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Physical Activity in Forest and Psychological Health Benefits: A Field Experiment with Young Polish Adults

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Abstract: Recently, many studies have been conducted on the impact of various elements of the natural environment, including forests, on human physical and mental health. However, little is known about the level of health benefits resulting from contact with forests depending on the type of physical activity undertaken. Therefore, in order to measure the impact of physical activity on the level of mental relaxation, a randomized experiment was conducted, which took into account three types of human physical activity: walking, cycling, and passive (without movement) observation of the forest. The study was carried out in the same forest and at the same time. Forty young people studying in Warsaw took part in the study. Four psychological questionnaires were used in the project before and after the experiment (Profile of Mood States, Schedule of Positive and Negative Affects, Recovery Scale, Subjective Vitality Scale). A pre-test was also performed in a university classroom. Research has shown that staying in the forest, regardless of the type of physical activity, brings positive health benefits in the form of an increase in positive feelings while reducing negative feelings. The results indicate that people who walk have the broadest range of benefits (cumulative benefits), in the form of less tension, reduced anger, fatigue, depression, increased concentration and greater vigor. Cyclists experienced significant benefits only in the form of reduced depression and greater vigor. The group passively observing the forest achieved statistically significant benefits only in terms of reducing fatigue and improving concentration. However, overall, the between-group results showed no statistically significant differences between the restorative effects of walking, cycling, and viewing the forest landscape. Each analyzed form of contact with the forest has a regenerating/regenerating effect (ROS scale) and contributes to the increase in vitality (SVS scale).

Keywords: forest bathing; forest therapy; human health; psychological tests; walking; cycling; nature observation

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1. Introduction

The overall goal of human development is to improve quality of life [1]. Physical activity is one of the most important factors affecting the health, quality of life, and longevity of humans [2]. The term "physical activity" has been defined by the WHO [3] as any bodily movement caused by skeletal muscles that requires energy expenditure. Physical activity includes walking, running, rollerblading, cycling, etc. Simple forms of sports exercises can be carried out at home and at work. However, in order for them to be effective, they must be undertaken regularly, and must be adapted in terms of intensity and duration to human capabilities [4]. Systematic physical activity prevents cardiovascular disease and contributes to the reduction of premature mortality and all-cause mortality. Physical activity is crucial to the prevention and treatment of overweight and obesity and prevents cancer and osteoporosis [5]. It also has beneficial effects on mental performance and is a protective factor against memory disorders. Physical activity reduces the incidence of depression and relieves stress, which is deeply associated with many mental disorders, as well as cardiovascular diseases. However, physical inactivity is becoming more and more common in many countries, with serious consequences for the prevalence of many diseases and the health of the population worldwide [6]. Around the world, 25% of adults and as many as 75% of teenagers (aged 11–17) do not perform physical activity in the form recommended by the WHO [4]. In Poland, there has been a reduction in physical activity among young people in the past few years [7]. Therefore, it is necessary to reverse this trend. This is important, because physical activity is an important factor in reducing stress. Stress control is a critical issue, particularly in economically developed societies [8]. Recently, many studies have been carried out on the health-promoting and therapeutic functions of individual elements of natural environments, and many different approaches to this subject have been proposed. It has been found that increased physical activity is positively correlated with greater access to green areas [9–12]. Green space is an element or aspect of the physical environment that is important for physical activity [13]. Its role is growing due to the progressing urbanization of space. It is estimated that by 2030, over 80% of Europe's population will live in urban areas; it will therefore be up to city leaders to promote health and well-being [14]. Urban greenery, particularly forests, provides opportunities for everyday recreation, physical activity, mental restoration, and social meeting. Most groups use urban forests for cultural ecosystem services, mainly for diverse recreational activities (such as exercise, relaxation, picnicking, family occasions, nature watching, etc.). The extent or frequency of use of public urban forests is mediated by the relative ease of access, either physically or financially, as well as the quality of the green areas [15]. The simplest form of physical activity, which requires no special preparation, has a low risk of injury, and is very popular in forest areas, is walking. In Poland, in addition to walking, the most popular forms of physical activity in forests within the range of agglomerations include bicycle tours and nature observation [16]. A significant number of studies indicate that physical activity in the natural environment can bring more benefits to human health than physical activity carried out in closed rooms (gyms, apartments) or in built-up areas [17–20]. In addition, Korpela et al. [21] showed that the process of regeneration of the human body in natural environments, especially in forest areas, is much more effective than in city parks or other open recreational areas in cities. However, there are also reports showing that, for example, while running may be more enjoyable, it is not necessary to run in a natural environment to obtain mood benefits [16]. However, the exact roles of running and the environment in mood changes and cognitive strategies remain uncertain. Therefore, further research is needed to examine the relationship between natural and urban environments and the mood and cognitive strategies of runners [22]. There is still a large knowledge gap in our understanding of how different types of forests influence health differently. The benefits of nature views, immersion, and experiences, including urban forests and trees, on a range of mental health and wellbeing conditions and indicators, such as reduced anxiety, depression, fatigue, stress, and tension, resulting in improved mood and sense of restoration, well-being, and happiness, may relate to specific forests [23–25]. In addition, little is known about whether the level of health benefits from contact with forests is dependent on the type of physical activity. What is more beneficial to a person: moderate physical activity in the forest, or passive observation of nature? In the present study, we attempt to compare the mental health benefits derived from the implementation of various forms of activities in the forest (passive activity, walking, and cycling). The hypotheses formulated for this study are as follows:

1. Contact with the forest has a positive restorative effect on humans and contributes to vitality.
2. The level of benefits to human mental health varies depending on the form of physical activity in the forest.

