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Self-Rated Effectiveness of Ayahuasca and Breathwork on Well-Being, Psychological Resilience, Self-Compassion, and Personality: An Observational Comparison Study

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Abstract: Background: In recent years, there has been a growing interest in the therapeutic potential of classical psychedelics like ayahuasca for mental health improvement. Naturalistic studies at ayahuasca retreats have shown (short-term) improvements in mental well-being but understanding the psychological mechanisms is crucial. We are interested in psychological processes such as resilience, self-compassion, and personality traits. Additionally, it is unclear whether changes are solely due to ayahuasca or influenced by the social setting. To address this, a control group participating in a breathwork session, similar to ayahuasca retreats, was included. Methods: In this observational study, individuals who attended an ayahuasca retreat ($n = 69$) and individuals who participated in a breathwork session ($n = 30$) completed an online survey one week before (baseline) and one, six, and twelve weeks after they entered the retreat/session. The survey included a series of questionnaires, i.e., the World Health Organisation-Five Well-Being Index, 14-item Resilience Scale, Self-Compassion Scale–Short Form, and Big Five Inventory-10. A linear mixed model (LMM) was used to analyze the outcome data. Results: It was shown that well-being, resilience, and self-compassion increased and remained stable over 12 weeks compared to baseline, regardless of group (ayahuasca or breathwork). Older participants generally reported higher resilience and self-compassion. Self-compassion was also higher in the ayahuasca group overall. Neuroticism decreased in both groups, with lower scores in the ayahuasca group. Agreeableness increased over time, also not influenced by group membership, while there were no changes in extraversion, conscientiousness, or openness. Discussion: Both interventions improved well-being, aligning with prior research. Importantly, this study unveils a novel finding: both interventions enhance resilience and self-compassion for up to three months, offering promise for conditions marked by low well-being, resilience, and self-compassion like depression and anxiety-related disorders. While acknowledging its limitations (e.g., self-selected sample, no specific information of the ayahuasca brew or the breathwork technique), it emphasizes the need for controlled studies with control groups, attention to social contexts in research on these interventions, and to assess other variables like depth of altered states of consciousness that might explain improvement in psychological processes and wellbeing.



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1. Introduction

In recent years, there has been increasing scientific interest in the therapeutic potential of classical psychedelics, such as psilocybin and ayahuasca, for improving mental health [1]. Ayahuasca is a psychedelic plant brew from the Amazon region that has been used in shamanic ceremonies by indigenous people for thousands of years as ritual sacraments [2]. The brew is a mix of the bark of *Banisteriopsis caapi*, containing beta-carboline alkaloids that

are monoamine oxidase-A inhibitors (MAO-A), and the leaves of *Psychotria viridis* containing the serotonergic 2A receptor agonist N, N-dimethyltryptamine (DMT). The MAO-A inhibitors inhibit the breakdown of the short-acting DMT, rendering it psychoactive for a couple of hours [3]. This will lead to ayahuasca's typical effects including visual imagery resembling dream-like scenes, heightened thought speed, and emotional reflection [4]. The effects typically begin around half an hour after ingestion, peaking around 1.5 to 2 h post-consumption and gradually diminishing over 4 to 6 h [4].

Research indicates that prevalent incentives for participating in ceremonies involving ayahuasca encompass curiosity, a desire to confront mental health concerns, the search for self-exploration, intrigue with psychedelic medicine, the pursuit of spiritual advancement, and the quest for life's purpose [5,6]. The primary perceived advantages involve heightened self-awareness, profound insights, and the ability to reach inner depths, thereby facilitating personal growth and connection with one's higher self, which in turn offers guidance in life [7]. Findings from controlled lab studies suggest that the administration of psychedelics along with psychological support can help treat severe psychopathologies, such as depression and anxiety disorders [8]. Naturalistic studies conducted on participants who attend an ayahuasca retreat have shown improvement in general mental health that persisted for one month, but not one year [9,10].

It is important to clarify the psychological mechanisms of action of this promising therapeutic intervention to understand the range of its applications. One of the essential psychological processes to target in mental health conditions, like depression, is psychological resilience. This concept refers to the ability to recover or overcome stressful life events and return to daily living activities [11]. Resilience is recognized as a key component of well-being; it embodies a multifaceted, ever-changing ability shaped by ongoing interactions between internal and external resources over a person's lifetime [11,12]. Of note, studies have shown an association between resilience and personality, e.g., resilience positively correlated with extraversion, openness, agreeableness, and conscientiousness, but negatively with neuroticism [13]. Next to personality, self-compassion, a constructive approach to addressing personal flaws or life challenges, characterized by internal compassion and the ability to embrace one's suffering with warmth and care, has been positively linked with resilience and well-being [14–16].

While there is a relative dearth of studies investigating the effects of ayahuasca on measures of resilience and self-compassion [17], naturalistic studies have demonstrated changes in personality after attending an ayahuasca retreat (e.g., [18,19]). Neuroticism was observed to decline substantially between pre-retreat measurement and the week following the ayahuasca ceremony [18,19], and remain substantially below pre-retreat scores three months following the ceremony [19]. Another study assessing at baseline and one-month follow-up showed significant increases in extraversion, agreeableness, and openness, and a decrease in neuroticism after the ayahuasca retreat [10].

While these abovementioned findings on ayahuasca, well-being, and personality are in general positive, they do not reveal whether these are due to 'ayahuasca' or the social setting in which the brew is consumed. Previously it was shown that next to the direct (biological) effects of ayahuasca on psychological processes, the (social) setting also contributes to the observed (persisting) effects [20]. To understand the contribution of such a social setting, we chose to include a control group consisting of participants in a meditation-based mindfulness-training program called 'breathwork'. Breathwork is an altered state of consciousness-induction technique; a session takes place in a group setting, similar to an ayahuasca retreat, and is guided by a facilitator and (live) music [21].

The present study, therefore, was aimed to test whether attending an ayahuasca retreat or a breathwork session enhances well-being and resilience over time, and secondarily whether changes from baseline are observed in self-compassion and personality after having attended an ayahuasca retreat or a breathwork session and whether these changes over time are different for the ayahuasca retreat compared to the breathwork session. We assessed these psychological characteristics in individuals before they participated in an

ayahuasca ceremony or a breathwork session, and at one, six, and twelve weeks after the ceremony or session. Based on the available research, we hypothesized that well-being and personality would have been changed one week after having attended an ayahuasca retreat, compared to baseline. More specifically, we expected that well-being would increase after the ceremony compared to baseline. Regarding personality, we expected that neuroticism would decrease, and extraversion, agreeableness, and openness would increase, after the ceremony compared to baseline. We did not formulate particular expectations regarding potential alterations in resilience or self-compassion, or any changes in the breathwork group, nor did we anticipate whether these changes, if any, would revert to baseline after a certain number of weeks.

