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Adapted Physical Activity Can Increase Life Appreciation in Patients with Parkinson's Disease

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(Article begins on next page)

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3 **1 Title: Adapted physical activity can increase life appreciation in patients with Parkinson's Disease**

4
5 **2 Abstract**

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7 **3 Objectives:** This study aimed to measure the effect of a treatment of adapted physical activity (APA) on
8
9 **4** motor symptoms and on positive psychological resources in a group of patients with PD.

10
11 **5 Methods:** 37 patients with PD ($M_{age} = 71.5$; 70.3% male) completed measures of disability level, motor
12
13 **6** performance, distress, well-being and quality of life before and after participating to a program of APA
14
15 **7** (duration: 7 months). Analysis of variance - repeated measures was performed to evaluate the effect of
16
17 **8** APA on disability, distress and well-being.

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19 **9 Results:** After intervention, patients reported significant improvements in their motor autonomy,
20
21 **10** disability level, psychological distress and in life appreciation.

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23 **11 Discussion:** A brief physical activity program was beneficial not only on patients' motor functioning, but
24
25 **12** also on their mental health, by reducing distress and promoting life appreciation.

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28 **13** Keywords: Parkinson; Physical activity; Disability; Life appreciation; Well-being

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1 Introduction

2 Parkinson's disease (PD) causes a progressive decline of functional autonomy. It is characterized by
3 physical symptoms such as resting tremor, muscle rigidity, bradykinesia and balance disorders and by
4 mental symptoms such as depression, apathy, somatic stress and anxiety. The complexity of this disorder
5 may progressively impair patients' quality of life (Anzaldi & Shifren, 2019; Frazier, 2002; Sabari et al.,
6 2015).

7 Even though PD is a progressive disease, medical guidelines recommend treatments aimed at reducing the
8 motor side effects associated with PD's medical treatment, together with programs aimed at
9 maintaining/re-activating the patient's physical and mental autonomy.

10 Recommended strategies consist in guided physical activity and physical rehabilitation (Sabari et al.,
11 2015). These treatments benefit cardiorespiratory and musculoskeletal functions, metabolism, posture,
12 body structure and also mental health (Sabari et al., 2015; Inoue et al., 2019; Ylitalo et al., 2019). Adapted
13 physical activity - APA was applied for patients with PD and it was found to yield positive effects in terms
14 of motor and physical functioning (e.g., motor symptoms) (Abrantes et al., 2012; Canning et al., 2012;
15 Cugusi et al., 2014; Morris et al., 2009; Protas et al., 2005). Additionally, APA program was found to
16 improve patient's life quality by providing benefits for self-efficacy, autonomy and social support (Inoue et
17 al., 2019; Kosma et al., 2007).

18 The positive psychological effects of APA can be related to individuals' engagement in meaningful and
19 challenging activities that may trigger a state of enjoyment and pleasure (Delle Fave et al., 2011; Hefferon
20 & Ollis, 2006; Inoue et al., 2019). Furthermore, practicing physical activity is useful to prevent states of
21 depression, stress and anxiety and it can be considered a key ingredient for promoting individual's well-
22 being (Boen et al., 2019; Diener et al., 2017; Huffman et al., 2022; Netz et al., 2005). This approach is in
23 line with the recent studies on neurodegenerative disorders, that broadened their focus by including also
24 the positive aspects of life that may favour patients' coping with the illness, their resilience and well-being
25 (Anzaldi & Shifren, 2019; Cesetti et al., 2017; Dural et al., 2003; Frazier, 2002; Vescovelli et al., 2019a,
26 2019b, 2020; Zhang and Chen, 2019).

27 Among different models of well-being, the one postulated by Ryff (1989, 2014) underlines the strong
28 connections between psychological well-being (PWB) and physical well-being. PWB may have a buffering
29 effect for stress and may influence the onset and progression of chronic illnesses (Huppert, 2009; Ryff,
30 1989, 2014). Ryff's model of PWB encompasses 6 dimensions (e.g., self-acceptance, positive relations with