2. Materials and Methods

2.1. Participants

The study involved 40 volunteers from among the students of the Warsaw University of Life Sciences, who did not show any visible symptoms of the disease on the day of the study. There were 23 men and 17 women aged 20–23. Participants were familiarized with the objectives, procedures and methods of the study in which they participated. Participants were not allowed to communicate with other participants or researchers during the forest observation (approximately 30 min) or while completing psychological test questionnaires (approximately 15 min). In addition, participants were not allowed to use cell phones, drink alcoholic and caffeinated beverages, or smoke cigarettes. The psychological questionnaires used in the study were anonymous. Participants and researchers used pseudonyms. Immediately after completing the forms by the participants, they were checked by the study supervisors for completeness. All actions taken during the study were in line with the ethical standards of the Polish Committee of Ethics in Science and the Declaration of Helsinki of 1964, as amended.

2.2. Site Test

The survey was conducted in April 2022 (20 April 2022) in the Kabaty Forest, the largest forest in Warsaw, consisting of more than 900 ha. The experiment began at 10 a.m. All respondents met with researchers at the Center for Environmental and Forestry Education (CEPL) of the Warsaw City Forest (assembly point, Figure 1). The participants were informed of the procedure of the experiment and the rules in force, and then, with the help of psychological tests, information was collected about their emotional state and mood. The next step was to randomly divide the volunteers into three groups. Each group, along with a researcher guide, went to the forest for the next stage of the experiment. The walking time from the CEPL building to the forest is approximately 7 min. The participants in Group A did not undertake any activity. They sat on benches and looked at the forest for 30 min (Item 1, Figure 2). The second group (B) traversed the forest on bicycles at the same time. The bicycles were all the same, having been rented from a self-service urban bicycle rental station operating as part of Warsaw Public Transport organized by the Warsaw City Roads Authority. The station is located in the Park of Culture in Powsin. The path along which the cyclists traveled was 4 km, in the form of a loop. It was a route on flat terrain without any elevation. Bicycle users were instructed to ride at a calm and even pace, without rushing. The third group (C) walked in the forest at the same time. The walk lasted approximately 30 min and followed a designated route of approximately 2.5 km. Participants started walking one at a time, a few minutes apart, to exclude the possibility of being able to communicate with each other. Volunteers were informed about the need to move at a calm and balanced pace. All of the routes in the Kabaty Forest are well marked, so participants in the experiment had no trouble determining the route.

Figure 1. Map with the location of the test sites.

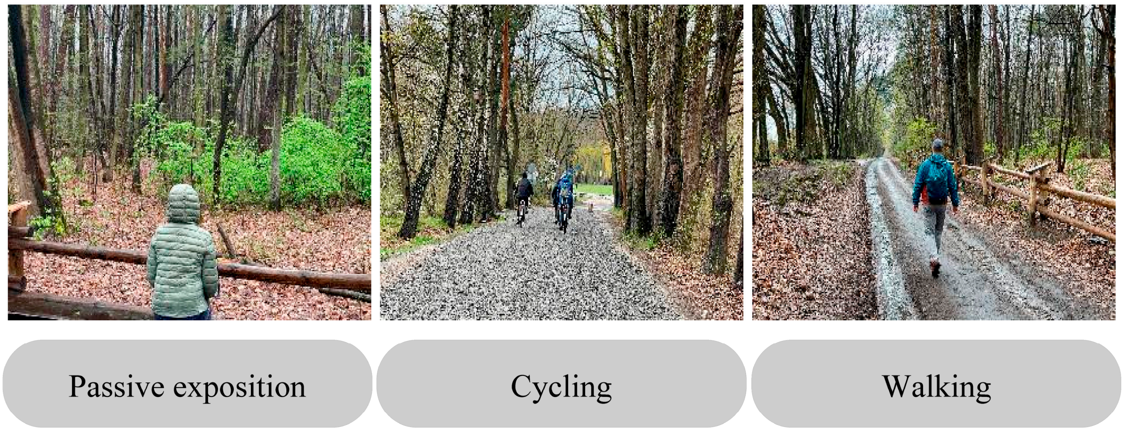

Figure 2. Sites for conducting the experiment.