2. Materials and Methods

2.1. Participants

Participants were attendees of ayahuasca and breathwork ceremonies at five different locations in the Netherlands. After registering for an ayahuasca or breathwork ceremony at an ayahuasca or breathwork center, all the attendees were approached by the center to ask them if they wanted to voluntarily participate in this study. To be eligible for study participation, respondents had to be 18 years or older and familiar with English as it was the language of the study materials. While the breathwork centers did not apply any exclusion criteria, the ayahuasca centers employed two exclusion criteria, i.e., pregnancy and use of blood pressure medication and/or antidepressants. Each study participant gave informed consent before the onset of the study.

2.2. Design and Procedure

In this longitudinal observational study, we followed individuals who participated in a single ayahuasca ceremony and individuals who participated in a single breathwork session over time. Both groups completed several online questionnaires 1 week before they attended the session (baseline, T0) and at 1-, 6-, and 12-week follow-ups (respectively, T1, T6, T12). The study protocol was approved by the Ethics Review Committee of Psychology and Neuroscience of Maastricht University (ERCPN198_10_09_2018 and ERCPN210_02_07_2019). Qualtrics was used as the platform to create the online survey. Data were collected via online questionnaires completed between August 2019 and December 2021.

2.3. Setting

Ayahuasca Setting

At the ayahuasca centers, mattresses were positioned on the floor in a circle. Sacred herbs, like sage, or a sacred wood, like palo santo, were burned to clean the environment energetically and to calm the mind in preparation for the ceremony. There was a shamanic altar in the middle of the circle, with statues of several animals, candles, crystals, and flowers. At one side of the circle, two facilitators were sitting to keep an eye on the attendees and help when needed. For example, when someone was overwhelmed with emotions, and it could interfere with the process of the other attendees, the person was comforted or temporally isolated from the group by the facilitators. The lights were switched off, and several candles were burning. The ceremony started with the attendees formulating their intentions for their journey before the group, and it ended with sharing their experiences. Shamanic music, called Icaros, was played, mainly through a digital device, and several ceremonies included live music. Some ceremonies took place during the middle of the day, and some during the evening with an overnight stay (during the weekend) or without a stay. After the ceremony, a light vegetarian meal was served, including, for example, a fruit salad and soup. Before the ceremony, all attendants were advised to stick to a strict diet and sexual abstinence for about a week to physically and mentally prepare for the ceremony. During the ceremony, all attendees were lying down on their mattresses and focused on

their spiritual healing journey. During the ceremony, there were two rounds of ayahuasca intake; every round had a duration of 2.5–3 h. The group consisted of five to nine people.

2.4. Breathwork Setting

Breathwork was conducted similarly to the ayahuasca ceremony in a safe and intimate setting. The environment was energetically cleaned with sacred herbs, like sage, or a sacred wood, like palo santo. There was a social group activity guided by a facilitator and (live) music. The setting included yoga mats, meditation cushions, or chairs set up in a circle, with a similar altar as at the ayahuasca ceremony. The breathwork ceremonies were held in the daytime and lasted for two to three hours. At the ceremony, the facilitator made music on shamanic instruments, like a drum, and sometimes sang along with it. The attendees could sit, lay down, or stand during the ceremony, depending on their desires. The breathing technique was explained before the ceremony began. The breathwork ceremony started with the attendees expressing their intention for their journey in the group and ended with sharing their experiences. The groups consisted of five to nine people.

3. Questionnaires

We used the short versions of all questionnaires to reduce the participant burden and facilitate response rates.

3.1. Demographic Information

Demographic data were collected from each participant, including age, gender, continent of origin, daily occupation, and the highest level of education. Participants indicated their daily occupation by choosing one from the following six pre-set response options: learning/studying, physical work, computer/office work, working with people, traveling, and creative work. Information on the level of education was obtained using a question with three response options: primary (e.g., elementary school), secondary (e.g., high school, academies, gymnasium), and tertiary education (e.g., university, trade school, college). Participants were also asked whether they had experience with the use of psychedelics.

3.2. Motivation to Attend the Ayahuasca Ceremony or Breathwork Session

Participants were asked to choose one or more of the three motivations to describe why they were attending the ayahuasca ceremony or breathwork session. Options were ‘To understand myself’, ‘To resolve problems’, and ‘Out of curiosity’. When none of those options matched their motivation, they could choose ‘Other’ and specify their motivation (Table S1).

3.3. World Health Organisation-Five Well-Being Index

The World Health Organisation-Five Well-Being Index assesses the current level of well-being within the time frame of the previous two weeks [22]. Participants were asked to evaluate five statements using a 6-point Likert scale, ranging from 0 (at no time) to 5 (all of the time). The sum of all scores, the total well-being index, was used as the dependent variable. The total raw score, ranging from 0 to 25, was multiplied by 4 to obtain a percentage score from 0 (the worst imaginable well-being) to 100 (the best imaginable well-being) [22].

3.4. The 14-Item Resilience Scale

The 14-item Resilience Scale (RS) consists of 14 seven-point Likert scale items, with answer options ranging from 1 (strongly disagree) to 7 (strongly agree) [23]. The total score is obtained by summing all the items and this score ranges from 14 to 98. This total score was used as the dependent variable quantifying the resilience of the participants in the current study. Scores between 14 and 56 indicate a very low degree of resilience, 57–64 indicates a low degree of resilience, 65–73 indicates a moderately low degree of resilience,

74–81 indicates a moderate degree of resilience, 82–90 indicates a high degree of resilience, and 91–98 indicates a very high degree of resilience [23].

3.5. Self-Compassion Scale—Short Form

The Short Form of the Self-Compassion Scale (SCS) includes 12 five-point Likert scale items with answer options ranging from 1 (almost never) to 5 (almost always) and assesses the level of self-compassion [24]. To compute the total self-compassion score, the items were summed and the mean was calculated. This mean ranges from 1 to 5. There are no clinical norms or scores that indicate that an individual is high or low in self-compassion. As an ad hoc rubric, however, scores in the range 1.0–2.49 can be considered to be low, 2.5–3.5 to be moderate, and 3.51–5.0 to be high [24]. The scores of the six subscales are generally not reported as they are unreliable in the SCS short form, as they only include two items each.

Two subscales ‘Self-disparagement’ and ‘Self-care’, each including six items, can be derived by summing certain items [25]. Self-disparagement indicates how the client views themselves concerning impatience, disapproval, and judgment toward oneself. A higher score indicates more self-disparagement and self-criticism. Self-care indicates compassion and how the client views themselves concerning tenderness, patience, and empathy. A higher score indicates more self-care and self-compassion.