1
2
3 1 others, autonomy, environmental mastery, purpose in life, and personal growth), which were found to
4
5 2 have various patterns of correlations with different physical biomarkers (Ryff, 2014; Ryff et al., 2004).
6
7 3 The protective effect of physical activity and sports on well-being emerged also for older individuals (Bae
8
9 4 et al., 2017; Boen et al., 2019; Diener et al., 2017; Huffman et al., 1995; Netz et al., 2005; Rector et al.,
10
11 5 2019). Netz et al. (2005) found that aerobic and moderate intensity activities were significantly related to
12
13 6 psychological well-being. At the same time, greater well-being may help sustain physical activity in the
14
15 7 long term (Rector et al., 2019).
16
17 8 Physical activity may be linked to PWB in various ways. For instance, patient's awareness of his/her own
18
19 9 physical condition may promote self-acceptance; the physical benefits of exertion may foster autonomy;
20
21 10 an improvement in psychomotor skills and a direct familiarity with the environment may favour
22
23 11 environmental mastery. Finally, group activities, social comparison and the opportunity to share personal
24
25 12 experience with other group members may encourage positive relations with others and social well-being,
26
27 13 leading participants to achieve a sense of personal growth and purpose in life out of the rehabilitation
28
29 14 program (Boen et al., 2019; Claesson et al., 2018; Ghorbani et al., 2014; Kang & Ellis-Hill, 2015; Smith &
30
31 15 Bryant, 2016; Zhang & Chen, 2021).
32
33 16 While some patients could perceive the chronic illness as traumatic other patients may experience it as a
34
35 17 process of growth and may re-discover new sources of meaning and well-being (Vescovelli et al., 2018,
36
37 18 2019a, 2020). This psychological process had been labelled as post-traumatic growth (Tedeschi &
38
39 19 Calhoun, 1996). Psychological well-being and post-traumatic growth, in turn, may favour patients'
40
41 20 psychological adaptation to the illness and protect their physical and mental health (Vescovelli et al.,
42
43 21 2018, 2019a, 2020).
44
45 22 Studies focused on the experience of positive psychological resources within a medical illness found a
46
47 23 specific type of illness-related growth, conceptualised as "new awareness of the body" (Ghielen et al.,
48
49 24 2017; Hefferon et al., 2009; Hefferon, 2012; Vescovelli et al., 2020). Originally, Tedeschi and Calhoun
50
51 25 (1996) did not conceptualize this path of growth in their model of post-traumatic growth (PTG).
52
53 26 Specifically, it consists in a new manner of connecting with the body, which leads to a greater awareness
54
55 27 of the physical and the mental self and to a more positive illness adaptation. The embodied perception of
56
57 28 PTG may be indicative of a peculiar dimension of this construct, conceived as "Corporeal PTG" (Hefferon,
58
59 29 2012). Individuals with cancer, cardiovascular diseases, HIV and other chronic medical conditions
60
30 influencing body functioning reported to experience this corporeal PTG (Kampman et al., 2015; Barskova

1
2
3 1 & Oesterreich, 2009). Unfortunately, the PTG inventory developed by Tedeschi and Calhoun (1996) did
4
5 2 not assess corporeal PTG and no other psychometric tools have been created up to date.

6
7 3 While some studies focused on psychological and post-traumatic growth in PD, only little research
8
9 4 explored the benefits of physical activity programs in terms of promoting well-being and post-traumatic
10
11 5 growth. With a qualitative methodology, Sheehy (2014) documented that PD patients were able to
12
13 6 perceive benefits by participating to a group physical activity program, such as improvements in
14
15 7 psychological symptoms through the use of better self-regulation strategies, and improvements in well-
16
17 8 being. Patients reported that they were able to appreciate the use of humour and to help others, rather
18
19 9 than focusing on their negative illness complaints.

20
21 10 To the best of our knowledge, none of existing studies on well-being and personal growth in chronic
22
23 11 illnesses have explored these dimensions in a sample of patients with PD undergoing a physical
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25 12 rehabilitation program (APA). Given the protective role of well-being on the progression of chronic
26
27 13 diseases as PD, this study aimed at evaluating the effects of APA in patients with PD, by analyzing
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29 14 neurodegenerative condition, physical/motor functioning, psychological distress, well-being and personal
30
31 15 growth. Based on previous findings with other groups of PD patients, it was hypothesized that this specific
32
33 16 APA program would have yielded beneficial effects in terms of reduction of disability and of psychological
34
35 17 distress and improvement in well-being dimensions.

36 18

38 19 **Methods**

40 20 ***Participants***

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42 21 This study is part of a larger Phd project concerning the evaluation of well-being and psychological
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44 22 distress in patients with Parkinson's disease and their caregivers. For the purpose of the present
45
46 23 investigation we included 37 consecutive patients with PD. They were recruited in a physical
47
48 24 rehabilitation center located in Northern Italy. The inclusion criteria established by preliminary physician
49
50 25 screenings were the following: diagnosis for PD (established by previous neurological exams based on
51
52 26 specific clinical criteria and neurological tests); Hoehn and Yahr scale < 4 (Hoehn and Yahr, 1967); Mini
53
54 27 Mental State Examination (MMSE) (Folstein et al., 1975) > 24; absence of a psychiatric illness or cognitive
55
56 28 impairment. Patients participated to a 7-month adapted physical activity (APA) program in accordance
57
58 29 with the regional directives of the healthcare system, consisting of exercises specifically tailored for PD
59
60 30 patients.

1
2
3 1 The APA program started in September 2020 and finished in April 2021 and consisted of two 1-hour
4
5 2 weekly sessions delivered by an expert in physical activity trained in physical exercises for PD. The
6
7 3 program has never stopped but was interrupted only during Christmas holiday for 3 weeks, in compliance
8
9 4 with the anti-covid regulations. During that period patients were recommended to continue the physical
10
11 5 exercise at home guided by a manual delivered to them before the Christmas break. The physical exercises
12
13 6 that were taught are displayed in BOX 1.

14
15 7 Only participants who voluntarily accepted to take part in the research study and provided their written
16
17 8 consent were included in the research. All patients provided their informed consent and at the end of the
18
19 9 program there were no drop-outs. These patients were involved only in this physical treatment (they did
20
21 10 not take part to any other type of rehabilitation intervention). The Ethical Committee of the rehabilitation
22
23 11 center approved the study protocol.

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25 12

26 13 ***Measures***

28 14 All patients underwent an extensive medical and psychological evaluation (BOX 2) before the beginning of
29
30 15 the physical activity program (September 2020) and after its ends (April 2021).

