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RESEARCH

Exploring adapted physical activity (APA) for individuals with intellectual and relational disability: findings from an exploratory Italian study

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Abstract
Adequate physical activity is crucial for health, preventing diseases such as diabetes, cardiovascular issues, and depression. The WHO advises adults to engage in 150 min of moderate or 75 min of intense activity weekly, with higher recommendations for seniors. Yet, those with intellectual relational disability (IRD) or psychiatric disorders often struggle due to exclusion from programs. In spring 2022, 203 IRD and 28 psychiatric disorder patients from Fondazione Sacra Famiglia participated in weekly 75 min APA sessions supervised by a kinesiologist and educator, using a customized "Modular APA" approach. Tests included Chair Sit and Reach, hand strength, Tug tests, heart rate, visual analog scale (VAS), and saturation levels. Multilevel statistical analysis adjusting for age and gender showed significant improvements with regard to "Chair Sit and Reach test" in severe and mild patients and "Tug test" across all patients, with most gains in initially less active patients. Psychiatric patients also improved in "Tug test". This study underscores APA's feasibility and benefits in enhancing physical performance and potentially life quality for IRD and psychiatric patients. Future efforts should increase APA frequency, integrate it into health standards, and base prescriptions on scientific criteria for sustained improvements and reduced healthcare costs.

Keywords Adapted physical activity · Disability · Psychiatric patients · Rehabilitation

Abbreviations
APA Adapted physical activity
SIDI Scheda individuale del disabile

Introduction

Adequate physical activity is a universally recognized as an essential tool for maintaining health and the efficiency of the body, as well as an irreplaceable tool for preventing the onset of many diseases [1]. Indeed, a broad literature demonstrates how physical activity serves as a form of therapy capable of preventing non-communicable diseases such as diabetes, obesity, cardiovascular diseases, depression, and various types of cancers [1].

In this regard, the World Health Organization (WHO) recommended a minimum level of physical activity in adults corresponding to a total of 150 min per week of moderate activity, or at least 75 min per week of intense activity in sessions lasting no less than 10 min, or an equivalent combination of moderate and vigorous activity [2]. In contrast, the elderly should increase moderate weekly physical activity up to 300 min or intense activity up to 150 min [2].

Additionally, a sedentary lifestyle poses a significant health risk, especially for individuals with intellectual relational disability (IRD) or psychiatric illnesses [3]. These individuals often struggle to adhere to WHO recommendations, mainly due to their frequent exclusion from participation in physical activity groups [4]. A recent meta-analysis highlights the effectiveness of physical activity in individuals with various

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disabilities who, being often inactive, can derive significant health benefits, even from low-intensity exercises [4].

In light of this evidence, the promotion of physical activity in individuals with intellectual relational disability (IRD) and/or psychiatric disorders becomes crucial, subjecting them to stimuli that facilitate social interactions, autonomy, and independence, and thus helping them stay physically active.

It is important to note that people with disabilities are a highly heterogeneous group in terms of age, type of disability, level of functionality, and years of living with the disability, so no one-size-fits-all approaches are available for the promotion of physical activity [4]. The proposal of APA sessions for individuals with IRD and/or psychiatric patients must, therefore, always consider not only their functional needs, but also their neuropsychological characteristics and personality [3, 5].

The low compliance of these populations, especially the psychiatric population, with continuous participation in diverse rehabilitative proposals, poses new challenges for care and rehabilitation aimed at achieving a better quality of life [3, 6].

In the context of defining an individual educational and rehabilitative plan, we believe that implementing movement-based interventions is effective, as suggested by previous literature related to APA [7, 8].

The Fondazione Sacra Famiglia, located in Cesano Boscone, in the metropolitan area of Milan, Italy, has been involved in the care of disabilities for many years and has consistently focused on the benefits of movement in individuals with IRD. Currently, the Fondazione proposes APA through a specific methodology developed from years of experience in this field, known as "Modular APA" [9].