2.3. Measurements

Four psychological questionnaires were used in the experiment:

1. The Polish version of the scale of D. Watson and L.A. Clark's positive and negative affect schedule developed by Brzozowski (PANAS) [26], consisting of 20 questions, ten of which are about positive feelings and ten about negative feelings. Each question is rated on a five-point Likert scale (1—strongly disagree to 5—strongly agree). The Positive and Negative Affect Schedule (PANAS) questionnaire includes two different scales. One of them measures positive affect (PA), and the other measures negative affect (NA). Based on the results obtained before (PAPRE, NAPRE) and after experimental exposure (PAPOST, NAPOST), the beneficial change in positive (ΔPA = PAPOST − PAPRE) and beneficial change in negative affect (ΔNA = NAPRE − NAPOST) were calculated. The reliability and accuracy of the PANAS questionnaire are high, which has been confirmed in many studies [26–28].
2. The Restorative Outcome Scale (ROS), containing six items, each of which is rated by participants using a seven-point Likert scale (1—strongly disagree to 7—strongly agree), was used sequentially. The Restoration Outcome Scale (ROS) is a single-scale questionnaire that measures subjective feeling of mental restoration. Based on results obtained before (ROSPRE) and after experimental exposure (ROSPOSt), the beneficial change in this specific dimension of psychological well-being (ΔROS = ROSPOST − ROSPRE) was calculated as differential data. This scale, developed by Korpela et al. [29] and adapted into Polish by Bielinis et al. [30], was used to measure perceived reconstructive outcomes.
3. Next, the Subjective Vitality Scale (SVS) was used to assess vitality. It reflects a sense of energy, vitality, and well-being (e.g., "I feel alive and vital" or "I look forward to each new day"). The four items were rated by participants using a seven-point Likert-type scale (1—very unlikely to 7—very likely). The Subjective Vitality Scale (SVS),

similar to the previous scale (ROS), is a single-scale questionnaire that measures the subjective feeling of vitality (the feeling of having energy available to oneself). Based on the results obtained before (SVSAPRE) and after experimental exposure (SVS-POST), the beneficial change in this specific dimensions of psychological well-being (ΔSVS = SVSPOST − SVSPRE) were calculated as differential data. This scale has been used in previous studies, thereby confirming its effectiveness Simkin et al. [28], Bielinis et al. [30].

4. The last scale was the Profile of Mood States (POMS) scale. The Polish adaptation of the questionnaire was developed by Dudek and Koniarek [31]. The Profile of Mood State (POMS) questionnaire includes six different scales: tension (T), anger (A), fatigue (F), depression (D), Confusion (C) and Vigor (V). Based on the results obtained before (TPRE, APRE, FPRE, DPRE, CPRE, VPRE) and after experimental exposure (TPOST, APOST, FPOST, DPOST, CPOST, VPOST), the beneficial change in six different dimensions of mood (ΔT = TPRE − TPOST, ΔA = APRE − APOST, ΔF = FPRE − FPOST, ΔD = DPRE − DPOST, ΔC = CPRE − CPOST, ΔV = VPOST − VPRE) were calculated. The POMS is a reliable and contemporary measure of mood state, previously used to assess the impact of the forest environment on the moods of individuals [32,33]. A total mood disorder (TMD) score was also calculated using POMS data. The given tool measures six subscales of mood state: confusion or disorientation, fatigue or inertia, anger or hostility, tension or anxiety, depression or despondency, and vigor or activity. A five-point Likert scale was used for each question to rate participants' mood states from 0 (strongly disagree) to 4 (strongly agree).

Noise and sunlight levels were controlled during the experiment. Sound and light levels were also measured with an iPhone 12 using the LUX Light Meter FREE (Version 1.1.1 2 November 2016) and Sound Level Analyzer Lite (Version 6.0.2 9 January 2022) applications. Similar applications have been used in other studies by Tsunetsugu et al. [34], and they meet standards comparable to professional laboratory equipment for sound analysis. Sound and light were measured at each exposure point before, 2× during, and immediately after completing the psychological test questionnaire. The average values of the sound and light at each point in the experiment are listed in Table 1.

Table 1. Average values of sound and light during the experiment.

Test Site	Sound Level (dB)	Light Intensity (lx)
Classroom	54 ÷ 59	412 ÷ 510
Walking path	54 ÷ 60	7119 ÷ 7423
Cycle path	54 ÷ 61	7121 ÷ 7433
Passive exhibition site	54 ÷ 62	7354 ÷ 7821

The meteorological data in effect at the time of the experiment were determined using data from the nearest meteorological station—the Meteo Station of the Warsaw University of Life Sciences located at an altitude of 100 m above sea level (location: 52°09′37.37′′ N 21°03′11.92′′ E). The average daily temperature was 6 °C (7.9 maximum °C, 4.9 minimum °C), the relative humidity was 78%–96%, the average cloudiness was 6.8 (on the octane scale), the atmospheric pressure was 1011 hPa, and the wind speed was up to 4.5 m/s.