32 16 *Neurodegenerative condition*

34 17 A physician (D.S.) evaluated patients' neurodegenerative condition with the following tools:

37 18 The *Unified Parkinson's Disease Rating Scale* (UPDRS) (Martinez-Martin et al., 1994) is one of the most
38
39 19 used clinical interviews for measuring common symptoms of PD including psychological distress and the
40
41 20 degree of motor disability. UPDRS is composed of four sections: evaluation of mental activity, behaviour
42
43 21 and mood; self-evaluation of activities of daily living; evaluation of motor function; evaluation of therapy
44
45 22 complications. The clinician administers semi-structured questions and rates patients' answers using a
46
47 23 likert scale from 0 = normal functioning to 4 = severe impairment. For example, for evaluating cognitive
48
49 24 impairment, a suggested question could be "Over the past week have you had problems remembering
50
51 25 things, following conversations, paying attention, thinking clearly, or finding your way around the house
52
53 26 or in town?"

56 27 The *Hoehn and Yahr Scale* has been used for the staging of the functional disability associated
57
58 28 with Parkinson's disease. It helps in describing the progression of the disease through various stages, thus
59
60 29 allowing us to measure the severity of each condition. The scale was originally published in 1967 in the

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2
3 1 journal Neurology by Melvin Yahr and Margaret Hoehn. That version included stages 1 (symptoms on one
4
5 2 side only, unilateral) to 5 needing a wheelchair or bedridden unless assisted. Since then, stage 0 has been
6
7 3 added (no signs diseases) and stages 1.5 and 2.5 have been proposed and are widely used.

8
9 4
10 5 The *Mini-Mental State Examination* (MMSE) (Folstein et al., 1975) measures the severity and the
11
12 6 progression of cognitive changes and impairment over time.

13
14 7 The *Parkinson's Disease Questionnaire 39 item* (PDQ39) (Jenkinson et al., 1997) is a patient-reported
15
16 8 clinical trial endpoint, which estimates the state of health and the quality of life of patients with PD. With
17
18 9 39-item it aims to analyse the following conditions: mobility (10 items), activities of daily living (6 items),
19
20 10 emotional well-being (6 items), stigma (4 items), social support (3 items), cognitions (4 items),
21
22 11 communications (3 items), and bodily discomfort (3 items). Patients may answer this questionnaire by
23
24 12 choosing an answer on a Likert-type scale ranging from 0 (never) to 4 (always). They have to rate how
25
26 13 often in the last month they have experienced specific difficulties for having Parkinson's disease.
27
28 14 Examples of items are "Had difficulty doing the leisure activities which you would like to do?" or "Had
29
30 15 difficulty dressing yourself? The scores of the eight sub-scales could be summarized in a single total score
31
32 16 Scale scores can range between 0 and 100 (100 = maximum level of problems). In the present study,
33
34 17 Cronbach's alpha (α) for the PDQ39 total scale was 0.908. Cronbach's alpha for the PDQ39 subscales was
35
36 18 as follows: $\alpha = 0.880$ for mobility, $\alpha = 0.847$ for activities of daily living, $\alpha = 0.855$ for emotions, $\alpha =$
37
38 19 0.713 for stigma, $\alpha = 0.596$ for social support, $\alpha = 0.651$ for cognition, $\alpha = 0.676$ for communications, α
39
40 20 $= 0.557$ for bodily discomfort.

41 21 *Physical / Motor functioning*

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44 22 An expert in physical activity (D.M.) administered the following tests:

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46 23 The *Six Minute Walking Test* (6MWT) (Balke, 1963) is a test that measures the patient's ability to walk as
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48 24 fast as possible for 6 minutes (taking breaks if needed). It provides information about the normal physical
49
50 25 abilities and its potential functional limitations. After each minute, the instructor measured the patient's
51
52 26 pulse rate, oxygen haemoglobin saturation and the meters walked. Dyspnoea was also measured before
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54 27 the conclusion of the test. For the purpose of this study, only the meters walked were considered.

55
56 28 The *Short Physical Performance Battery* (SPPB) (Guralnik et al., 1994) is an objective assessment tool that
57
58 29 combines the results of the gait speed, chair stand and balance tests. The battery is composed of three
59
60 30 sections. The first section consists in evaluating the motor balance of patients and is subdivided into three

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2
3 1 different sections (1) the maintenance of balance in upright stand for a duration of 10 seconds; (2) the
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5 2 maintenance of balance in semi-tandem stand — by placing the hallux of one foot near the heel bone of
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7 3 the other — for a duration of 10 seconds; (3) the maintenance of balance in tandem stand—by placing the
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9 4 hallux of one foot behind the heel bone of the other—for a duration of 10 seconds. In this first macro-
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11 5 section a score between 0 and 4 may be assigned. The second section consists in evaluating patients’
12
13 6 walking ability over a 4 linear meter surface on the basis of the performance time. In this section a score
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15 7 between 0 (unable to perform the test) and 4 (able to perform the test in less than 4.8 seconds) may be
16
17 8 assigned. The third section consists in evaluating patients’ ability to stand up and sit down from a chair for
18
19 9 5 times in a row. In this section, a score between 0 (unable to perform the test) and 4 (able to perform the
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21 10 test in less than 11.2 seconds) may be assigned.