The regularly conducted APA programs aim to provide a broad segment of the population facing fragility/disability with the opportunity to engage in physical activity tailored to the abilities and needs of each individual. APA is also recommended for individuals with intellectual relational disability (IRD) or psychiatric disorders, who tend to be inactive and, consequently, are at risk of aging characterized by chronic degenerative diseases.

The aim of this prospective observational study is to evaluate the impact of APA on four groups of patients: three groups with intellectual and physical disabilities and one group of psychiatric patients. The study has exploratory, hypothesis-generating and monitoring objectives for the APA activities proposed to the patients.

Methods

In the spring of 2022, a total of 199 individuals with intellectual relational disability (IRD) were recruited from residential disability facilities. Patients were categorized according to the Lombardy regional severity SIDI classification, where SIDI stands for "Scheda Individuale del Disabile", translated in English as "Individual Disability Record". Specifically, patients classified as SIDI 4 or SIDI 5 constituted the mild disability group, SIDI 3 patients were in the moderate disability group, and SIDI 1 or SIDI 2 patients constituted the severe disability group. Additionally, 28 individuals with psychiatric disorders admitted to the Psychiatric Community of Fondazione Sacra Famiglia were also recruited.

Almost all participants underwent weekly sessions of APA, each lasting 75 min. All sessions were conducted under the supervision of a kinesiologist and a professional educator.

The decision to limit physical activity to 75 min per week is based on the specific characteristics of the population involved in the APA program and supported by Ginis et al. [4]. These meta-analyses also demonstrate that health benefits can be achieved with less than 150 min of physical activity per week and suggest that any amount of physical activity is better than none.

The APA sessions followed a specific operational methodology developed by Fondazione Sacra Famiglia, the aforementioned 'Modular APA'. This approach involves a personalized combination of motor modules assembled based on the functional objectives and needs of each individual.

The 'Modular APA' method, implemented at the Fondazione Sacra Famiglia, adopts an approach divided into three domains:

- Physical Module: focuses on assessing the functional aspects underlying the activities of daily living (ADLs).
- Mental Module: evaluates the aspects guiding the use of cognitive, emotional, motivational, and behavioral resources.
- Social Module: analyzes communication patterns in interpersonal relationships, interactions with the environment, enjoyment of the activity, and overall quality of life.

These three domains are developed through an operational sequence divided into six distinct phases, each with specific timing and methods depending on the characteristics of the target population:

- Reception: This initial phase involves accompanying participants from their living units to the gym setting. It requires the full attention and professionalism of the instructor, as the welcome is never random, but aimed at fostering adherence to the session. Familiarity with the participants allows for the implementation of communicative actions that guide individuals toward a conscious approach to the day, with attention to current needs. Recalling pleasant past experiences and applying moti-

vational strategies can support the desire to repeat the activity.

- Start (motor activation): Involves opening procedures of the session, including initial contact, familiarization with the equipment, and a preparatory warm-up for the next phase. This entails the progressive activation of muscle groups and both small and large joints, sequenced according to the specific modules and oriented toward achieving the session's goals.
- Workload (goal-oriented functional work): includes the core content of the program targeting specific functional objectives. Exercises—either body weight or using adapted equipment—are tailored to individual capabilities, with the setting and technical content specifically adapted to each participant.
- Recover (muscle cool-down): a progressive reduction of workload using mobilization and guided or assisted stretching exercises. The aim is to prevent injuries and promote muscle blood flow, including for participants in wheelchairs.
- Relax (relaxation): a gradual redirection of participants' attention to reduce physical effort through guided breathing exercises. This phase encourages social reintegration within the group and marks the beginning of the session's closure.
- Greeting (end of session): a shared organizational moment among group members as they return to their living units. It includes a guided ritual involving structured verbal and non-verbal exchanges to consolidate awareness of the session's conclusion, perceived enjoyment, and anticipation of the next session.