2.4. Data Analysis

All raw data were stored in Excel (Microsoft 2019, version 1808, Redmond, WA, USA), and mean values as well as standard deviation (SD) values were calculated using this program. Further analysis was performed using STATISTICA version 13.3 (TIBCO Software Inc., Palo Alto, CA, USA).

3. Results

3.1. Positive and Negative Affect Schedule (PANAS)

The average value of these benefits (ΔPA, ΔNA) with the expanded uncertainty intervals (having a level of confidence of 95%) that were observed for each of the three tested groups are shown in Figure 3.

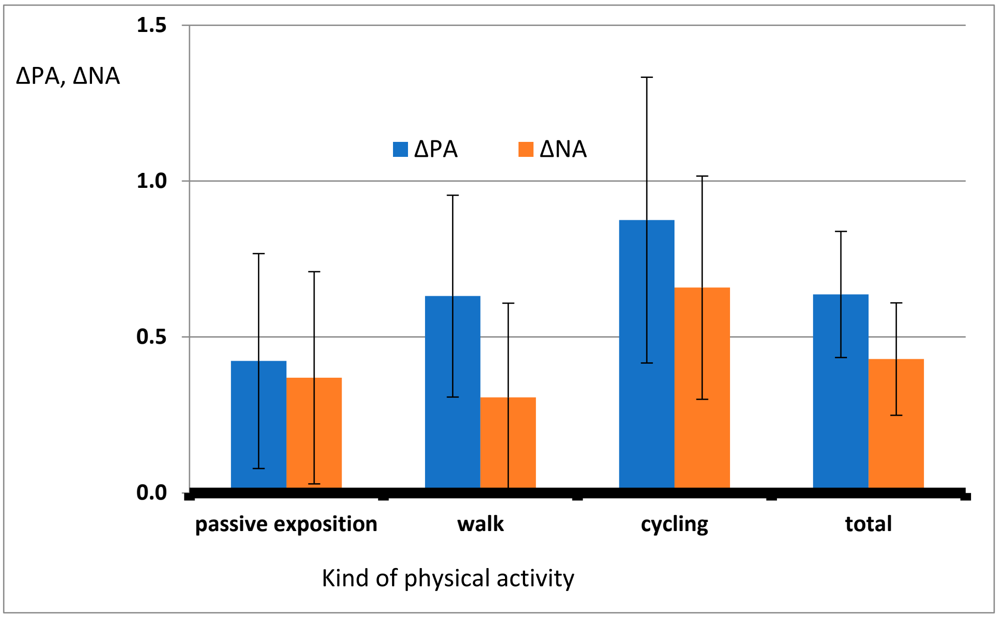

Figure 3. Beneficial change in positive (ΔPA) and negative (ΔNA) affect as measured using the Positive and Negative Affect Schedule (PANAS) questionnaire.

Based on additional statistical analyses (*t*-test in SPSS Statistics), a statistically significant increase in positive feelings and a decrease in negative feelings was observed for all tested groups (Table 2). In contrast, using one-way ANOVA in SPSS Statistics, there were no statistically significant intergroup differences, although Figure 3 suggests that cycling may be slightly more beneficial than the others.

Table 2. Means and *t*-test results of psychological measures of PANAS during the experiment.

Measures	Passive Exposition			Walk			Cycling			Total		
	Mean	T	*p*	Mean	T	*p*	Mean	T	*p*	Mean	T	*p*
ΔPA	0.4 ± 0.3	2.67	0.010	0.6 ± 0.3	4.15	0.001	0.9 ± 0.5	4.20	0.001	0.6 ± 0.2	6.35	0.001
ΔNA	0.4 ± 0.3	2.36	0.018	0.31 ± 0.3	2.15	0.024	0.7 ± 0.4	4.05	0.001	0.4 ± 0.2	4.81	0.001

Based on the data from Table 2, we calculated the overall cumulative affect improvement (ΔPANAS = ΔPA + ΔPN). The average values of the overall indices are shown in Figure 4. The largest improvement in emotional state was observed in the cycling group (1.5 ± 0.6); however, the possible superiority of cycling over passive exposure (0.8 ± 0.5) was not statistically significant. The lack of significance can be easily determined by comparing the expanded uncertainty intervals (having a level of confidence of 95%), which were observed for each of the three tested groups.