3.6. Big Five Inventory-10

The Big Five Inventory (BFI-10) is composed of 10 five-point Likert scale items, ranging from 1 (strongly disagree) to 5 (strongly agree). The BFI-10 measures five basic distinct personality traits, i.e., extraversion, agreeableness, conscientiousness, neuroticism, and openness. The answers to the two items are averaged for each dimension. For this purpose, the negatively polarized item was first recoded, after which the mean value of the recoded and the non-recoded item was formed per dimension. The value range of the five dimensions is then between 1 and 5 [26,27].

4. Statistical Analysis

Demographic data at T0 were analyzed with t-tests (age) and chi-squared tests (sex, diagnosed mental illnesses, highest level of education, occupation type, and medication use) to test for differences in these variables between groups. Questionnaire data were analyzed with a linear mixed model (LMM) analysis including time (four levels: T0, T1, T6, T12) as a within-subjects factor and group (two levels: ayahuasca, breathwork) as a between-subjects factor. Age was recoded into three categories (18–35, 36–45, >46 years), and centered at a mean of 40; it was included as a covariate because this differed significantly between the two groups at baseline. Time, group, time by group, age, age by time, age by group, and age by time by group were included in the fixed part of the LMM. If age, and the interactions with age, had no significant effect on the dependent variable, it was dropped to simplify the model. Inspection of the covariance matrix suggested that a compound symmetry covariance structure was adequate for the LMM. Preliminary analyses further showed that including a random slope or quadratic trends were not necessary and could be dropped from the model. For main and interaction effects, partial eta squared (η_p^2) was provided, and for pairwise comparisons, the 95% confidence intervals (CI) were used to offer a more comprehensive understanding of the effect size and the precision of estimated parameters. Partial eta squared is based on Cohen’s f, which defines small, medium, and large as 0.10, 0.25, and 0.0, respectively, which correspond to η_p^2 of 0.01, 0.06, and 0.14 [28].

The Statistical Package for the Social Sciences (SPSS, v. 27.0) was used to analyze the data, adopting a *p*-value of 0.05 (two-tailed) as the level of significance.

5. Results

Table S2 shows in detail the number of respondents that completed the separate questionnaires; it is therefore also a reflection of the missing data.

5.1. Participants

A total of 127 volunteers signed up to express their willingness to participate in this study. Two participants could not read English and were not enrolled in the study. The remaining participants were classified according to whether they attended the ayahuasca session ($n = 87$) or the breathwork session ($n = 38$). The process of participant selection and the reasons for dropout over the 12-week follow-up are illustrated in Figure 1.

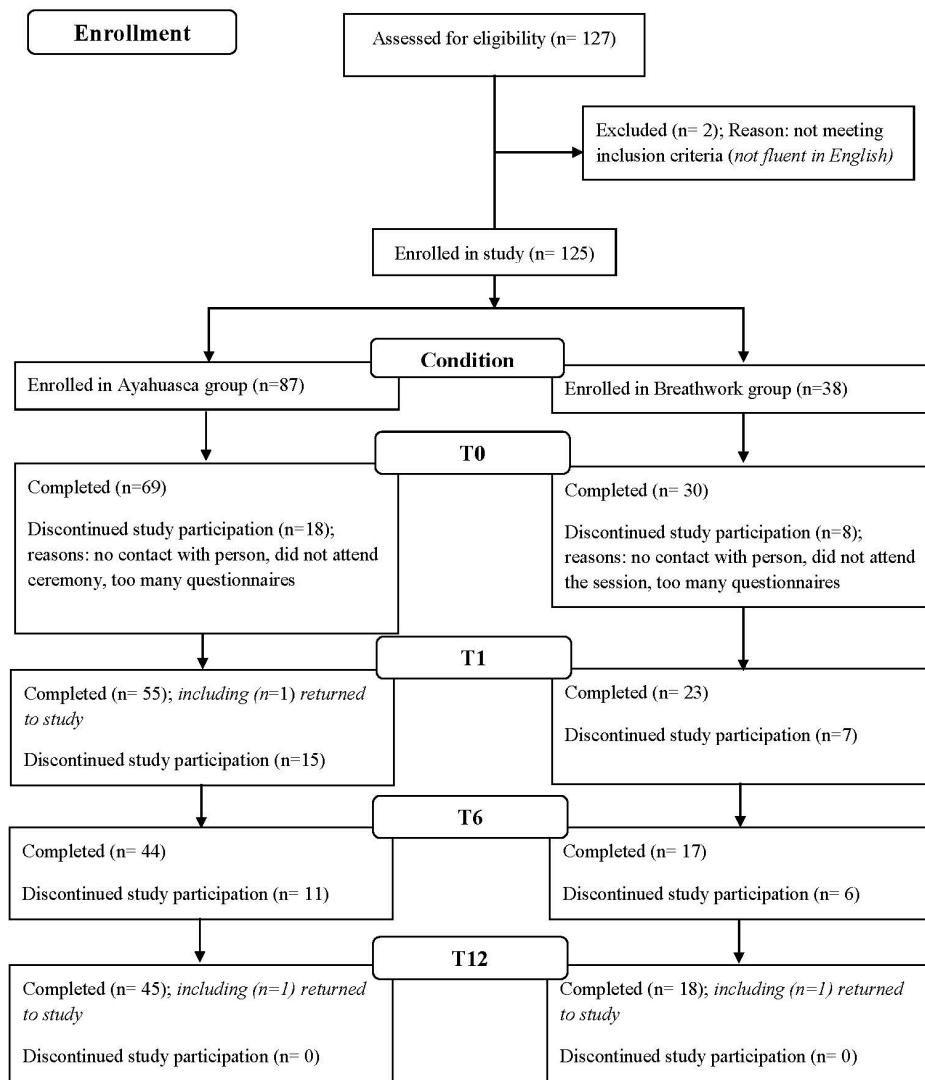


Figure 1. Flowchart depicting participants' enrollment and dropout; T0 = Baseline, T0 = 1 week, T6 = 6 weeks, and T12 = 12 weeks after the ayahuasca retreat or the breathwork session.

5.2. Demographic Data

The average age of participants in the Ayahuasca group was 37.3 years ($SD = 9.2$) and that in the Breathwork group was 45.9 ($SD = 12.8$). Independent-sample t-tests showed that groups differed significantly in age ($t(95) = -3.745; p < 0.001$) at T0, with the Breathwork group being 8.6 years older on average compared to the Ayahuasca group. As described earlier, we took into account this pre-existing group difference by including age as a covariate in the LMM.