All participants underwent the following functional evaluation tests at both baseline and during each APA session: Chair Sit and Reach, right-hand strength, left-hand strength, Tug Up, Tug Go, initial heart rate, final heart rate, maximum heart rate, visual analogue scale (VAS), initial saturation, final saturation, minimum saturation, and tandem test.All administered tests are validated in the general population. For certain participants, preliminary training and guided support during execution by a kinesiologist were necessary to facilitate proper test performance.

Statistical analysis

Gaussian continuous variables were described by mean and standard deviation. Median and interquartile range were used in case of skewness. Counts and percentages were used for categorical variables. Normality distribution of continuous variables was verified by the Shapiro–Wilk test.

The trajectories of the measured outcomes were explored using multilevel models with random intercepts, where the session sequence number of APA was included as an independent variable, adjusting for the patient's gender and age. The goodness of fit of the models was evaluated through the analysis of standardized Pearson residuals.

Results

The sample consisted of 231 patients, of whom 83 (35.9%) had severe disability, 15 (6.5%) had moderate disability, 105 (45.5%) had mild disability, and 28 (12.1%) were psychiatric patients. SIDI 1–2 had 51 (61.45%) males and 32 (38.55%) females, with a median age of 51 years (IQR 34–59). SIDI 3 comprised six (40%) males and nine (60%) females, with a median age of 49 years (IQR 37–57). SIDI 3–4 consisted of 63 (60%) males and 42 (40%) females, with a median age of 51 years (IQR 34–59). Psychiatric patients were represented by 24 (85.71%) males and 4 (14.29%) females, with a median age of 50.3 years (IQR: 44–53).

Considering the trajectories from the first to the third visit for all the tests performed, no deterioration in performance was observed (Table 1).

Significant improvements were noted in the Chair Sit and Reach test, with the mean score in the SIDI 1–2 group changing from 21.3 (visit 1) to 16.34 (visit 2, $p=0.013$) and to 14.39 (visit 3, $p=0.012$).

Improvement in this test is associated with enhanced musculoskeletal mobility, which in turn contributes to a better quality of life and facilitates assistance with basic activities of daily living.

In the SIDI 4–5 group, the mean similarly decreased from 18.26 (visit 1) to 15.80 (visit 2, $p=0.001$) and to 12.75 (visit 3, $p=0.005$).

Significant improvements were also observed for the Tug Up and Tug Go tests. In the SIDI 1–2 group, the mean increased from 12.02 (visit 1) to 15.27 (visit 2, $p<0.001$) and to 17.00 (visit 3, $p<0.001$). In SIDI 4–5 patients, the mean rose from 15.68 (visit 1) to 19.48 (visit 2, $p<0.001$) and to 18.06 (visit 3, $p<0.001$). Tug Up also showed improvements in the SIDI 3 group, increasing from 9.92 (visit 1) to 13.78 (visit 2, $p=0.001$) and to 14.20 (visit 3, $p=0.006$).

For psychiatric patients, a benefit was observed in the Tug Go test, with the score increasing from 11.74 (visit 1) to 10.63 (visit 2, $p=0.026$) and to 9.69 (visit 3, $p<0.001$).

This translates into greater safety during postural transitions in daily life, a reduced risk of falls, improved dynamic balance, and increased walking endurance.

Further statistically significant improvements can be observed in Table 1 for almost all other tests performed, although these did not reach a relevant clinical significance.

