

This is an Accepted Manuscript of an article published by Taylor & Francis in **Leisure Sciences** on 17 Sep 2019, available at: <https://doi.org/10.1080/01490400.2019.1667283>.

Citation:

Subiza, M., Vozmediano, L. & San Juan, C. (2019). A tale of two sticks: walking towards restoration. *Leisure Sciences*, 44,7771-785. <https://doi.org/10.1080/01490400.2019.1667283>.

Document version: Article. Accepted version

Tale of Two Sticks: Walking towards Restoration

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ABSTRACT

Most studies conducted on Nordic Walking have addressed bio-medical questions, such as recovery from injuries or medical interventions and its therapeutic value for various health conditions. However, the psychological outcomes of this activity remain so far greatly under-researched, along with its implications for research in leisure and recovery literature. In this paper we present a pretest-posttest study assessing the affective restoration achieved by the participants of two different walks along two urban settings varying in naturalness. Participants filled in a questionnaire comprising of a set of psychological scales measuring affective states and restoration outcomes. Pretest-posttest score comparisons revealed that participants experienced immediate psychological improvements, due to the reduction of negative affect indicators and the increase of positive ones. Implications for future research on Nordic Walking and psychological restoration are discussed.

KEYWORDS: Nordic walking; psychological restoration; outdoor exercise; recovery

Introduction

The value of leisure for psychological health

Literature on leisure often highlights its value in the maintenance of a balanced health status. It has been stated that job performance, family issues, daily responsibilities and interpersonal relationships often lead to stress and other deleterious psychological outcomes (Iwasaki & Schneider, 2003). In this regard, the return to the pre-stressor functioning level may come from activities that foster detachment from the stressor source, increasing feelings of relaxation or allowing the development of new skills and talents (Sonnentag & Fritz, 2007; Sonnentag & Zijlstra, 2006). From this perspective, leisure might be presented as a plethora of strategies used to cope with negative daily feelings and to foster enjoyment and self-enhancement (Merritt, Zawadzki, Paolo, Kayla, & Ayazi, 2017).

Physically active leisure activities could be good candidates for such a recovery. Exercise has been found to increase positive affect (Reed & Buck, 2009) and reduce depressive and anxiety symptoms (Rethorst, Wipfli, & Landers, 2009; Wipfli, Rethorst, & Landers, 2008). Similarly, evidence points out its protective role against stress (Gerber, Uwe, & Hse, 2009) and its value as auxiliary treatment for clinical disorders (Zschucke, Gaudlitz, & Ströhle, 2013). Of particular interest for this study, a relevant body of literature deals with the advantages of performing physical activity in green and outdoor settings (Barton & Pretty, 2010; Mackay & Neill, 2010; Pasanen, Tyrväinen, & Korpela, 2014; Pretty, Griffin, Sellens, & Pretty, 2003).

In addition to stress recovery and affective potentiation, leisure activities are also thought to contribute to psychological health because they may foster the satisfaction of basic psychological needs (Gui, Kono, & Walker, 2019), thus increasing subjective wellbeing (Kuykendall, Tay, & Ng, 2015).

More specifically, leisure-time physical activity has been found particularly interesting in mid and later stages of life because it improves health, autonomy and life satisfaction (Grant, 2008; Kim, Lee, Chun, Han, & Heo, 2017; Paillard-Borg, Wang, Winblad, & Fratiglioni, 2009; Ryu & Heo, 2018; Sarid, Melzer, Kurz, Shahar, & Ruch, 2010) and may help to reduce the deleterious effects of acute episodes of stress (Chang, 2015).

The presence of psychological restoration in leisure literature

In the field of environmental psychology, in the last decades there has been an increasing interest in the study of restoration, defined as the renewal of physical, psychological, and/or social resources diminished in ongoing efforts to meet everyday demands (Hartig, 2004). Thus, a restorative experience allows a person to recover from psychological depletion while improving his/her mood and allowing certain levels of reflection and transcendence (e.g., reflection on life goals, his/her place in the world or his/her relationships with others). This line of research shares part of the premise that inspires investigations in occupational health and recovery from work (de Bloom et al., 2017; Sianoja, Syrek, de Bloom, Korpela, & Kinnunen, 2018; Sonnentag & Fritz, 2007; Sonnentag & Zijlstra, 2006), as daily performance is thought to deplete psychological resources (i.e.

cognitive and emotional abilities) that can be restored by contact with environments and activities that meet various requirements (Kaplan & Kaplan, 1989; Ulrich, 1993). This noteworthy similarity in conceptual terms (Korpela & Kinnunen, 2011) explains the presence of restoration studies within the main leisure journals (Han, 2018; Home, Hunziker, & Bauer, 2012; Von Lindern, Bauer, Frick, Hunziker, & Hartig, 2013; Weng & Chiang, 2014; Wöran & Arnberger, 2012).