Other demographic variables including sex ($\chi^2(2, n = 98) = 3.543; p = 0.172$), reported history of a diagnosed mental illness ($\chi^2(1, n = 98) = 3.357; p = 0.067$), highest education level ($\chi^2(6, n = 98) = 6.682; p = 0.351$), occupation type ($\chi^2(5, n = 98) = 6.512; p = 0.260$), and medication use ($\chi^2(1, n = 98) = 0.735; p = 0.391$) did not show statistically significant differences between groups at baseline in a chi-squared test. The majority in both groups

was female and had a tertiary education level. Most of the people in the ayahuasca group worked with people, while most people in the breathwork group performed computer or office work (Table 1). Forty-three of the participants (62%) in the ayahuasca group had previous experience with ayahuasca ($n = 7$) or other psychedelics; twelve (40%) of the participants in the breathwork group had previous experience with ayahuasca ($n = 5$) or other psychedelics. Six and four individuals from the ayahuasca and breathwork groups, respectively, who stated they had used psychedelics, did not give information about the exact substance.

Table 1. Demographic data and personal history of mental illness of the ayahuasca and breathwork group at T0 based on the maximum number of participants who completed one of the scales; see Table S2 to see the participant numbers per scale and assessment moment.

	Ayahuasca Group	Breathwork Group
<i>n</i>	69	30
Mean age (SD)	37.2 (9.2)	45.9 (12.8)
Age range	22–61	27–72
Gender (<i>n</i> (%))		
Male	28 (40.6)	7 (23.3)
Female	40 (58.0)	23 (76.7)
Other	1 (1.4)	0 (0.0)
Level of education (<i>n</i> (%))		
Primary	1 (1.4)	0 (0.0)
Secondary	6 (8.7)	5 (16.7)
Tertiary	62 (89.8)	25 (83.3)
Daily occupation (<i>n</i> (%))		
Learning/studying	4 (5.8)	3 (10.0)
Physical work	4 (5.8)	1 (3.3)
Computer/office work	19 (27.5)	13 (43.3)
Working with people	36 (52.2)	9 (30.0)
Travelling	1 (1.4)	0 (0.0)
Creative work	5 (7.2)	4 (13.3)
Diagnosed with mental illness (<i>n</i> (%))		
Yes	15 (22.1)	12 (40.0)
No	54 (78.3)	18 (60.0)

5.3. Motivation to Attend the Ayahuasca Ceremony or Breathwork Session

The most frequently chosen motivation in the ayahuasca group was ‘To understand myself’ ($n = 50$; 72%), followed by ‘To resolve problems’ ($n = 26$, 37%), ‘Out of curiosity’ ($n = 25$, 36%), and ‘Other’ ($n = 17$, 24%). For the breathwork group, the most frequently chosen motivation was ‘To resolve problems’ ($n = 15$, 50%), followed by ‘Other’ ($n = 12$, 40%), ‘To understand myself’ ($n = 10$, 33%), and ‘Out of curiosity’ ($n = 9$, 30%). The ‘Other’ motivations are depicted in Table S1.

5.4. World Health Organisation-Five Well-Being Index

The age covariate had no significant effect and was therefore dropped from the model, making it more parsimonious. The linear mixed model analysis produced a significant main effect of time on the well-being score, ($F(3, 201.33) = 8.14, p < 0.001, \eta_p^2 = 0.11$). Bonferroni-corrected pairwise comparisons showed that follow-up ratings of well-being scores differed significantly from the baseline rating, with the former (=follow-up) being higher at all time points compared to the baseline time point ($\Delta T1-T0 = 9.79, p < 0.001$, 95% CI [3.4,16.2]; $\Delta T6-T0 = 9.98, p = 0.001$, 95% CI [3.0,17.0]; $\Delta T12-T0 = 9.87, p = 0.002$, 95% CI [2.8,16.9]) (Figure 2, Panel A). The follow-up time points did not differ statistically significantly from each other. The analysis did not reveal a statistically significant main

effect of group ($F(1, 93.74) = 1.45, p = 0.231, \eta_p^2 = 0.01$) or time by group interaction effect ($F(3, 201.33) = 0.77, p = 0.511, \eta_p^2 = 0.01$).

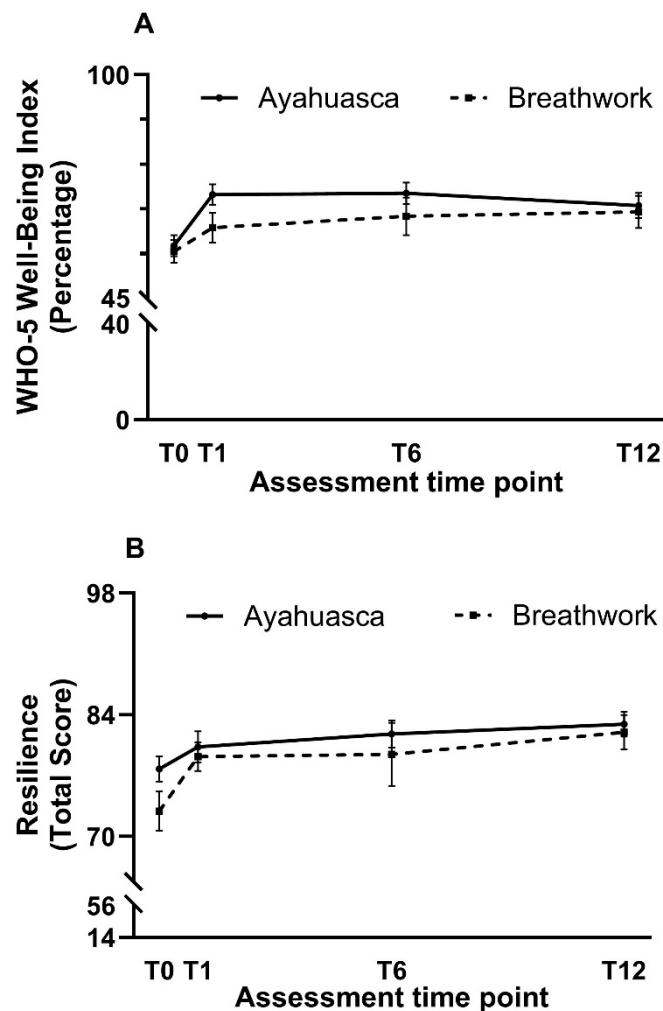


Figure 2. Mean (SE) of the WHO-5 Well-Being Index (A), and the resilience total score (B); T0 = Baseline, and T0 = 1 week, T6 = 6 weeks, and T12 = 12 weeks after the ayahuasca retreat or the breathwork session.