While several outcomes reached statistical significance, we acknowledge that the magnitude of some effects was modest. Specifically, we emphasize that even small

Table 1 Functional and physiological outcomes across disability severity groups and psychiatric patients during Adapted Physical Activity (APA) sessions

		SIDI 1–2				SIDI 3				SIDI 4–5				Psychiatrics			
	Time point	*n*	mean	sd	*p*	*n*	mean	sd	*p*	*n*	mean	sd	*p*	*n*	mean	sd	*p*
Chair sit and reach	1	37	21,30	14,74	Reference	11	13,91	14,54	Reference	88	18,26	15,45	Reference	27	14,04	11,86	Reference
	2	35	16,34	12,50	0,013	9	11,11	11,65	0,933	60	15,80	14,04	0,001	20	12,95	12,61	0,711
	3	23	14,39	12,08	0,012	4	14,00	10,03	0,125	44	17,36	12,75	0,005	18	14,28	11,04	0,85
	4	5	14,40	14,10	0,346	1	10,00		0,089	9	19,67	13,60	<0,001				
Right-hand strength	1	56	11,26	6,90	Reference	11	7,54	3,86	Reference	91	12,14	5,39	Reference	28	21,86	5,32	Reference
	2	42	12,71	7,77	0,16	8	8,31	3,64	0,377	64	12,64	5,55	0,168	20	21,72	5,28	0,286
	3	33	11,45	7,56	0,877	3	6,10	0,26	0,887	46	12,48	5,53	0,935	18	22,28	4,74	0,814
	4	6	15,15	8,66	0,442	1	2,30		0,283	10	11,63	5,08	0,665				
Left-hand strength	1	51	11,67	6,34	Reference	10	8,19	4,81	Reference	90	11,61	5,76	Reference	28	21,45	6,42	Reference
	2	41	11,94	6,71	0,645	7	7,17	2,39	0,382	63	11,78	5,66	0,502	20	20,47	5,15	0,539
	3	34	11,27	7,63	0,281	3	5,80	1,66	0,525	46	11,83	5,90	0,74	18	20,57	5,55	0,936
	4	6	15,53	10,22	0,374	1	2,20		0,161	11	11,65	5,68	0,415				
Tug up	1	41	12,02	6,75	Reference	12	9,92	4,64	Reference	91	15,68	7,22	Reference	28	18,96	7,42	Reference
	2	37	15,27	7,62	<0,001	9	13,78	6,44	0,001	64	19,48	7,24	<0,001	19	21,00	7,55	0,316
	3	24	17,00	8,27	<0,001	5	14,20	6,53	0,006	48	18,06	7,13	<0,001	18	21,61	6,18	0,165
	4	5	18,20	8,04	<0,001	1	23,00		0,002	11	21,18	7,65	<0,001				
Tug go	1	53	22,22	18,85	Reference	12	18,49	9,08	Reference	91	15,46	7,64	Reference	28	11,74	3,25	Reference
	2	42	17,56	15,07	0,073	10	15,85	6,22	0,123	61	12,71	15,24	0,138	20	10,63	2,94	0,026
	3	32	18,14	10,28	0,301	5	14,19	4,22	0,117	48	18,40	22,08	0,673	18	9,69	2,55	<0,001
	4	5	29,57	34,57	0,045	1	11,78		0,269	11	17,37	11,60	0,298				
Initial heart rate	1	68	77,57	14,53	Reference	13	81,77	11,53	Reference	101	74,00	12,84	Reference	28	89,11	19,28	Reference
	2	55	76,89	15,19	0,963	10	79,90	15,82	0,988	66	72,88	14,30	0,656	20	86,30	20,26	0,383
	3	41	75,88	14,96	0,837	5	73,80	12,52	0,465	49	75,20	11,45	0,579	18	81,11	20,04	0,069
	4	6	81,33	8,66	0,015	1	76,00		0,998	11	71,64	12,39	0,973				
Final heart rate	1	47	88,23	20,19	Reference	11	89,36	8,89	Reference	92	82,68	14,56	Reference	28	96,82	20,61	Reference
	2	42	92,93	21,58	0,116	10	85,20	16,89	0,827	62	86,52	14,97	0,041	20	96,40	17,15	0,782
	3	32	80,09	15,57	0,015	5	80,20	10,89	0,426	49	83,43	14,73	0,764	18	89,22	21,89	0,224
	4	5	89,80	8,35	0,634	1	80,00		0,808	11	80,00	16,29	0,517				
Maximum heart rate	1	11	90,91	11,98	Reference	4	94,25	7,41	Reference	21	80,86	14,78	Reference	22	96,41	19,64	Reference
	2	10	99,60	17,02	0,105	2	107,50	14,85	<0,001	14	79,93	19,67	0,855	16	97,00	14,89	0,647
	3	9	83,67	10,02	0,193	1	79,00		<0,001	14	85,21	12,23	0,483	14	92,00	19,43	0,769
	4	0				0				0							