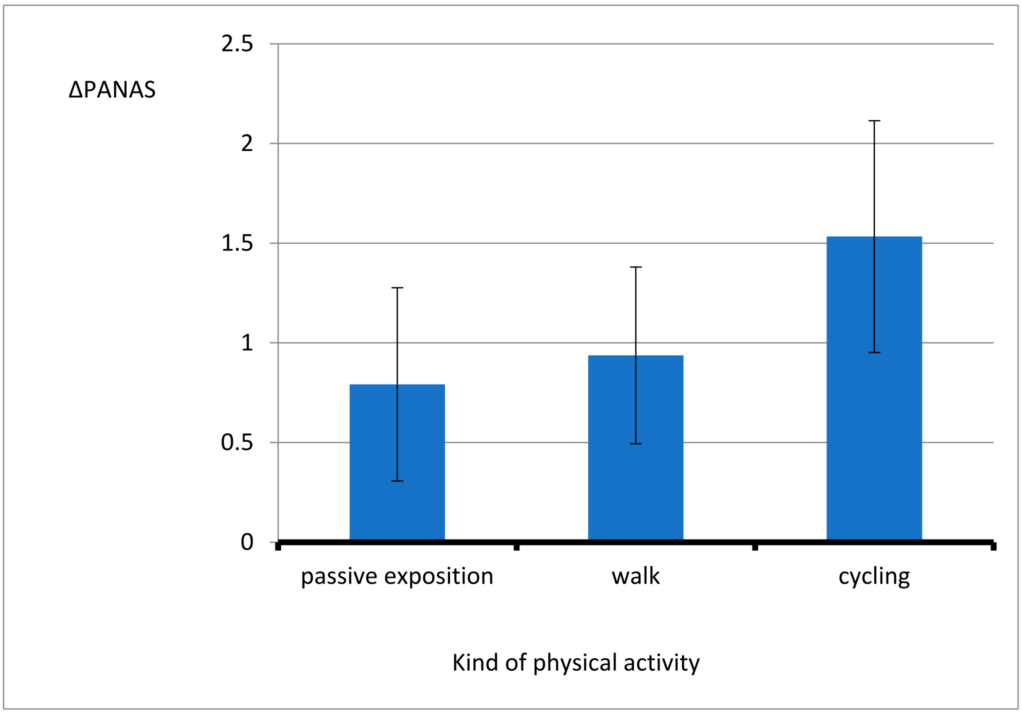

Figure 4. Overall cumulative affect improvement (ΔPANAS = ΔPA + ΔNA), as measured using the Positive and Negative Affect Schedule (PANAS) questionnaire.

3.2. Restorative Outcome Scale (ROS) and Subjective Vitality Scale (SVS)

The average values of these benefits (ΔROS, ΔSVS) with their expanded uncertainty intervals (with a confidence level of 95%) observed for each of the three tested groups are shown in Figure 5.

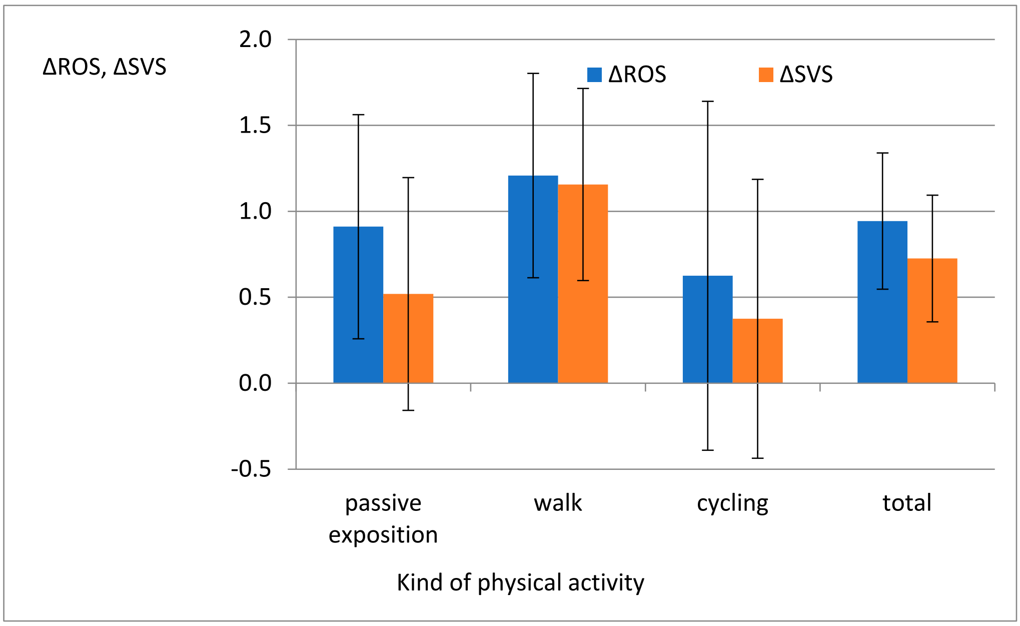

Figure 5. Beneficial change in subjective restorativeness (ΔROS) and subjective vitality (ΔSVS) as measured using the Restorative Outcome Scale (ROS) and Subjective Vitality Scale (SVS) questionnaires, respectively.

Based on statistical analyses (*t*-test in SPSS Statistics), it was found that both analyzed benefits (ΔROS, ΔSVS) were not statistically significant in all studied groups (Table 3).

The results of the analyses suggest that in the group of cyclists, there was no statistically significant improvement in regeneration and vitality. However, in the group of walkers, the improvement was significant. However, one-way ANOVA in SPSS Statistics did not provide the basis for demonstrating the existence of significant differences between groups (which was a consequence of large ranges of measurement uncertainty). Thus, there is no basis for rejecting the null hypothesis that each of the three activities included in the study is similarly effective in improving mental status, as measured by the Restorative Outcome Scale (ROS) and the Subjective Vitality Scale (SVS).