5.5. The 14-Item Resilience Scale

The LMM analysis showed a significant main effect of time, $F(3, 193.55) = 9.95, p < 0.001, \eta_p^2 = 0.13$. Bonferroni-corrected pairwise comparisons showed that resilience scores at follow-up time points were significantly higher compared to baseline ($\Delta T1-T0 = 5.01, p = 0.002, 95\% \text{ CI } [1.36, 8.66]$; $\Delta T6-T0 = 5.27, p = 0.003, 95\% \text{ CI } [1.30, 9.24]$; $\Delta T12-T0 = 7.66, p < 0.001, 95\% \text{ CI } [3.69, 11.62]$) (see Figure 2, Panel B). The follow-up time points did not differ statistically significantly from each other. The analysis did not reveal a statistically significant main effect of group ($F(1, 94.25) = 2.87, p = 0.093, \eta_p^2 = 0.03$) or time by group interaction effect ($F(3, 193.55) = 1.92, p = 0.128, \eta_p^2 = 0.03$). Finally, the effect of age included as a covariate in the LMM was found to be significant ($F(1, 95.58) = 8.26, p = 0.005, \eta_p^2 = 0.08$). The latter result indicates that the resilience scores, irrespective of time and group membership, were higher in older participants than in younger participants.

5.6. Self-Compassion Scale–Short Form

5.6.1. Total Score

LMM analysis revealed a significant main effect of time on the self-compassion scores ($F(3, 192.20) = 20.31, p < 0.001, \eta_p^2 = 0.24$). Bonferroni-corrected pairwise comparisons showed that the follow-up self-compassion scores were significantly higher com-

pared to baseline ($\Delta T1-T0 = 3.15, p < 0.001, 95\% \text{ CI } [1.35, 4.95]$; $\Delta T6-T0 = 4.63, p < 0.001, 95\% \text{ CI } [2.64, 6.62]$; $\Delta T12-T0 = 5.05, p < 0.001, 95\% \text{ CI } [3.10, 6.99]$) (see Figure 3, Panel A). The follow-up time points did not differ statistically significantly from each other. The analysis also revealed a main effect of group ($F(1, 94.68) = 6.93, p = 0.010, \eta_p^2 = 0.07$), meaning that irrespective of time, the ayahuasca group had higher self-compassion scores compared to the breathwork group (mean difference: 0.29, $p = 0.010, 95\% \text{ CI } [0.07, 0.50]$). No interaction effect between time and group was found ($F(3, 192.20) = 0.14, p = 0.937, \eta_p^2 < 0.01$). Finally, the effect of age included as a covariate in the model was significant ($F(1, 95.99) = 20.44, p < 0.001, \eta_p^2 = 0.17$), reflecting that the older participants displayed overall higher self-compassion scores than the younger participants.

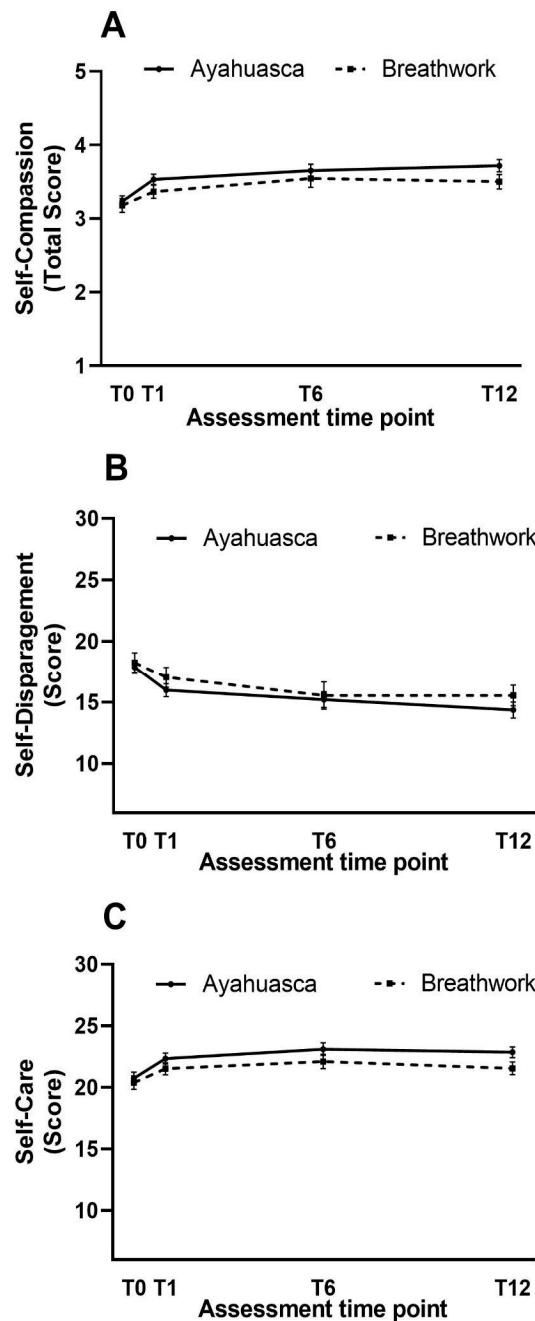


Figure 3. Mean (SE) of the self-compassion total score (A), and the two subscales, self-disparagement (B) and self-care (C); T0 = Baseline, and T0 = 1 week, T6 = 6 weeks, and T12 = 12 weeks after the ayahuasca retreat or the breathwork session.

5.6.2. Self-Disparagement

LMM analysis revealed a significant main effect of time on the self-disparagement subscale scores of the SCS-SF ($F(3, 200.08) = 14.94, p < 0.001, \eta_p^2 = 0.18$). Bonferroni-corrected pairwise comparisons showed that the baseline self-disparagement scores were significantly higher compared to all remaining time points ($\Delta T0-T1 = 1.71, p = 0.002, 95\% \text{ CI } [0.47, 2.95]$; $\Delta T0-T6 = 2.44, p < 0.001, 95\% \text{ CI } [1.08, 3.81]$; $\Delta T0-T12 = 3.16, p < 0.001, 95\% \text{ CI } [1.82, 4.50]$) (see Figure 3, Panel B). Further, the one-week time point differed significantly from the twelve-week time point ($\Delta T1-T12 = 1.45, p = 0.032, 95\% \text{ CI } [0.08, 2.82]$), but not the six-week time point ($\Delta T1-T6 = 0.73, p = 0.985, 95\% \text{ CI } [-0.67, 2.13]$). The six- and twelve-week time points did not differ significantly from each other ($\Delta T6-T12 = 0.72, p > 0.999, 95\% \text{ CI } [-0.73, 2.16]$). The analysis also revealed a main effect of Group ($F(1, 97.94) = 6.55, p = 0.012, \eta_p^2 = 0.06$). Bonferroni-corrected pairwise comparisons indicating that, irrespective of time, the ayahuasca group had lower self-disparagement scores compared to the breath-work group (mean difference: $-2.08, p = 0.012, 95\% \text{ CI } [-3.72, -0.47]$). No interaction effect between time and group was found ($F(3, 200.08) = 0.08, p = 0.970, \eta_p^2 < 0.01$). Finally, the effect of age included as a covariate in the model was significant ($F(1, 99.63) = 22.21, p < 0.001, \eta_p^2 = 0.18$), reflecting that the older participants displayed overall lower self-disparagement scores than the younger participants.