Table 1 (continued)

		SIDI 1–2				SIDI 3				SIDI 4–5				Psychiatrics			
	Time point	*n*	mean	sd	*p*	*n*	mean	sd	*p*	*n*	mean	sd	*p*	*n*	mean	sd	*p*
Visual analog scale (VAS)	1	33	1,24	2,45	Reference	6	0,00	0,00	Reference	39	0,13	0,80	Reference	8	2,00	2,78	Reference
	2	33	0,24	1,00	0,018	6	0,33	0,82	0,303	38	0,00	0,00	0,098	9	0,33	1,00	0,034
	3	18	1,33	2,63	0,629	2	0,00	0,00	0,919	36	0,08	0,50	0,358	4	0,00	0,00	0,017
	4	2	0,00	0,00	0,026	1	0,00		0,766	6	0,00	0,00	0,1				
Initial saturation	1	68	97,22	2,37	Reference	13	97,92	0,95	Reference	101	98,19	1,20	Reference	28	98,18	0,61	Reference
	2	55	97,89	1,08	0,029	10	98,60	0,52	0,022	66	98,41	0,86	0,153	20	98,10	0,64	0,682
	3	41	97,24	1,09	0,948	5	98,80	0,45	0,029	49	98,16	0,92	0,772	18	97,83	0,71	0,056
	4	6	98,50	1,05	0,064	1	99,00		0,232	11	98,18	0,98	0,831				
Final saturation	1	47	97,11	2,05	Reference	11	97,09	1,70	Reference	92	97,68	1,29	Reference	28	98,29	0,81	Reference
	2	42	97,69	1,22	0,08	10	97,90	0,74	0,001	62	98,06	0,87	0,01	20	97,35	1,14	0,002
	3	32	97,50	1,22	0,213	5	97,80	1,30	0,004	49	97,84	1,01	0,292	18	97,44	1,42	0,01
	4	5	98,20	0,84	0,037	1	96,00		0,563	11	97,55	1,13	0,779				
Minimum saturation	1	11	97,36	1,03	Reference	4	97,50	1,00	Reference	21	97,00	1,92	Reference	22	97,95	0,65	Reference
	2	10	98,00	0,67	0,031	2	97,00	1,41	>0,999	14	97,93	1,00	0,097	16	97,13	0,96	0,001
	3	9	97,11	1,36	0,326	1	98,00		>0,999	14	97,71	1,07	0,242	14	97,00	1,47	<0,001
	4	0				0				0							
Tandem test	1	14	3,64	3,52	Reference	3	1,00	1,73	Reference	49	2,41	3,48	Reference	27	6,63	3,14	Reference
	2	16	5,06	3,77	0,004	2	3,50	4,95	<0,001	38	2,92	3,24	0,091	19	6,21	3,54	0,721
	3	11	3,64	3,93	0,165	3	0,33	0,58	<0,001	24	3,79	3,50	0,009	18	5,22	3,42	0,181
	4	1	0,00		0,88	1	0,00		<0,001	5	2,20	1,92	0,219				

improvements in functional or behavioral parameters—particularly in populations with complex needs—can translate into meaningful gains in autonomy, engagement, or quality of life. Furthermore, in line with the exploratory nature of the study, these results may serve as preliminary evidence to support the development of tailored interventions in similar settings. We agree that future studies should aim to quantify minimal clinically important differences to better contextualize the impact of observed outcomes.