22 11 *Psychological distress*

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24 12 A clinical psychologist (F.V.) administered the following psychometric tests:

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26 13 The *Psychosocial Index (PSI)* (Sonino & Fava, 1998; Piolanti et al., 2016) is a screening tool divided into
27
28 14 two different sections: a self-rating test and an observer-rating test. The scale of self-rating includes 55
29
30 15 items, of which 38 items (item 1-20; 37-54) were selected from Kellner’s Screening List for Psychosocial
31
32 16 Problems (SLP). The first observed rated part of the questionnaire (12 items) was administered to collect
33
34 17 *sociodemographic* and *clinical data* including information concerning medical and psychiatric history, the
35
36 18 patient's family, employment and habits (such as alcohol or drug use). Then, patients answered to the self-
37
38 19 report part of the questionnaire including 4 sections: stress, psychological distress, well-being, abnormal
39
40 20 illness behaviour, quality of life. The section on stress (17 items with yes/no answers) is an integration of
41
42 21 both perceived and objective stress, life events and chronic stress. The total score ranges from 0 to 17. The
43
44 22 *Well-being* section (6 items with yes/no answers) covers different areas of well-being, such as positive
45
46 23 relations with others, environmental mastery and autonomy, with a score ranging from 0 to 6. The
47
48 24 *Psychological distress* section (15 items) consists of a checklist of symptoms addressing sleep
49
50 25 disturbances, somatization, anxiety, depression and irritability. The total score may range from 0 to 45.
51
52 26 Questions 37-40 refer to sleep disturbances (range 0-12) and may also be scored separately from the
53
54 27 other questions. The section on *Abnormal illness behavior* (3 items) guides the clinician in the assessment
55
56 28 of hypochondriacal beliefs and bodily preoccupations. The total score may range from 0 to 9. Finally the
57
58 29 last item is a question for measuring *Quality of life* and its score may range from 0 to 4. Cronbach’s alpha
59
60 30 for the PSI total score in the present study is reported in BOX 3.

1
2
3 1 The *Symptom Questionnaire* (SQ) (Kellner, 1987) is a 92-item self-rating questionnaire composed of 92
4
5 2 dichotomous questions (“Yes” / “No”). It contains 4 scales of distress (anxiety, depression, somatic
6
7 3 symptoms, hostility-irritability) and 4 scales of well-being (relaxation, happiness, physical well-being and
8
9 4 friendliness). Each scale of stress varies within a range of 0-17 scores, whereas each scale of well-being
10
11 5 varies within a range of 0-6 scores. Cronbach’s alpha indicators in SQ total scales are reported in BOX 3.
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13 6

14
15 7 *Psychological well-being and personal growth*

16
17 8 The *Psychological Well-Being Scales* (PWBS) (Ryff, 1989) is a 42-item self-rating scale. It is composed of six
18
19 9 sub-scales in accordance with the six factors of positive functioning, namely autonomy, environmental
20
21 10 mastery, personal growth, purpose in life, positive relations with others and self-acceptance. Patients
22
23 11 answer the survey using a Likert-type scale ranging from 1 (strongly disagree) to 6 (strongly agree). The
24
25 12 negative answers have to be recoded and summarized in the final score. In the present study the same
26
27 13 items of the well-being section of the PSI were excluded in order to avoid redundancy (see previous
28
29 14 section). Examples of items are: “In general, I feel I am in charge of the situation in which I live”; “I think it
30
31 15 is important to have new experiences that challenge how you think about yourself and the world”.
32
33 16 Cronbach’s alpha values for the PWBS values are reported in BOX 3,

34
35 17 The *Post-traumatic Growth Inventory* (PTGI) (Tedeschi & Calhoun, 1996) is a 21-item scale assessing the
36
37 18 positive changes reported by individuals who have experienced a traumatic event. Patients are requested
38
39 19 to provide an answer referring to their PD diagnosis on a Likert-type scale ranging from 0 (I did not
40
41 20 experience this as a result of my crisis) to 5 (I experienced this change to a very great degree as a result of
42
43 21 my crisis.). Patients are requested to answer to item as follows: “I have a greater appreciation for the
44
45 22 value of my own life”, “I have a greater sense of closeness with others”. The questionnaire provides a final
46
47 23 score and five sub-scales scores of the following sections: relating to others (7 items), new possibilities (5
48
49 24 items), personal strength (4 items), spiritual change (2 items), and appreciation of life (3 items). The total
50
51 25 score may range from 0 to 105. In the present study, Cronbach’s alpha for the PTGI total score is reported
52
53 26 in BOX 3.

54
55 27 The *Life Satisfaction* (LS) (International Wellbeing Group, 2013) scale is a 1-item rating scale to estimate
56
57 28 patients’ life satisfaction by asking “How satisfied are you with your life as a whole?”. Answer may range
58
59 29 from 1 (completely dissatisfied) to 10 (completely satisfied).
60
30

1 **1 Statistical analyses**

2 Socio-demographic characteristics of the sample were analysed with descriptive statistics.

3 Bivariate correlations among neurodegenerative condition measures, physical/motor functioning
4 measures, psychological distress measures and well-being measures before and after the physical activity
5 program were calculated using Pearson's r coefficients (small = 0.1; medium = 0.3; large = 0.5) (Cohen,
6 1988). Since these are descriptive data, only correlations for the total scale scores are provided.