Table 3. Means and *t*-test results of psychological measures of ROS and SVS during the experiment.

Measures	Passive Exposition			Walk			Cycling			Total		
	Mean	**T**	***p***	**Mean**	**T**	***p***	**Mean**	**T**	***p***	**Mean**	**T**	***p***
ΔROS	0.9 ± 0.7	3.04	0.005	1.2 ± 0.6	4.33	0.001	0.6 ± 1	1.36	0.101	0.9 ± 0.4	4.81	0.001
ΔSVS	0.5 ± 0.7	1.67	0.060	1.2 ± 0.6	4.41	0.001	0.4 ± 0.8	1.02	0.165	0.7 ± 0.4	3.98	0.001

3.3. Profile of Mood States

The average value of these benefits (ΔT, ΔA, ΔF, ΔD, ΔC, ΔV) with the expanded uncertainty intervals (having a level of confidence of 95%) that were observed for each of the three tested groups are shown in Figure 6.

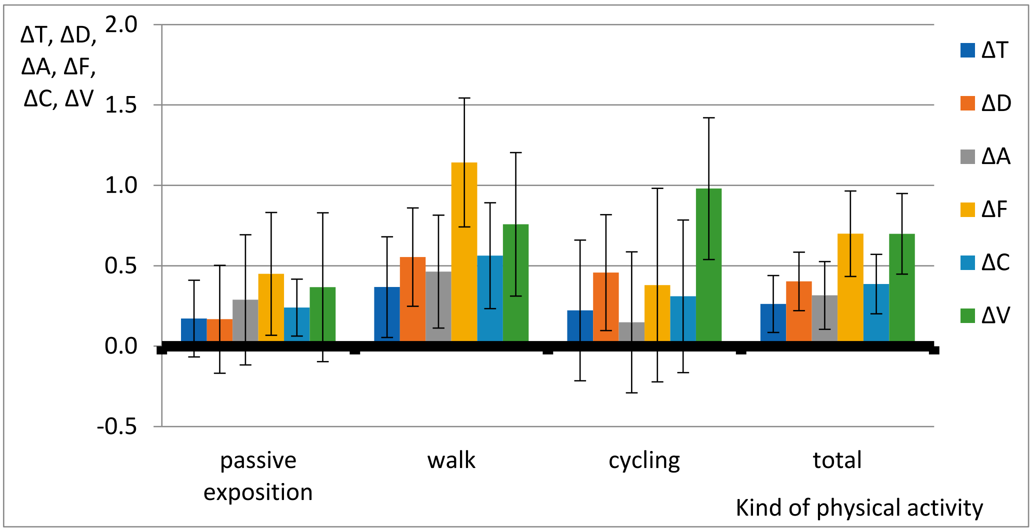

Figure 6. Beneficial change in six different dimensions of mood: Tension (ΔT), Anger (ΔA), Fatigue (ΔF), Depression (ΔD), Confusion (ΔC) and Vigor (ΔV), as measured using the Profile of Mood State (POMS) questionnaire.

Based on the results of additional statistical analyses (*t*-test in SPSS Statistics) in Table 4, it was found that only in the group of walkers was there a statistically significant improvement in all six mood dimensions. In the other groups, the statistically significant improvement was in only two different dimensions (Depression and Vigor in the cyclist group, and Fatigue and Confusion in the "inactive rest" group).

In addition, a one-way ANOVA in SPSS Statistics was conducted to determine whether there were statistically significant intergroup differences for any of the six variables, understood to be beneficial changes in different dimension variables of mood: Tension (ΔT), Anger (ΔA), Fatigue (ΔF), Depression (ΔD), Confusion (ΔC), and Vigor (ΔV). The positive results of such a test were only related to improvement in mood, defined as Fatigue (F = 4.245 and $p = 0.022$). To better interpret this, Benferroni's post hoc test was performed, which showed that the improvement in the Fatigue score obtained in the walker group was statistically significantly greater than that in the cyclist group. No other statistically significant intergroup differences were found.

Table 4. Means and *t*-test results of psychological measures of POMS subscales during the experiment (results marked with bold numbers indicate statistically significant differences)).