Discussion

This study provides concrete insights supporting the feasibility and benefits of continuous physical activity in populations often excluded from such activities, namely psychiatric patients and individuals with intellectual and physical disabilities. Although the proposed physical activity regimen was less than the WHO's recommended 150 min per week, due to organizational challenges and the specific nature of the participants, significant benefits were still observed, particularly among the most sedentary and deconditioned individuals.

The observed improvements suggest that those who are initially less active derive the greatest benefit from APA. This indicates that even minimal engagement in APA can lead to noticeable improvements in physical performance and possibly quality of life. Furthermore, increasing the frequency and intensity of APA sessions could potentially yield additional benefits across all participant groups and in parameters that remained stable in this study.

Participation in "modular APA" sessions can also contribute to improved quality of life and social relationships for psychiatric patients or those with intellectual disabilities, even for those residing in institutional settings. This finding underscores the importance of integrating regular, adapted physical activity into the routine care of these populations.

Future studies should aim to increase the frequency of APA sessions to further explore and confirm these potential benefits. Additionally, addressing common barriers to APA participation, such as the inherent challenges of the disabilities themselves, lack of family support, and insufficient tailored programs in healthcare facilities, is crucial.

The literature supports these findings. For instance, a recent systematic review highlights several perceived barriers to regular physical activity in individuals with intellectual disabilities, including personal, family, social, financial, and environmental factors [10]. Understanding these barriers is critical for institutions and professionals to enhance participation in regular APA programs. Similarly, another review emphasizes the importance of physical activity for individuals with disabilities and identifies numerous barriers, including medical, psychological, social, and environmental obstacles [11]. Rehabilitation professionals, and in particular kinesiologists, may play a vital role in helping patients navigate these barriers and maintain physical activity.

Our study's strengths include the evaluation of a variety of exercise types, providing a comprehensive view of APA's impact.

Patient heterogeneity and varying observation periods represent important limitations of this study. The variability in cognitive, functional, and behavioral profiles among participants may have influenced both adherence to the intervention and response to the assessments, thereby potentially affecting the consistency of the results. Additionally, the differences in observation duration across subjects may have introduced a temporal bias in the outcome measures. To partially address these issues, individualized support was provided during the assessments, and the intervention was adapted to the specific needs of each participant. Despite these limitations, we consider the methodology appropriate for the exploratory nature of the study. Future research should aim to include larger and more homogeneous samples and standardized follow-up durations to enhance comparability and generalizability of findings.

Conclusions

This study highlights the benefits of APA in improving physical performance and potentially enhancing the quality of life for individuals with disabilities. Future efforts should focus on increasing the frequency of APA sessions included in health standards and prescribed according to strictly scientific criteria as a fundamental element for health. This would facilitate more comprehensive and lasting improvements for this disadvantaged population, as well as significantly reduce healthcare costs for the entire community.

Author contributions IG, GCG, GDG, and FEP designed the research. IG, SD, DT, and MM performed the research. IG, GVG, GDG, and FEP analyzed the data. All authors have read and agreed to the published version of the manuscript.

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Data availability Data supporting the findings of this study are available upon reasonable request from the corrisponding author.

Declarations

Conflict of interest The authors declare no competing interests.

Ethical approval This study received ethical approval from the Ethics Committee of Fondazione Sacra Famiglia-ONLUS. Data collection was conducted in accordance with the institution's ethical guidelines as part of normal rehabilitation activities and in accordance with Italian legislation

Declaration of Helsinki All research procedures involving human participants were carried out in compliance with the ethical standards of the institutional ethics committee and in accordance with the principles outlined in the Declaration of Helsinki (1964) and its subsequent amendments.

Informed Consent Written informed consent was obtained from all participants. For participants unable to provide informed consent personally due to cognitive limitations, consent was provided by their legally authorized representatives.

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