7 Pre-post differences in neurodegenerative condition (UPDRS, PDQ39), physical/motor functioning and
8 psychological distress measures (PSI, SQ) and well-being measures (PWBS, PTGI and LS) of the sample
9 were analysed with Anova Repeated Measures. Effect sizes were calculated using Cohen's d (small = 0.2;
10 medium = 0.5; large = 0.8). In order to provide a complete overview of the APA's effect, differences in all
11 subscales of the questionnaires were analysed and reported. The software used for our statistical analyses
12 was SPSS Statistics (25.0 version).

13 **14 Results**

15 Socio-demographic characteristics of the sample are reported in Table 1.

16 Correlations between variables are reported in Table 2 and Table 3. The most robust correlations were
17 among indicators of physical/motor functioning and scores at UPDRS and PDQ39. Measures of
18 psychological distress and psychological well-being were inversely correlated, but not significantly
19 correlated to indicators of motor functioning, also after the APA program.

20 After APA, significant improvements were reported in UPDRS total score ($F_{1,36} = 15.040, p = 0.001$), and
21 PDQ39 total score ($F_{1,36} = 35.445, p < 0.001$) (Table 4). PDQ39 resulted to be improved particularly in the
22 sub-scales of mobility ($F_{1,36} = 13.069, p = 0.001$), activities of daily living ($F_{1,36} = 22.262, p < 0.001$),
23 emotional well-being ($F_{1,36} = 7.765, p = 0.008$), stigma ($F_{1,36} = 5.797, p = 0.021$), cognitions ($F_{1,36} = 10.593, p$
24 $= 0.002$), and bodily discomfort ($F_{1,36} = 22.396, p < 0.001$).

25 Concerning physical/motor functioning (Table 4), a significant improvement both in meters walked ($F_{1,36}$
26 $= 14.532, p = 0.001$) and in the physical test's final score ($F_{1,36} = 5.484, p = 0.025$) emerged after APA.

27 Concerning the psychological distress dimensions, after APA patients reported significant improvements
28 in PSI total score ($F_{1,36} = 14.331, p = 0.001$), SQ total scale of anxiety ($F_{1,36} = 11.731, p = 0.002$), somatic
29 symptoms ($F_{1,36} = 13.385, p = 0.001$), hostility-irritability ($F_{1,36} = 3.938, p = 0.055$) (Table 4), documenting
30 a beneficial effect of APA on patients' psychological distress.

1
2
3 1 Concerning pre-post differences on well-being dimensions (Table 5), a significant improvement in PTG
4
5 2 sub-scale of appreciation of life ($F_{1,36} = 7.901, p = 0.008$) was observed with the largest effect size among
6
7 3 all variables included. PWBS and LS final scores were improved, but they did not reach statistical
8
9 4 significance.

10 11 5 12 13 6 **Discussion**

14
15 7 The main purpose of this research was to examine the role of APA in improving physical and psychological
16
17 8 health in individuals with PD. Our findings documented the beneficial effects of APA in regard to mobility,
18
19 9 activities of daily life, bodily discomfort, and motor function. These results confirmed previous literature
20
21 10 on the important role of APA in Parkinson's disease (Abbruzzese et al., 2016). Abbruzzese and his
22
23 11 research team (2016) observed that physical rehabilitation should be considered as a key-factor of the
24
25 12 medical treatment (medicines / surgery) for PD patients.

26
27 13 Concerning psychological distress, our results are in line with previous findings showing significant
28
29 14 reduction in emotional distress, anxiety, somatic symptoms, and hostility-irritability following the
30
31 15 physical activity program. The positive impact of the physical activity program on patient's mental
32
33 16 symptoms appears to be in line with recent research studies and reviews (Abbruzzese et al., 2016; Boen et
34
35 17 al., 2019; Cusso et al., 2016; Inoue et al., 2019; Wu et al., 2017).

36
37 18 The APA intervention had also a beneficial effect on some dimensions of well-being, particularly the life
38
39 19 appreciation subscale of the PTG inventory, which showed the most robust change after APA, according to
40
41 20 its effect size value. Life appreciation represents a core dimension of existential well-being and
42
43 21 psychological growth. This result fits with the model of "corporeal growth" as conceptualized by Hefferon
44
45 22 et al. (2012). A previous investigation documented that PD patients with high levels of psychological well-
46
47 23 being reported also changes in the perception of their body functioning and more awareness of their
48
49 24 bodies following the onset of their illness (Vescovelli et al., 2020). After improving their motor abilities
50
51 25 through the APA program, our PD patients reported an increased appreciation of life. It is possible that
52
53 26 they may have increased their body awareness and body functioning through the APA and, as a result,
54
55 27 they also developed a better appreciation of their present life conditions. Alternatively, it is possible that
56
57 28 the improvements in life appreciation might be due to the important role of social support, since APA was
58
59 29 delivered in a group setting. This setting may favour a process of social support and social comparison
60
30 among patients with PD (Boen et al., 2019; Claesson et al., 2018; Ghorbani et al., 2014; Kang & Ellis-Hill,

1
2
3 1 2015; Smith & Bryant, 2016; Zhang & Chen, 2021). These social benefits might result in a better
4
5 2 appreciation of life as well. In fact, during the post assessment, patients referred that they found the group
6
7 3 format very supportive and that the struggle of engaging in exercises helped them appreciate what they
8
9 4 were still able to do. Since to date no standardized measures have been developed for evaluating the
10
11 5 dimension of “corporeal growth”, future studies are recommended for filling this gap of research
12
13 6 (Vescovelli et al., 2020).