5.6.3. Self-Care

LMM analysis revealed a significant main effect of time on the self-care subscale scores of the SCS-SF ($F(3, 195.85) = 13.28, p < 0.001, \eta_p^2 = 0.17$). Bonferroni-corrected pairwise comparisons showed that the baseline self-care scores were significantly lower compared to all remaining time points ($\Delta T0-T1 = -1.43, p < 0.001, 95\% \text{ CI } [-2.36, -0.49]$; $\Delta T0-T6 = -2.18, p < 0.001, 95\% \text{ CI } [-3.22, -1.14]$; $\Delta T0-T12 = -1.86, p < 0.001, 95\% \text{ CI } [-2.88, -0.85]$) (see Figure 3, Panel C). The remaining time points did not differ significantly from each other. The analysis did not reveal a main effect of group ($F(1, 87.98) = 3.43, p = 0.067, \eta_p^2 = 0.04$). No interaction effect between time and group was found ($F(3, 185.85) = 0.15, p = 0.927, \eta_p^2 < 0.01$). Finally, the effect of age included as a covariate in the model was significant ($F(1, 89.00) = 8.25, p = 0.005, \eta_p^2 = 0.08$), reflecting that the older participants displayed overall higher self-care scores than the younger participants.

5.7. Big Five Inventory-10

The five dimensions' scores are represented in Figure 4.

5.7.1. Extraversion

The age covariate had no significant effect and was therefore dropped from the model. The LMM analysis did not show a main effect of time ($F(3, 192.00) = 1.33, p = 0.266, \eta_p^2 = 0.02$), group ($F(1, 95.57) = 0.002, p = 0.969, \eta_p^2 < 0.001$), or interaction between time and group ($F(3, 192.00) = 0.69, p = 0.559, \eta_p^2 = 0.01$) on the BFI-10 extraversion scores (Figure 4, Panel A).

5.7.2. Agreeableness

LMM analysis showed a main effect of time ($F(3, 188.24) = 4.18, p = 0.007, \eta_p^2 = 0.06$). Bonferroni-corrected pairwise comparisons showed that the follow-up agreeableness scores (T6 and T12) were significantly higher compared to baseline scores ($\Delta T6-T0 = 0.35, p = 0.011, 95\% \text{ CI } [0.05, 0.65]$; $\Delta T12-T0 = 0.11, p = 0.048, 95\% \text{ CI } [0.002, 0.63]$) (see Figure 4, Panel B). There was no statistically significant difference between T1 and baseline. The follow-up time points did not differ statistically significantly from each other. Further, there was no effect of group ($F(1, 88.31) = 2.79, p = 0.098, \eta_p^2 = 0.03$), or interaction between time and group ($F(3, 188.24) = 0.30, p = 0.827, \eta_p^2 < 0.01$). Age did have a main effect on agreeableness scores ($F(1, 193.37) = 0.35, p = 0.789, \eta_p^2 < 0.01$), with older participants generally having higher agreeableness scores.

5.7.3. Conscientiousness

The age covariate had no significant effect and was therefore dropped from the model. The LMM analysis did not show a main effect of time ($F(3, 194.94) = 0.73, p = 0.535, \eta_p^2 = 0.01$), group ($F(1, 95.07) = 0.50, p = 0.483, \eta_p^2 < 0.01$), or interaction between time and group ($F(3, 194.94) = 0.26, p = 0.856, \eta_p^2 < 0.01$) on the BFI-10 conscientiousness scores (Figure 4, Panel C).