Han (2018) conducted a valuable systematic review to gather all the existing restoration or restorativeness self-report scales and to integrate their psychometric properties. Home et al. (2012) analyzed the psychological outcomes of outdoor leisure activities in a sample of Swiss citizens. Some psychological benefits evaluated in their questionnaire clearly refer to psychological restoration as defined by ART (Attention Restoration Theory) (e.g., to experience calm or to escape from routine or work pressure), and were found to predict the practice of activities such as walking, jogging or picnicking. Also, with a considerable sample of Swiss citizens, Von Lindern et al. (2013) studied the restorative experiences of forest professionals while visiting natural settings. The mediation model they built indicated that having a forest-related profession both increased and decreased restoration, via familiarity and being away respectively. Wöran and Arnberger (2012) used restoration to predict the flow experience of Austrian hikers and found that being away, fascination and compatibility (three of the ART components) were positive significant predictors of flow.

In a study closely related to the one presented here, Weng and Chiang (2014) assessed the restoration achieved through the practice of different activities (e.g., walking or surfing the Internet) with a sample of university students using a pretest-posttest design. They chose a measure of attentional performance and a self-reported scale to quantify anxiety. Walking in a green environment – this time a university campus – led to significant improvements in both variables. Moreover, the study by de Bloom et al. (2017) used pretest-posttest comparisons to evaluate the effects of short relaxation group activities and park walks during lunch breaks in a sample of knowledge workers at two separate times of the year. They found that such activities caused significant improvements in relaxation and other psychological indicators.

In summary, psychological restoration might be useful for leisure literature for two reasons. First, it may be a convenient and valid operationalization of the psychosocial benefits of leisure behavior and could be interesting to use for many research purposes as shown in previous paragraphs. Secondly, the use of this framework might help to advance in the understanding of the emotional aspects of subjective well-being within leisure literature (Gui et al., 2019; Kuykendall et al., 2015)

Nordic walking

Nordic Walking (NW) can be defined as walking with a pair of poles, similar to the ones used in cross-country skiing (Morgulec-Adamowicz, Marszałek, & Jagustyn, 2011). Apart from moving lower body muscles, this modality of brisk walking also activates upper body musculature thanks to the use of poles. This fact increases energy consumption and exerts less pressure on body joints, compared to general walking (Park & Yu, 2015). NW has been presented as suitable for all ages and physical or health conditions because it is inexpensive, easy to perform, does not require high technique or concentration and may cause fewer injuries than other activities because performers can use the poles for support. In fact, the use of poles might provide assistance when walking, and thus be useful for people with walking impairments (Je-Myung, 2012). Perhaps due to these characteristics, NW, after appearing in Finland during the 90's, spread across many other European countries, USA, Canada and Australia (Österlund-Pötzsch, 2013). Nowadays, it is practiced around the world, and federations and associations at the international and local levels are devoted to promoting its practice.

Available evidence presents Nordic Walking (NW) as a valuable tool for rehabilitation after injuries or medical interventions, as well as for increasing walking performance, boosting physical endurance and decreasing depression in clinical samples (Lee & Park, 2015; Morgulec-Adamowicz et al., 2011; Skórkowska-Telichowska et al., 2016; Strömbeck, Theander, & Jacobsson, 2007). Another study found that individuals with normal glucose tolerance who had regularly practiced NW for 4 months, reduced their BMI, improved sleep quality and increased general perceived health, in comparison to a control group (Fritz et al., 2011). In the same study, individuals with Type 2 Diabetes Mellitus had better sleep quality and increased their satisfaction with their physical health compared to a control group. Similarly, authors of a review of studies concluded that NW had positive effects in several physiological indicators (heart rate, blood pressure, exercise capacity and maximal oxygen consumption among others) in a wide range of clinical disorders (Tschentscher, Niederseer, & Niebauer, 2013).