14
15 7 On the other hand, other dimensions of well-being, such as life satisfaction or other subscales of PTG and
16
17 8 of PWB did not show significant differences from pre to post intervention. A possible explanation for these
18
19 9 null results may be related to the small sample size, which limited the statistical power. Alternatively, it is
20
21 10 possible that the APA program did not affect the cognitive dimensions of well-being, such as satisfaction
22
23 11 with life or PWB subscales. In fact, the former has been defined as a global cognitive judgement of
24
25 12 satisfaction with one’s life (International Wellbeing Group, 2013), while the six dimension model of
26
27 13 psychological well-being was found to be strongly associated with the level of education, with the
28
29 14 cognitive skills and with the characteristics of the participants (Blasco-Belled & Alsinet, 2022). Thus, the
30
31 15 suitability of these measures for detecting improvements in well-being following APA programs needs to
32
33 16 be tested by future studies with larger samples.

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35 17 This study is limited by the small, self-selected sample size, the absence of a control group, and the use of
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37 18 self-reports for assessing psychological distress and well-being. However, the findings documented that
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39 19 the physical activity program (APA) not only helped patients to improve their motor abilities, but it also
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41 20 helped patients to reduce their psychological symptoms and to increase their well-being.

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43 21 The results of this study call for the necessity of enlarging the standard evaluation of patients with
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45 22 Parkinson’s disease by including the assessment of well-being and other dimensions of positive
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47 23 functioning. The combined assessment of well-being and distress, through appropriate and sensitive
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49 24 quantitative measures, according to the clinimetric approach (Carrozzino et al., 2020) may help clinicians
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51 25 to better capture profiles of patients’ problems and resources and to tailor treatments to their specific
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53 26 needs (Anzaldi & Shifren, 2019; Cesetti et al., 2017; Vescovelli et al., 2018, 2019a, 2019b, 2020).

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55 27 APA program appeared to be particularly beneficial for our sample of patients in terms of physical
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57 28 functioning, psychological distress and life appreciation. However, APA’s implementation may be difficult
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59 29 and it is not always included in the national health systems of countries. Future studies should better test
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30 30 the beneficial effects of APA interventions for PD patients by using control groups or by comparing APA

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3 1 with other types of physical treatments.

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5 2 A promising approach may be represented by the development of new digital technologies, such as virtual
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7 3 reality (VR) in order to deliver the APA treatment (Alves et al., 2015; De Melo et al., 2018; Thangavelu et
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9 4 al., 2020; Van der Kolk et al., 2019). Future studies should test if such VR approach might have similar
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11 5 positive results as traditional APA. In fact VR and computerized therapies may overcome barriers that
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13 6 patient with physical disabilities may encounter within traditional intervention and may be delivered
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15 7 directly at home. During the recent Covid-19 pandemic waves across countries, the possibility of
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17 8 maintaining rehabilitative programs for patients with chronic conditions as PD may be crucial, although
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19 9 the beneficial effects of the group setting might be lost. At the same time, it would be useful to support
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21 10 APA with a specific psychological program aimed to promote emotional well-being and life satisfaction in
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23 11 patients with vulnerable psychological profiles (Thangavelu et al., 2020; Zhang & Chen, 2021). Well-
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25 12 established psychological treatments (e.g., cognitive behavioural therapy, Thangavelu et al., 2020) or
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27 13 other mind-body techniques such as “Mindfulness” resulted to be well accepted by PD patients
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29 14 (Fitzpatrick et al., 2010) and to be effective in improving their cognitive and emotional functions (Advocat
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31 15 et al., 2016; Cash et al., 2016; Dissanayaka et al., 2016). These psychological programs may support and
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33 16 motivate PD patients to engage in specific rehabilitation program, which could further ameliorate their
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35 17 physical and mental conditions. The findings of this preliminary study, in fact, suggested that a simple
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37 18 rehabilitation program improved life appreciation and well-being of PD patients. Future studies with
38
39 19 larger samples are needed to confirm and replicate these promising findings.

40 20

41 21 **Clinical Implications**

- 42 22 • Significant improvements in distress, cognition, mobility, activities of daily life, bodily discomfort,
43 23 motor function and life appreciation emerged after an adapted physical activity program.
 - 44 24 • A combined assessment of motor functioning and distress with the measurement of well-being may
45 25 help clinicians to better capture profiles of patients’ problems and resources to tailor treatments
46 26 according to their specific needs.
 - 47 27 • A brief physical activity program was beneficial not only on patients’ motor functioning, but also on
48 28 their mental health, by reducing distress and promoting well-being.
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Table 1 *Socio-demographic and clinical characteristics of patients with PD (N=37)*

	M / N	SD (%)
Age	71.5 (age range 52-84 yrs)	7.1
Years of education	11.6	4.4
Years since diagnosis	5.4	3.9
Gender		
<i>Male</i>	26	70.3%
<i>Female</i>	11	29.7%
Marital Status		
<i>Not Married</i>	6	16.2%
<i>Married</i>	31	83.8%
Children		
<i>Yes</i>	35	94.6%
<i>No</i>	2	5.4%
MMSE	28.8 (score range 24-30)	1.3

Notes. PD=Parkinson's Disease; MMSE=Mini Mental State Examination.