Measure	Walk			Walk			Cycling			Total		
	Mean	T	*p*	Mean	T	*p*	Mean	T	*p*	Mean	T	*p*
ΔT	0.2 ± 0.25	1.57	0.072	**0.4 ± 0.3**	**2.50**	**0.012**	0.2 ± 0.4	1.12	0.144	**0.3 ± 0.2**	**3.00**	**0.002**
ΔD	0.2 ± 0.3	1.09	0.149	**0.6 ± 0.3**	**3.87**	**0.001**	**0.5 ± 0.4**	**2.79**	**0.009**	**0.4 ± 0.2**	**4.48**	**0.001**
ΔA	0.3 ± 0.4	1.55	0.073	**0.5 ± 0.4**	**2.81**	**0.007**	0.15 ± 0.4	0.75	0.236	**0.3 ± 0.2**	**3.03**	**0.002**
ΔF	**0.5 ± 0.4**	**2.57**	**0.012**	**1.1 ± 0.4**	**6.07**	**0.001**	0.4 ± 0.6	1.39	0.096	**0.7 ± 0.3**	**5.32**	**0.001**
ΔC	**0.25 ± 0.2**	**2.95**	**0.006**	**0.6 ± 0.3**	**3.64**	**0.001**	0.3 ± 0.5	1.44	0.089	**0.4 ± 0.2**	**4.22**	**0.001**
ΔV	0.4 ± 0.45	1.73	0.055	**0.8 ± 0.5**	**3.62**	**0.001**	**1 ± 0.4**	**4.90**	**0.001**	**0.7 ± 0.3**	**5.63**	**0.001**

In addition, the beneficial effects of walking in the forest are well demonstrated by the data presented in Figure 7. This figure shows the values of the overall cumulative mood improvement (ΔPOMS = ΔT + ΔA + ΔF + ΔD + ΔC + ΔV), which were calculated based on the data in Table 4. The data shown in Figure 7 suggest that the cumulative benefits defined above were the greatest in the group of walkers. It is worth noting that the difference between the walker group (3.8 ± 0.9) and the physically inactive group (1.7 ± 0.9) was statistically significant. In contrast, the cumulative benefit of cyclists (2.5 ± 1.1) was not significantly different from that of any of the other groups. The above significance or non-significance was evidenced by comparing the expanded uncertainty intervals (having a level of confidence of 95%), which were observed for each of the three tested groups.

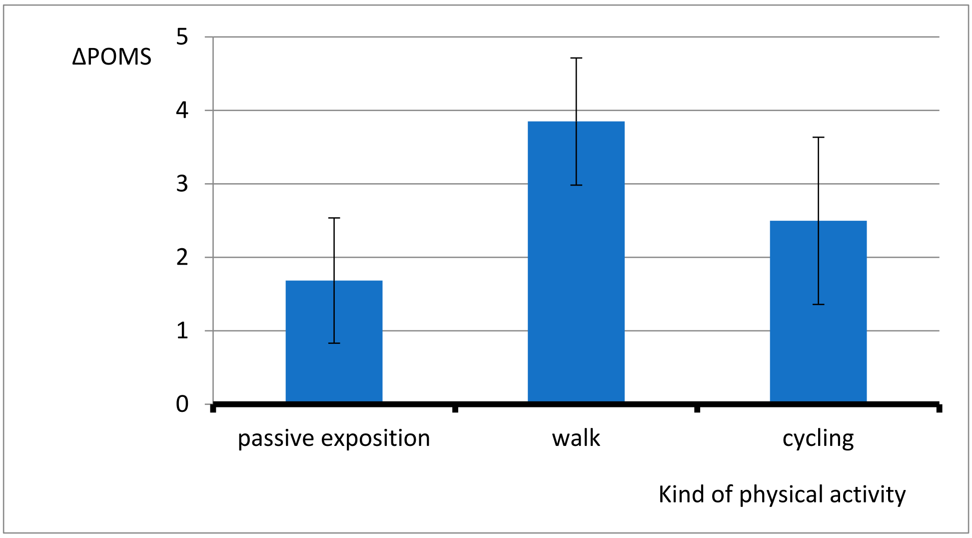

Figure 7. Overall cumulative mood improvement (ΔPOMS = ΔT + ΔA + ΔF + ΔD + ΔC + ΔV) as measured using the Profile of Mood State (POMS) questionnaire.