Therefore, it seems that most studies have been directed towards physical health outcomes and under an overall medical-health perspective (Morgulec-Adamowicz et al., 2011). Conversely, far less is known about the psychological benefits of this activity for the general population. To the best of the authors' knowledge, the only study analyzing the psychological benefits of NW in a general population sample was the one conducted by Stoughton (1992). The author found that practicing NW 4 times a week for 12 weeks led to decreases in feelings of depression, anger, and fatigue and an increase in vigor in a

sample of 87 women. It appears that no more studies following Stoughton's work have been developed later, and therefore, the psychological effects of NW remain insufficiently researched.

When dealing with general walking, studies on psychological restoration have found that it is an activity leading to improvements in mood (Gidlow et al., 2016; Johansson, Hartig, & Staats, 2011). According to a recent review on pretest-posttest studies on the subject, most researchers have used green or natural environments (i.e. forests, urban parks or university campuses) and resorted to university samples (Subiza-Pérez, Vozmediano, & San Juan, 2019). They concluded that adding new activities, environments and samples might result in significant advances in this area of research. Some of these issues are addressed in the present study.

Research aim

The general aim of the study was to evaluate the psychological value of this leisure modality for the general population. Specifically, we assessed the affective restorative potential of NW for the general population. This concurs with Ryu and Heo (2018), who recommended analyzing the specific psychological outcomes of each leisure activity, which might eventually lead to specific leisure guidelines for different profiles (e.g., health status or needs). Even though it was not the primary study objective because data was collected in two different outdoor walks varying in their degree of naturalness (built vs green/blue), it was also possible to test whether the environment could affect the psychological outcomes of the activity.

Due to the exploratory nature of this research, we formulated only the general hypothesis that the practice of NW is restorative. We based this hypothesis on the review of literature shown before regarding physical activity, well-being and green/out-door exercise. In this specific study, the restorative potential of NW could be complemented by the positive outcomes of the social interactions taking place along the walk, as the activity was done in groups.

Results of the study are expected to provide knowledge about the affective benefits and restoration achieved by the performance of a kind of exercise never studied in these terms (NW). This study will provide leisure scientists and stakeholders with first hand evidence about some of the psychological benefits that could be obtained through the practice of this leisure activity. Moreover, the design developed here will allow us to overcome some of the previously exposed limitations of *restoration* pretest-posttest field studies.

Methods

Participants, activity and setting description

The study sample was composed of 60 middle-aged adults ($M = 56.75$; $SD = 7.40$), of whom 43 indicated their gender as women (71%). Participants were recruited from two different walks that took place in October and November 2016.

The first walk ($n = 32$) took place on Wednesday, the 5th of October 2016 at 20.00 and lasted one hour. The tour went through the city center where the study was undertaken and was immediately preceded and ended with a short stretching and warming up/muscle-relaxing session. Participants walked mainly through streets presenting the multiplicity of land uses and activities that characterize urban landscape, including a medium level of traffic load. This environment featured low levels of greenness (trees or pots), although some natural elements could be seen in the horizon (mountains and hills). Additionally, part of the walk followed the riverside across the city. The second walk ($n = 28$) occurred on Sunday, the 13th of November 2016 at 10.00 and took 1.5 hours. The tour was completed in the same city, but it took place in more natural surroundings as it went along three beaches. The participants marched both along the sidewalks by the seaside and on the beaches. None of the participants taking part in the first walk were included in the analyses of the second.

Instruments

The questionnaire was comprised of two separate parts; the pretest and posttest, each containing the same 4 affective scales. The demographic section asked participants their age, gender and number of hours that they had worked since the beginning of that day and week. The word "work" was used in an open sense; as hours of cognitive performance and voluntary attention activity (following ART postulates). It includes work but also attendance to lectures, studying, voluntary service, and so on.

The Spanish short adaptation of the *Profile of Mood States* (Andrade, Arce, & Seane, 2002) consists of 25 adjectives describing affective states that can be grouped in five dimensions: *tension-anxiety* ($\alpha = .85$ & $.76$), *depression-dejection* ($\alpha = .73$ & $.65$), *anger-hostility* ($\alpha = .89$ & $.56$), *fatigue* ($\alpha = .86$ & $.77$) and *vigor* ($\alpha = .84$ & $.89$) and summarized in a *Total Mood*

Disturbance index. The rating scale ranged from 0 (not at all) to 4 (extremely). *The Spanish short version of The Positive Affect Schedule* ($\alpha = .80$ & $.86$; Robles & P'aez, 2003) was used as well, with the same rating scale. The 10 items belong to a unique dimension of *positive affect*. Finally, two 0 to 100 thermometer-like scales were used to measure *stress* and *happiness* (van den Berg, Koole, & van der Wulp, 2003).