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Table 2 Correlations in patients with PD before APA

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Covariable												
1. SPPB	-											
2. 6MWT	.748**	-										
3. UPDRS	-.628**	-.399*	-									
4. PSI total	-.107	-.145	.234	-								
5. PDQ39 total	-.280	-.302	.385*	.831**	-							
6. PWBS total	.233	.165	-.205	-.396*	-.375*	-						
7. SQ anxiety	-.211	-.071	.293	.643**	.641**	-.608**	-					
8. SQ depression	-.321	-.207	.397*	.531**	.535**	-.753**	.734**	-				
9. SQ somatization	-.195	-.210	.274	.699**	.594**	-.244	.652**	.507**	-			
10. SQ hostility-irritability	-.088	-.005	.325	.627**	.609**	-.336*	.678**	.583**	.525**	-		
11. LS Life satisfaction	.174	.104	-.191	-.318	-.347*	.472**	-.358*	-.244	-.217	-.154	-	
12. PTGI total	-.167	-.226	-.074	.066	.104	.275	-.048	-.212	.115	-.012	-.041	-

Notes. SPPB=Short Physical Performance Battery; 6MWT=Six minute Walking Test; UPDRS=Unified Parkinson's Disease Rating Scale; PSI=Psychosocial Index; PDQ39=Parkinson's Disease Questionnaire; PWBS=Psychological Well-being Scales; SQ= Symptom Questionnaire; LS=Life Satisfaction; PTGI=Post Traumatic Growth Inventory. * $p < 0.05$. ** $p < 0.01$

Table 3 Correlations in patients with PD after APA

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Covariable												
1. SPPB	-											
2. 6MWT	.657**	-										
3. UPDRS	-.205	-.190	-									
4. PSI total	.259	-.258	.267	-								
5. PDQ39 total	-.052	-.291	.552**	.577**	-							
6. PWBS total	.064	.217	-.186	-.413*	-.462**	-						
7. SQ anxiety	.184	-.026	.529**	.708**	.742**	-.506**	-					
8. SQ depression	.160	-.006	.410*	.605**	.618**	-.739**	.854**	-				
9. SQ somatization	-.100	-.298	.272	.515**	.373*	-.121	.528**	.402*	-			
10. SQ host,-irritability	.120	-.025	.408*	.538**	.670**	-.366*	.729**	.669**	.264	-		
11. LS	.025	.188	-.157	-.356*	-.489**	.500**	-.493**	-.478**	-.276	-.328	-	
12. PTGI total	-.137	-.167	.006	-.155	.092	.319	-.086	-.290	-.041	-.022	.097	-

Notes. SPPB=Short Physical Performance Battery; 6MWT=Six minute Walking Test; UPDRS=Unified Parkinson's Disease Rating Scale; PSI=Psychosocial Index; PDQ39=Parkinson's Disease Questionnaire; PWBS=Psychological Well-being Scale; SQ= Symptom Questionnaire; LS=Life Satisfaction; PTGI=Post Traumatic Growth Inventory. * $p < 0.05$. ** $p < 0.01$

Table 4 Differences in patients with PD (N=37) between T1 (before APA) and T2 (after APA) in PSI, SQ, UPDRS, PDQ39, 6MWT, SPPB

	T1		T2		F	Cohen's <i>d</i>
	M	SD	M	SD		
PSI						
<i>Distress</i>	10.59	5.29	7.35	6.31	13.036**	0.56
<i>AIB</i>	0.67	1.00	0.62	0.86	0.075	0.05
<i>Stress</i>	1.54	1.52	1.40	1.26	0.417	0.10
<i>Well-being</i>	7.03	1.14	7.24	1.74	0.722	0.14
<i>Quality of life</i>	2.49	0.77	2.65	0.79	0.225	0.20
<i>PSI total</i>	12.81	6.00	9.38	6.89	14.331**	0.53
SQ						
<i>Anxiety</i>	6.25	4.78	4.42	4.67	11.731**	0.39
<i>Depression</i>	6.11	4.21	5.78	4.45	0.496	0.08
<i>Somatization</i>	11.05	4.55	8.94	4.56	13.385**	0.46
<i>Hostility-irritability</i>	4.14	3.93	3.33	4.40	3.938*	0.19
UPDRS						
<i>Non motor problems</i>	14.53	6.63	12.22	5.91	6.846*	0.37
<i>Motor problems daily life</i>	13.03	7.30	10.25	6.3	11.065**	0.41
<i>Motor exam</i>	22.69	14.94	15.44	10.86	11.286**	0.55
<i>Motor complications</i>	1.28	2.63	0.69	1.73	2.190	0.26
<i>UPDRS total</i>	51.53	25.08	38.31	17.57	15.040**	0.61
PDQ39						
<i>Mobility</i>	40.59	24.47	28.73	20.67	13.069**	0.52
<i>Daily activity</i>	36.81	23.43	22.38	22.94	22.262**	0.62
<i>Emotional Well-being</i>	28.81	21.86	20.40	21.64	7.765**	0.39
<i>Stigma</i>	20.24	20.38	12.08	13.00	5.797*	0.48
<i>Social support</i>	13.05	21.86	9.86	19.70	1.068	0.15
<i>Cognitions</i>	35.54	23.37	25.76	18.03	10.593**	0.47
<i>Communications</i>	21.62	23.08	18.03	20.84	1.653	0.16
<i>Bodily discomfort</i>	42.59	28.07	24.08	21.71	22.396**	0.74
<i>PDQ39 Total</i>	238.70	106.90	160.89	84.84	35.445**	0.81
6MWT	384.2	110.0	415.7	102.4	14.532**	0.30
SPPB	9.3	2.5	10.1	2.6	5.484*	0.29