4. Discussion

The influence of the environment on the psychological benefits of physical activity has been the subject of research by many scientists in recent years [20]. Most often, the welfare impact of the forest is assessed through activities such as walking or exercising in the forest, or more passive interactions, including sitting to observe the forest or being exposed to the forest atmosphere without further specification [35]. However, few studies have compared and evaluated the impact of different types of activity, both passive and more active, on health parameters. While our research does not support this, work indicates that health-promoting benefits may be associated with the degree of engagement in a particular type of physical activity in the forest. For example, Shin et al. [36] found that meditative walking was more effective in terms of psychological aspects than sports walking. Specifically, meditative walking in forests was most effective at increasing happiness. Our research focuses exclusively on the impact of forests on people undertaking specific physical activities in the forest. In the initial stage of the study, we contacted all participants. Each volunteer participated in the experiment individually. The participants did not interact with each other during physical activity, and there was considerable distance between them. Thus, the results of our study can only be applied to individual forest therapy. According to Grassini [37], studies comparing the regenerative effects achieved by both individual and group walks or other forms of physical activity are lacking. An example of this type of work is the study by Johansson et al. [38], which showed that, compared to walking alone, walking with a friend produces more favorable outcomes for calmness, anxiety and depression, anger, and physical exhaustion. In studying the effects of the forest on the well-being of a person undertaking a specific physical activity, it is important to carefully select the location of the study, as pointed out by Toda et al. [39], who showed that walking or cycling on flat forest terrain can produce a completely different restorative effect than the same form of physical activity carried out on terrain that is more varied in terms of relief. A study by Toda et al. [39] found that a forest walk with climbing or physically demanding terrain can increase physiological stress, and showed it to have positive effects in terms of alleviating psychological stress, leaving the participant feeling uplifted. In our study, neither walking nor cycling required traversing uneven terrain, and the terrain was characterized by flat relief. Our study showed that staying in the forest, regardless of the type of physical activity, brings positive health benefits in the form of an increase in positive feelings and a decrease in negative feelings. Both passive exposure to the forest and moderate physical activity, such as walking or slow cycling, can contribute to a decrease in negative feelings and an increase in positive feelings. Previous research clearly showed that short walks in the forest are followed by a significant decrease in negative feelings [34]. In addition, Takayama et al. [40] showed that a decrease in negative feelings was accompanied by an increase in positive feelings. The results of our study show that contact with the forest environment contributes to improved mood. Several other studies have confirmed this [41,42]. Ochiai et al. [41] found that walking in the forest according to the guidelines of a standard "forest therapy" program induced physiological and psychological relaxation. Park et al. [42] noted the effects of relaxation and stress management in a forest environment using a pro-file questionnaire of mood states. His study found that walking in the woods and sitting and observing the forest landscape had an attention-restoring effect. Previous studies have found that viewing nature effectively reduces mental fatigue, irritability, anger and anxiety; sustains attention and interest; and increases concentration and feelings of pleasure [43,44]. Ulrich's [45] landmark research project illustrated the effectiveness of watching natural scenes during the recovery of postoperative patients. In addition, a study by Tsunetsuga et al. [46] suggested that even short-term forest viewing has a relaxing effect. A study by Ochiai et al. [41] found that the negative emotion "tension–anxiety" was reduced and the positive feeling of "vigor" was higher after forest therapy. The results of our study indicate some differences in terms of the levels of psychological benefits and the type of activity undertaken in the forest. Walkers have the widest spectrum of benefits (cumulative benefits) in the form of less tension, decreased anger, fatigue, depression, increased concentration, and greater vigor. In addition, Grassini [37] states that the results of several papers support the effectiveness of natural walks. Cyclists benefited significantly only in terms of decreased depression and greater vigor. The group passively observing the forest benefited statistically significantly only in terms of decreased fatigue and improved concentration. However, overall, the results between the groups did not indicate statistically significant differences between the restorative effects of walking, cycling, and viewing the forest landscape. Each form of forest contact analyzed has a restorative/restorative effect (ROS scale) and contributes to increased vitality (SVS scale).

5. Limitations

The most serious limitation of our study was the relatively small sample size of respondents. However, many other studies have used much smaller sample sizes. For example, An et al. [47] included 13 students, while Takayama et al. [48] had 17 participants. Another limitation is that we did not control for the gender of respondents. In the case of walkers or volunteers pursuing a passive form of activity, the gender ratio was maintained, and we had an overrepresentation of men in the case of cyclists. Many previous studies have suggested that the environment and landscape are perceived differently by men and women, and behaviors and attitudes towards the environment differ between the sexes. However, few studies have analyzed the effect of gender; for example, Barton and Pretty [49] found that men experienced slightly greater mood improvement after exercising in green spaces than women. In contrast, Puett et al. [50] found that men were more likely to engage in outdoor physical activity. Therefore, women may experience greater psychological benefits from greenspace physical activity than men. In future studies, we would like to have more control regarding the equal representation of both sexes. Our study was conducted during a relatively cool period. In field studies, data such as humidity, temperature, and light are reported mainly for methodological reasons regarding the repeatability of the study, and it is less common to link weather factors directly to the therapeutic value of the forest. For example, An et al. [47] showed that there was a correlation between the benefits of forest bathing and temperature and humidity when university students visited an urban forest. Therefore, it is worthwhile to continue research under more comfortable weather conditions to clearly establish the optimal conditions for implementing both individual and group forest therapy programs. The same is true for the time of year. We conducted our research in early spring, when nature was just waking up. We previously pointed out in earlier works [34,51] that certain landscape features associated with time variability (e.g., autumn leaf discoloration, snow, or a certain light level in the forest) can impinge on perceived recovery. However, as Joung et al. [52] rightly pointed out, evidence for this is sparse. Research on season-specific influences on human well-being and identification of relevant forest features responsible for these influences should be further developed.

6. Conclusions

Being in the forest, regardless of the form of activity, statistically significantly improves all the dependent variables we measured, which determine a person's level of psychological well-being. Thus, we provide another highly reliable empirical estimate in favor of forest therapy effectiveness. These findings have important implications for urban planning and green social prescription for mental health.

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