The posttest section of the questionnaire additionally included the *Spanish Adaptation of the Restoration Outcome Scale* (ROS-S, $\alpha = .87$; Subiza-Pérez, Vozmediano, & San Juan, 2017 - adapted from Korpela, Yl'en, Tyrväinen, & Silvennoinen, 2008). This instrument, using a 0 to 5 scale, includes items related to the main components of a *restorative experience*: *relaxation and calmness, attention restoration, clearing ones thoughts and reflection*.

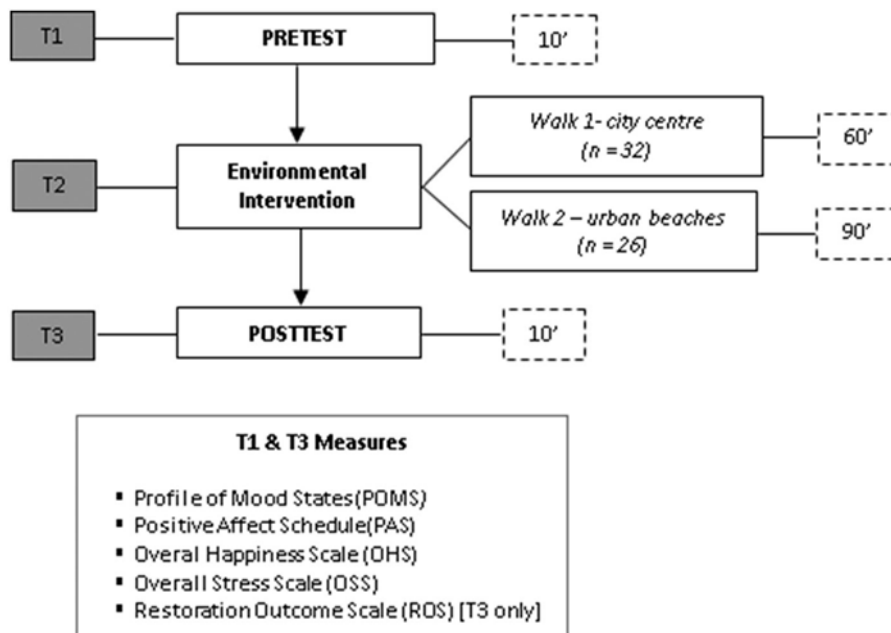


Figure 1. Schema of the experimental procedure designed for this study. Minutes are the unit of time used for the description of each part of the procedure.

Procedure

Regular attendees to the walks scheduled by the Basque Association of Nordic Walking in the city of Donostia-San Sebastián were informed about the nature of the study by one of the activity researchers and monitors weeks before data collection. Implications and practicalities of taking part in the study (date, duration and procedure) were also discussed following the recommendations of the Ethics Committee of The University of the Basque Country UPV/EHU, who approved the application to conduct this study. On the data collection day, walk attendees were again approached and invited to join the study. Participants were given the questionnaires and instructed to fill in the pretest part before starting the activity. After the post-walk stretching session, participants answered the posttest section. Finally, they were debriefed and thanked. A summary of the procedure is shown in Figure 1.

This study was conducted following the ethics guidelines of the Ethics Committee for Research on Human Beings – University of the Basque Country UPV/EHU. Informed consent was oral and given before the data collection. Participants were not required to sign a document as authors did not collect personal identification data (i.e. name or ID).

Data analysis

Pretest and posttest scores in the study scales were compared using repeated measures MANOVA with Bonferroni correction. When significant differences between these scores were detected, effect size was calculated using η^2 for within-subjects due to its strength and robustness for F tests (Lakens, 2013; Levine & Hullet, 2002; Richardson, 2011). According to Kotrlik and Williams (2003), η^2 coefficients below .01 are indicative of small effect sizes, between 0.01 and 0.059 are medium and effects above 0.138

can be considered as large.

Table 1. Pretest-Posttest differences for walk 1.