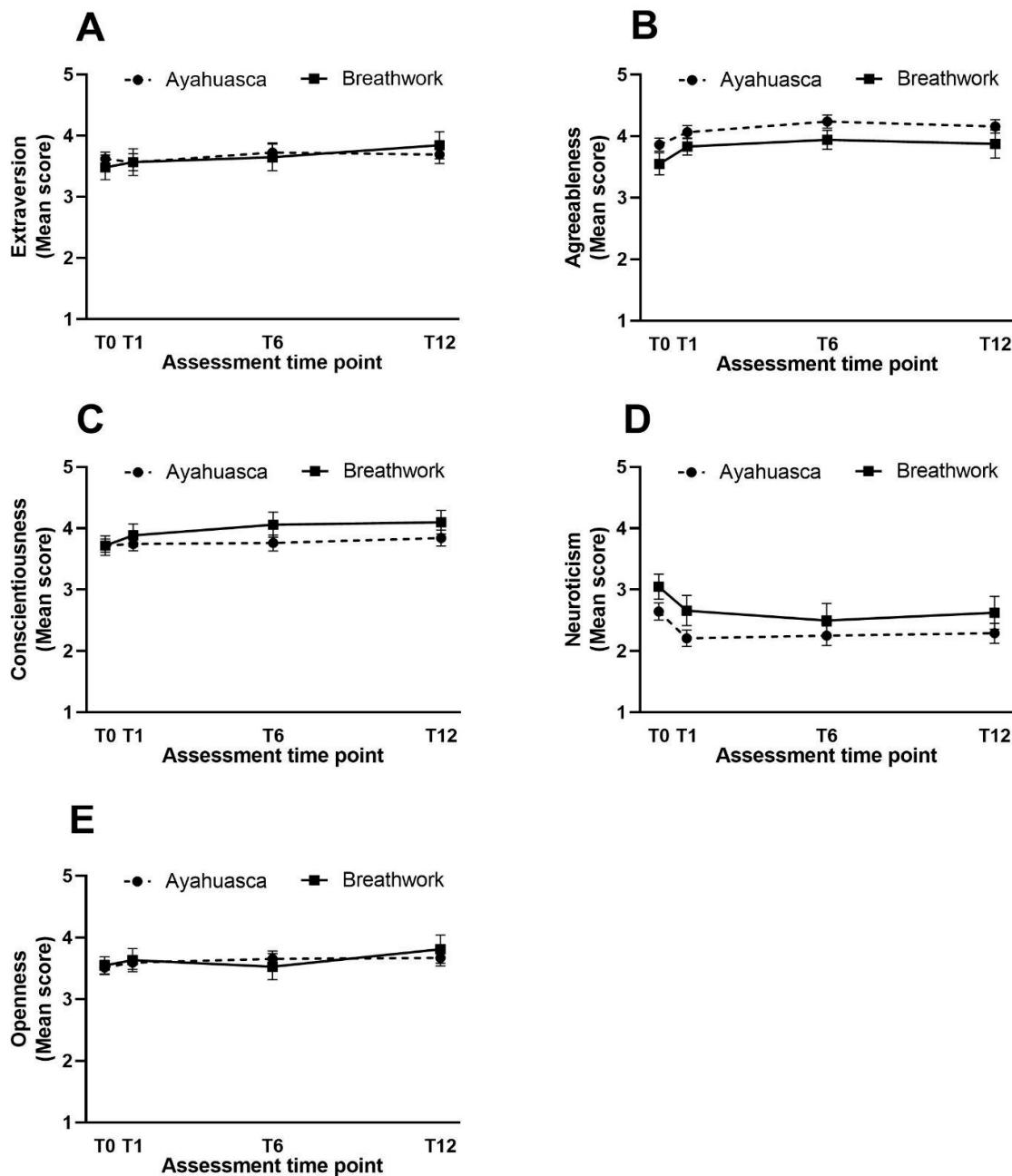


Figure 4. The five subscales of the BFI-10 scale: (A) extraversion, (B) agreeableness, (C) conscientiousness, (D) neuroticism, and (E) openness in the ayahuasca and breathwork groups; T0 = Baseline, and T0 = 1 week, T6 = 6 weeks, and T12 = 12 weeks after the ayahuasca retreat or the breathwork session.

5.7.4. Neuroticism

LMM analysis showed a main effect of time ($F(3, 187.84) = 6.12, p < 0.001, \eta_p^2 = 0.09$). Bonferroni-corrected pairwise comparisons showed that the follow-up neuroticism scores were significantly lower compared to baseline ($\Delta T1-T0 = -0.38, p = 0.006, 95\% \text{ CI } [-0.68, -0.08]$);

$\Delta T6-T0 = -0.43, p = 0.005, 95\% \text{ CI } [-0.76, -0.10]$; $\Delta T12-T0 = -0.42, p = 0.006, 95\% \text{ CI } [-0.76, -0.09]$) (Figure 4, Panel D). The follow-up time points did not differ statistically significantly from each other. Further, a main effect of group was found ($F(1, 91.53) = 5.23, p = 0.025, \eta_p^2 = 0.05$), with neuroticism scores for the ayahuasca group being significantly lower overall compared to those of the breathwork group (mean difference: $-0.52, p = 0.024, 95\% \text{ CI } [-0.98, -0.07]$). No interaction between time and group ($F(3, 187.84) = 0.66, p = 0.581, \eta_p^2 = 0.01$) was found. Age did have a main effect on the BFI-10 neuroticism scores ($F(1, 92.38) = 9.48, p = 0.003, \eta_p^2 = 0.09$), showing that older participants had overall lower neuroticism scores compared to younger participants.

5.7.5. Openness

The age covariate had no significant effect and was therefore dropped from the model. LMM analysis did not show a main effect of time ($F(3, 202.09) = 1.29, p = 0.278, \eta_p^2 = 0.02$), group ($F(1, 99.20) = 0.000, p = 0.998, \eta_p^2 = \text{not determined}$), or interaction between time and group ($F(3, 202.09) = 0.57, p = 0.637, \eta_p^2 < 0.01$) on the BFI-10 openness scores (Figure 4, Panel E).

6. Discussion

The present study aimed to evaluate the effect of attending an ayahuasca retreat on measures of well-being, resilience, self-compassion, and personality, over time and compared to a group that attended a breathwork session. It was hypothesized that well-being would increase after attending an ayahuasca ceremony compared to baseline and that neuroticism would decrease, whereas other personality traits (extraversion, agreeableness, and openness) were expected to increase. There were no specific hypotheses about the other measures, or the control group (breathwork). We showed that well-being, resilience, and self-compassion increased from baseline to the follow-up measurements. The increase remained stable over 12 weeks and was independent of group (ayahuasca, breathwork). Of note, older people rated their resilience and self-compassion higher overall than younger people. Self-compassion was also higher overall in the ayahuasca group, independent of the time at which it was assessed. So, as hypothesized, well-being indeed increased in the ayahuasca group, but a similar increase was visible in the breathwork group. Regarding personality, it was demonstrated that in line with expectations, neuroticism decreased; however, this change was visible in both groups. People in the ayahuasca group scored lower on neuroticism on average than the people in the breathwork group. Also in line with expectations, agreeableness increased over time but was independent of group membership. Of note, older people scored lower on neuroticism and higher on agreeableness than younger people. There were no changes in extraversion, conscientiousness, and openness.

Both groups had a baseline well-being rating of approximately 56–57, which is albeit slightly higher by a couple of points when compared to data from a large global sample collected during the same period [29]. This baseline score surpasses 50, a cutoff indicative of low mood [30]. The ayahuasca group experienced an average well-being increase of 18.9%; the breathwork group saw a 13.8% increase; both changes align with the threshold for a clinically relevant change, as defined by Topp et al. (2015), set at 10% [22]. This increase in self-reported well-being is in line with other studies assessing the (sub-)acute and longer-lasting effects of ayahuasca consumption (e.g., [18,31]) and breathwork [32,33], although with slightly different measures asking about well-being in a larger context (e.g., ‘satisfaction with life’).

Regarding resilience, at baseline, these ratings in the ayahuasca group fell into the category of ‘moderate resilience’ according to Wagnild’s classification (2016), while the breathwork group was categorized as having ‘low resilience’ [23]. Following the ‘interventions’, both groups experienced improvements, with the ayahuasca group increasing by an average of 5% and the breathwork group by 10%, resulting in a classification of ‘moderate-to-high’ resilience for both groups. While there have been suggestions in prior research that breathwork could enhance resilience [34], and ayahuasca users have reported

improved coping strategies in dealing with illness [35], this study represents, to the best of our knowledge, the first objective evidence that both interventions enhance resilience, and these effects persist for at least three months.

