Future Studies

The study's small and homogeneous college sample, single-site delivery, and focus on the ecotherapy arm limit generalisability and causal inference. Reliance on self-report using DERS without behavioral NSSI frequency, objective attention or interoception measures, or physiological markers reduces mechanistic certainty. Absence of blinding, lack of active clinical comparators, and short-term follow-up further constrain interpretation.

Future research should use adequately powered randomised trials with active comparators and pre-specified mediator analyses. These analyses should include DERS subscales, interoceptive tasks, attention tests, and biomarkers. Future studies should also report objective NSSI outcomes, ensure fidelity monitoring, and extend follow-up to at least 12 months. Research should recruit diverse samples and include cost-effectiveness and implementation studies to support scalability.

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