Measure	Pretest	Posttest	F (1, 31)	p	ω^2
<i>Tension-Anxiety</i> **	0.78 (0.86)	0.28 (0.36)	15.85	<.001	0.13
<i>Depression-Dejection</i> **	0.54 (0.69)	0.21 (0.40)	11.46	.002	0.08
<i>Anger-Hostility</i> *	0.31 (0.66)	0.13 (0.33)	4.26	.047	0.2
<i>Fatigue</i>	0.87 (0.83)	0.94 (0.70)	0.71	.792	–
<i>Vigor</i> *	2.46 (0.83)	2.77 (0.80)	6.13	.019	0.06
<i>Total Mood Disturbance</i> **	0.05 (2.98)	–1.21 (1.56)	11.25	.002	0.07
<i>Positive Affect</i>	2.16 (0.64)	2.32 (0.78)	3.02	.092	–
<i>Stress</i> ***	42.42 (29.77)	16.37 (19.76)	30.36	<.001	0.23
<i>Happiness</i> ***	69.35 (20.30)	83.54 (11.94)	21.01	<.001	0.17

Note: average, standard deviation of walk 1 for pretest and posttest scores, F statistic value and p value is referred for each of the variables above. p value < .05.

** = p value < .01.

*** = p value < .001.

Results

Results of first walk

According to their answers to the questionnaire, participants had worked an average of 6.86 (SD¼ 2.78) and 22.48 (SD¼ 15.78) hours, respectively, the day of and the week before data collection took place. The initial psychological state of the participants could be inferred from the pretest scores and might be described as generally good, as indicated in the Total Mood Disturbance (TMD) index. Specifically, they showed low levels of Tension-Anxiety, Depression-Dejection, Anger-Hostility and Fatigue, whereas their level of Vigor and Positive Affect was moderate. The Stress mean score was also moderate and the Happiness one, medium-high.

Repeated measures MANOVA conducted for assessing the differences between pretest and posttest scores in the study variables showed some statistically significant results. Participants attending the walk session had a significant reduction in *tension-anxiety*, *depression-dejection*, and *anger-hostility*. They also increased their level of *vigor* and perceived *happiness* while experiencing a decrease in *stress*. The magnitude of the effect sizes of these changes was moderate for all those cases (χ^2 ¼ 0.06–0.13) with the exception of Stress and Happiness, which might be considered large (χ^2 ¼ 0.23 and 0.17, respectively). These results are displayed in Table 1.

In Table 2, the ROS-S scores for this walk are shown. The global ROS-S score indicated that the walk was rated by the participants as restorative, as it had a mean of 3.17 out of 5 points. According to the scores given in the sub-domains, the most relevant restorative outcomes achieved through this activity were *attention restoration* and *relaxation and calmness* with medium to high values. By contrast, *clearing ones thoughts* and *reflection* got lower ratings.

Table 2. Restoration outcomes walk 1.

ROS-S domain	Score
Global score	3.17 (1.25)
<i>Relaxation & Calmness</i>	3.45 (0.93)
<i>Attention Restoration</i>	3.71 (2.81)
<i>Clearing ones thoughts</i>	2.75 (1.03)
<i>Reflection</i>	2.29 (1.45)

Note: 0 = Not at all; 1 = Very little; 2 = A little; 3 = Moderately 4 = A lot 5 = Completely.

Results of second walk

Participants reported that they had worked an average of 1.35 (SD= 4.16) and 44.08 (SD1 19.31) hours respectively the day and week data collection took place. Their pre-test score was low for *tension-anxiety*, *depression-dejection*, *anger-hostility* and *fatigue*. *Vigor*, *positive affect* and *happiness* were medium to high. Finally, participants rated their level of *stress* as low. Thus, it

can be stated that they showed a good psychological state, supported also by the *TMD* index score.

The statistical comparison between pretest and posttest scores revealed significant changes in most of the variables. Walkers experienced a reduction in *tension-anxiety* and *depression-dejection*. Additionally, they increased their level of *vigor*, *positive affect*, and perceived *happiness*. The *Stress* score was also reduced after the walk. The magnitude of the effect sizes for these changes was small for *vigor*, *positive affect* and *happiness* (η^2 0.01–0.03) and moderate for *depression-dejection*, *TMD* and *Stress* (η^2 0.07–0.10). Results of this analysis are shown in Table 3.