The self-compassion ratings showed a pattern of effects similar to those of well-being and resilience, i.e., being increased after the interventions. Previously, it was shown that levels of non-judgment, which might be related to self-compassion, were improved after breathwork [33]. Following Raes' (2011) criteria, both groups could be categorized as having a 'moderate' level of resilience at the outset [24]. However, this level elevated to 'high' for the ayahuasca group, persisting for up to three months after the ceremony. Similarly, the breathwork group also achieved a 'high' level of resilience, which was observed 1.5 months after the session. Domínguez-Clavé et al. (2021) demonstrated, using the same scale as in the present study (although a 26-item version), that self-compassion increased by 8.6% from baseline to the day after the ayahuasca ceremony, which compares to our 9.2% increase over the same period [36]. Of note, the self-compassion ratings in our ayahuasca group were in general higher compared to those in the breathwork group. Additional analyses of the self-compassion subscales demonstrated that this difference was due to lower levels of self-disparagement in the ayahuasca group, compared with the breathwork group; there was no difference between groups in levels of self-care, the second self-compassion subscale.

Regarding personality it was shown that two of the five dimensions changed in both groups in a positive sense, with agreeableness increasing and neuroticism decreasing. For ayahuasca, it has been previously shown that personality traits can change after the 'experience' (e.g., [18,19]). While our findings align with these studies, it is important to note that our results are limited to alterations in two personality dimensions. Other studies have reported changes in additional personality scales, such as extraversion, openness, and conscientiousness, lasting from one month [10] to three months after the ayahuasca experience [19]. In contrast, one study only observed a decrease in neuroticism one week after the ayahuasca ceremony compared to baseline [18]. These variations in findings suggest that the extent and duration of personality trait changes following an ayahuasca ceremony may be influenced by various factors, including the individual's mindset and the environment in which the experience occurs. Regarding breathwork and its impact on personality, there is currently no existing research that directly compares to our data. The closest related research examined changes in temperament and character traits (specifically self-directedness, cooperativeness, and self-transcendence) one week and one month after a breathwork session [37]. This study indicates that a breathwork session can indeed lead to lasting effects on personality traits.

While not the primary focus of this study, it became evident that older individuals exhibited higher levels of resilience, self-compassion, and the personality trait agreeableness when compared to their younger counterparts. Conversely, neuroticism and self-disparagement were found to be lower in older individuals. In the context of self-compassion and self-disparagement, it has been proposed that individuals may tend to become more self-compassionate later in life (aged 65+) as they progress through Erik Erikson's eighth and final stage of psychosocial development, which entails self-acceptance [15]. Furthermore, personality traits can undergo changes with age, as seen in our sample where neuroticism decreased and agreeableness increased [38]. Concerning resilience and age, previous research indicates that resilience does not necessarily decline with age. Instead, it suggests that older adults may exhibit greater emotional resilience, marked by enhanced emotion regulation skills, while younger individuals may benefit from stronger social support, which is also considered an element of resilience [39]. We did not examine variations in resilience types because we employed a measurement scale distinct from that used by Gooding et al. (2012) [39]. However, these data illustrate that resilience, depending on the specific type being measured, can be more prominent in older age, as our study demonstrated.

Like every study, the current one has its limitations. Firstly, it was a naturalistic study, which means that participants were not randomly assigned to specific conditions;

instead, they self-selected. However, an examination of the demographic data indicates that the samples in both groups were generally comparable, even including 22.1–40.0% of individuals with a mental diagnosis. According to the Institute of Health Metrics and Evaluation, in 2019, approximately 12.5% of the global population had been diagnosed with some form of mental disorder. This suggests that our groups had a slightly higher representation of individuals with a mental diagnosis compared to the global population. We view this diversity in mental health as a strength of this study when contrasted with clinical trials that often involve either neurotypical participants or those with specific mental conditions. The higher percentage of individuals with mental diagnoses in our sample may be related to the motivation for participating in an ayahuasca ceremony or breathwork session; 37% of participants cited their primary motivation as ‘resolving problems’. However, it is worth noting that well-being ratings in our study fell within the same range as population-based norm values collected during the same period [29]. Another limitation stemmed from data collection across multiple ayahuasca and breathwork centers, introducing additional variability into the data due to differences in settings and practices among these centers. Additionally, it is well known that no two ayahuasca brews are identical, and their composition can vary across sessions and centers (e.g., [18,40]). Therefore, we recommend that future research not only includes information about the quantity consumed by participants but also collects samples of the brew for subsequent determination of alkaloid concentration. These quantitative data can then be included as a covariate in statistical analyses to account for such variations. Additionally, future studies should collect more detailed data on the exact breathwork method that was used, as that can also vary. Here it should be acknowledged that some types of breathwork aim at inducing altered states of consciousness (e.g., ‘high ventilation breathwork’) while other types (‘more traditional practices’) focus on reaching enlightenment [34]. The former type of breathwork can therefore induce a state resembling a psychedelic-induced altered state of consciousness, but to a lesser extent. Lastly, we did not collect information about whether breathwork attendees continued their breathwork on their own or in a group setting, which might have influenced the persistence of changes in the assessed variables over time. The same goes for the ayahuasca attendees, who might have engaged in more sessions, or even other types of practices like breathwork.

Despite these limitations, our findings significantly contribute to the existing knowledge regarding the impact of attending either an ayahuasca ceremony or a breathwork session on various psychological factors. The observation of improved well-being following both interventions aligns with prior research. However, this study is groundbreaking in demonstrating that both interventions can enhance resilience and self-compassion for up to three months post-intervention, marking the first time such effects have been documented. Additionally, the alterations in personality traits largely conform to previous studies on ayahuasca, and notably, our study is the first to report these changes following breathwork.

7. Conclusions

Together, these findings suggest that both interventions hold promise for the treatment of conditions characterized by lower well-being, resilience, and self-compassion, such as depression or anxiety-related disorders. Previous research has already indicated the potential of ayahuasca in depression treatment [41,42], and our study provides insights into the potential psychological mechanisms underlying this therapeutic effect. Furthermore, our findings underscore the importance of including a control group in naturalistic studies, as it becomes evident that both groups experienced similar changes. This highlights the need for large, well-controlled studies that can rigorously investigate the psychological effects of ayahuasca and breathwork, while also taking into account the social context in which these interventions are administered, and to assess other variables like depth of altered states of consciousness that might explain improvement in psychological processes and wellbeing.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/psychoactives3020011/s1>, Table S1: ‘Other’ motivations listed by participants to attend the ayahuasca retreat or the breathwork session; Table S2: Total number of participants that completed the surveys per time point and group.

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Data Availability Statement: The datasets generated for this study will be available on request to the corresponding author when all the data of the project are published and the dataset is anonymized.

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Conflicts of Interest: Kim PC Kuypers is a scientific advisor of Clerkenwell Health, a company that runs trials with psychedelics and is developing training for therapists <https://www.clerkenwellhealth.com/>.

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