Notes. PSI=Psychosocial Index; AIB=Abnormal Illness Behavior; SQ=Symptom Questionnaire; UPDRS=Unified Parkinson Disease Rating Scale; PDQ39= Parkinson's Disease Questionnaire; SPPB=Short Physical Performance Battery; 6MWT=Six minute Walking Test * $p \leq 0.05$. ** $p \leq 0.01$

Table 5 Differences in patients with PD (N=37) between T1 (before APA) and T2 (after APA) in PWBS, LS, PTG

	T1		T2		F	Cohen's <i>d</i>
	M	SD	M	SD		
PWBS						
<i>Autonomy</i>	31.89	5.36	33.13	5.28	2.327	0.23
<i>Environmental mastery</i>	30.94	5.88	31.78	6.51	1.276	0.13
<i>Personal growth</i>	30.67	6.79	30.62	5.58	0.005	0.01
<i>Positive relationships</i>	33.05	6.08	33.59	5.23	0.568	0.09
<i>Purpose of life</i>	28.11	5.28	27.94	5.83	0.024	0.03
<i>Self-acceptance</i>	30.86	6.54	31.29	6.38	0.276	0.07
<i>PWBS total</i>	185.54	27.09	188.38	25.01	0.947	0.11
LS	7.14	1.60	7.57	1.42	0.122	0.28
PTGI						
<i>Relationships</i>	20.46	7.94	21.29	8.46	0.454	0.10
<i>New possibilities</i>	11.51	7.51	12.40	6.40	0.760	0.13
<i>Personal forces</i>	9.86	5.51	10.84	4.84	1.931	0.19
<i>Spirituality</i>	4.27	3.61	4.51	3.16	0.267	0.07
<i>Life appreciation</i>	7.59	4.58	8.89	4.21	7.901**	0.29
<i>PTGI total</i>	53.70	26.33	57.94	23.84	1.714	0.17

Notes. PWBS=Psychological Well-Being Scales; LS=Life Satisfaction; PTGI=Posttraumatic Growth Inventory. * $p \leq 0.05$. ** $p \leq 0.01$

BOX 1

Exercises included in the protocol of Adapted Physical Activity

1. Mobilization for neck and back pain
2. Mobilization for posture
3. Exercises of stretching
4. Exercises for manual dexterity
5. Exercises for coordination, resistance and breathing
6. Exercises for flexibility
7. Exercises facial gymnastics and gesture
8. Mobilization for the ankle
9. Exercise for balance and equilibrium
10. Relaxation
11. Aerobic exercises

BOX 2 Description of questionnaires

Questionnaire	Abbreviation	Minimum value	Maximum value
Hoeh and Yahr	n/a	0 (absence of disability)	5 (most severe level of disability)
Mini Mental State Examination	MMSE	0 (most severe level of deterioration)	30 (absence of deterioration)
Unified Parkinson's Disease Rating Scale	UPDRS	0 (absence of signs and symptoms)	199 (most severe level of disability)
Parkinson's Disease Questionnaire 39	PDQ39	0 (absence of disability)	100 (most severe level of problems)
Six Minute Walking Test	6MWT	N/A	N/A
Short Physical Performance Battery	SPPB	0 (impaired lower extremity function)	12 (better lower extremity function)
Psychosocial Index	PSI	0 (lowest level of distress)	48 (higher level of distress)
Symptom Questionnaire Anxiety Scale	SQ	0 (lowest level of anxiety)	23 (all of the symptoms are present)
Symptom Questionnaire Depression Scale	SQ	0 (lowest level of depression)	23 (all of the symptoms are present)
Symptom Questionnaire Somatization Scale	SQ	0 (lowest level of somatization)	23 (all of the symptoms are present)
Symptom Questionnaire Hostility-Irritability Scale	SQ	0 (lowest level of hostility-irritability)	23 (all of the symptoms are present)
Parkinson's Disease Questionnaire 39	PDQ39	0 (absence of problems)	100 (maximum level of problems)

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Psychological Well-being Scale	PWBS	0 (lowest level of well-being)	252 (higher level of well-being)
Post-Traumatic Growth Inventory	PTGI	0 (lowest level of change)	105 (highest level of change)
Life Satisfaction	LS	0 (lowest level of life satisfaction)	10 (highest level of life satisfaction)

BOX 3 Cronbach’s Alpha indicators in the questionnaires at T1 (before APA) and T2 (after APA)

Questionnaire	Pre-test	Post-test
PDQ39 total scale	0.913	0.913
PSI total score	0.729	0.775
SQ anxiety	0.658	0.650
SQ depression	0.549	0.555
SQ somatic symptoms	0.709	0.725

SQ anger-hostility	0.773	0.726
PWBS total scale	0.726	0.699
PTGI total scale	0.956	0.939

Notes. PDQ39 = Parkinson's Disease Questionnaire; PSI=Psychosocial Index; AIB=Abnormal Illness Behavior; SQ=Symptom Questionnaire; PWBS=Psychological Well-Being Scales; PTGI=Posttraumatic Growth Inventory.