As can be seen in Table 4, the activity was evaluated as restorative by participants (average of 3.63/5). Again, *attention restoration* and *relaxation and calmness* were the most relevant achieved outcomes, whereas *clearing one's thoughts* and *reflection* obtained lower scores.

Table 3. Pretest-posttest differences for walk 2.

Measure	Pretest	Posttest	F (1,27)	p	ω^2
<i>Tension-Anxiety</i> **	0.71 (0.66)	0.32 (0.49)	11.97	.002	0.09
<i>Depression-Dejection</i> **	0.22 (0.31)	0.05 (0.13)	7.80	.009	0.10
<i>Anger-Hostility</i>	0.15 (0.33)	0.17 (0.80)	0.02	.877	–
<i>Fatigue</i>	0.39 (0.51)	0.43 (0.67)	0.07	.792	–
<i>Vigor</i> **	2.95 (0.66)	3.36 (0.52)	18.29	<.001	0.10
<i>Total Mood Disturbance</i> **	–1.47 (1.63)	–2.39 (1.44)	10.42	.003	0.07
<i>Positive Affect</i> *	2.53 (0.59)	2.75 (0.56)	8.64	.007	0.03
<i>Stress</i> *	24.82 (29.49)	10.60 (17.66)	6.43	.017	0.07
<i>Happiness</i> **	73.57 (20.13)	81 (16.44)	8.41	.007	0.03

Note: average, standard deviation of walk 2 for pretest and posttest scores, F statistic value and p value is referred for each of the variables above.

* = p value < .05.

** = p value < .01.

Table 4. Restoration outcome walk 2.

ROS-S domain	Score
Global score	3.63 (0.99)
<i>Relaxation & Calmness</i>	3.95 (1.04)
<i>Attention Restoration</i>	3.70 (1.31)
<i>Clearing one's thoughts</i>	3.44 (1.31)
<i>Reflection</i>	3.17 (1.25)

Note: 0 = Not at all; 1 = Very little; 2 = A little; 3 = Moderately 4 = A lot 5 = Completely.

Discussion

NW is a walking modality using two poles that effectively stimulates upper and lower body muscles and its practice has experienced significant growth from Finland to other western countries in the past decades (Lee & Park, 2015; Österlund-

Pöttsch, 2013). Evidence gathered to date has highlighted its therapeutic value after medical interventions or injuries and its effects on medical health variables. However, as stated in the introduction, much less is known about the psychological outcomes of this activity that may presumably entail important consequences regarding psychological health and well-being. The findings of the study showed that, in line with the theoretical basis and hypothesis of the study, the practice of NW leads to psychological benefits in terms of reduction of negative affect (walks 1 & 2) and increase of positive affect (walk 2) just after finishing the exercise session. The sizes of these changes are similar to those reported in previous studies on traditional walking (Gidlow et al., 2016; Johansson et al., 2011; Weng & Chiang, 2014). Further evidence to support this statement comes from participants' ROS-S answers, which indicated that the walk allowed them to relax, restore their attention capacity, clear their thoughts and reflect in different degrees. This was the first attempt to assess the psychological effects of this kind of activity, and these results are meaningful and promising, showing that further studying NW from this perspective could corroborate its psychological benefits and expand our knowledge on this matter.

From the perspective of leisure and occupational health research traditions, the findings were compatible with the role that has been previously assigned to physical activity in the maintenance of health and well-being. In this regard, pretest-posttest comparisons highlighted the benefits of this activity for alleviating stress and other psychologically deleterious effects. Additionally, answers to ROS-S indicated that the activity allowed the participants to calm down and restored attentional capacity. In the case of the former, it concurred with one of the main defining features of recovery activities, which is relaxation (Sonntag & Fritz, 2007). Therefore, the Nordic walks assessed in this study could have provided participants with detachment from life stressors as well, as the activity and the environments where the walks took place may not have represented the features of the activities or issues leading to stress and emotional fatigue for most people. Finally, even if the NW technique is not complicated, it still requires a certain level of accuracy and therefore requires learning, which also involves mastery, another factor for psychological recovery. This latter reasoning supports the claim of NW being a suitable candidate as a recovery experience.

In regard to research on NW as a whole, this contribution is original since previous studies were comprised of psychological measures and aimed at clinical populations (Lee & Park, 2015; Piotrowicz, Piotrowski, & Piotrowicz, 2016; Strömbeck et al., 2007). This study resumes a line of inquiry initiated three decades ago (Stoughton, 1992), but apparently not continued afterwards. We have evaluated the psychological effects of NW in a general population sample and discovered that this activity has positive implications in this sphere. In addition, regarding research on restoration, this study might be relevant for literature on this topic as it overcame limitations of previous work by including non-university samples, and performing a new activity in both city-center and urban beach settings (Subiza-Pérez et al., 2019).

A final consideration can also be made regarding the environments where the walks were performed. Studies on green exercise assume that physical activity, when performed in settings more natural than people's daily environments, will lead to greater psychological outcomes (Mackay & Neill, 2010; Pretty et al., 2003). In this study, walk 2 offered a very natural setting, whereas walk 1 went mostly along streets of the city center with low levels of green elements. Therefore, and considering that both walks caused a positive effect on participants' psychological state, we should consider that not only green environments provide *restorative experiences*; instead, the mere fact of being outdoors may result in positive psychological outcomes from exercise and physical activity¹. In this sense, it is worth noting those studies involving outdoor exercise seemed to show greater psychological improvements than indoor practice (Pasanen et al., 2014; Rogerson, Gladwell, Gallagher, & Barton, 2016; Thompson Coon et al., 2011), and other studies that did not find significant differences between environments showing different levels of naturalness (Bodin & Hartig, 2003; Butryn & Furst, 2003; Gidlow et al., 2016; Johansson et al., 2011). It might be that the city where we conducted the study, even in its less green parts, had a very friendly and walkable design (Frank, Schmid, Sallis, Chapman, & Saelens, 2005; Saelens, Sallis, Black, & Chen, 2003), along with a healthy social atmosphere. Thus, our choice of location may not have been representative of the average city or urban landscape. Consequently, an emerging question from this study would be the comparison among distinct levels of gray landscape (e.g., varying in walkability, esthetic value, friendliness, traffic congestion).

Study limitations, future lines of research and study implications

Limitations of this study should also be noted. First, it is well-known that the use of self-reported data when measuring affective states may be impacted by the participants' expectations about the activity and its psychological outcomes (Buckworth & Dishman, 2002). Second, the sample size was limited and the study lacked a control group. As stated by Schweizer and Furley (2016), the use of small samples could lead to an overestimation of effect size due to the greater vulnerability of strong variations in data. In this regard, we strongly recommend replicating this study with larger samples to better calculate the psychological effect of the activity. A self-selection bias may have also occurred as participants were recruited among the walk attendees. Another point that deserves consideration is that pretest-posttest measures reflected only affective states. Due to the fact that the posttest questionnaire was filled just after the walk, we were unable to conclude whether – and to what extent – the positive

benefits of the activity remain hours or days after the performance of the activity. Studies to come should include measurements in a wider time frame in order to address this specific question. Additionally, the inclusion of a wider set of measures would allow us to gather information about NW's influence on other variables (e.g., social outcomes or self-esteem) not included in this study, helping to develop a more holistic and comprehensive understanding of the benefits from NW.

Although it would be difficult to claim that NW does not have the psychological effect of other exercise modalities, results and conclusions here need further replication. Future studies should continue analyzing the psychological benefits of NW using larger samples and more complex designs (e.g., within-subjects or control groups). In addition, once the one single session effects were demonstrated, longitudinal studies might be able to assess the long term (or chronic) effects of NW. If these results are replicated and extended, it would be advisable to include this activity in public strategies aimed at developing healthier cities. Moreover, promoting psychologically healthy and socially positive activities in the public space would be a relevant contribution to the development of city models that are more sustainable, inclusive and socially harmonic.

Acknowledgements

Authors want to express their gratitude to the Euskadiko Nordic Walking Elkarte and Nordic Walking Donostia for their collaboration and openness at the time of planning and conducting the studies presented here, especially to Jesús M^a Eraña, Maria José Villalbo and Xabier Madina. Secondly, we also want to appreciate the assistance given by Aitziber Erkizia and Gabriela Renée Rivas in the field sessions. Thanks a lot for that long and unforgettable sunny Sunday Gabi.

Funding

This research was conducted as a part of the project "Attachment and Restorative Power of the Urban Space", funded by the University of the Basque Country UPV/EHU through its Convocatoria de Contratación para Formación de Personal Investigador in 2014 (PIFUPV- EHU2014/83).

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