



## RESEARCH ARTICLE

# Development and evaluation of an adapted physical activity program in anorexia nervosa inpatients: A pilot study

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## Abstract

**Background and context:** Problematic use of physical activity is frequent in subjects with anorexia nervosa (AN). Although it increases resistance to therapeutic treatment, paradoxically, physical activity in AN can also improve mental and physical health. Based on the literature review we hypothesized that adding an adapted physical activity (APA) program to treatment programs could be more beneficial than a total suppression of physical activities. We designed this open study to evaluate the outcome of AN inpatients after an APA program implementation as well as the perceived effect of APA.

**Method:** Forty-one women with AN (17.2 ( $\pm$ 2.5) years old, BMI of 16.86 ( $\pm$ 2.0)) were included. An eight-session (1 h30/session/week) standardized APA program was delivered and evaluated by structured questionnaires assessing exercise dependence, perceived physical activity, eating disorder (ED) symptoms, body mass index (BMI), along with an interview before and after the APA program.

**Results:** Twenty-nine women complete the PA program and evaluation. BMI and perceived PA score significantly increased, ED and exercise dependence scores significantly decreased ( $p < .01$ ). Participants appreciated the program.

**Discussion/conclusion:** The inpatient program which included APA program helped AN inpatients in decreasing their ED symptoms and their dependence to PA, without any deleterious effect on BMI. Furthermore, APA was appreciated by participants.

### Highlights

- An adapted physical activity (APA) program which contained an educational component was specifically designed for anorexia nervosa (AN) inpatients and showed beneficial outcomes.
- The tested APA program did not constrain the body mass index increase in AN inpatients.
- The dependence to PA of the AN inpatients and their eating disorder symptoms were significantly decreased after the completion of the present APA program.
- The participants appreciated the proposed APA program.
- This study clearly pleads to conducting a multicentre randomized controlled trial in order to extend the present results into full clinical impacts.

### KEYWORDS

adapted physical activity program, anorexia nervosa, problematic physical activity

## 1 | INTRODUCTION

Anorexia nervosa (AN) is a severely debilitating eating disorder (ED), difficult to treat (Roux, Chapelon, & Godart, 2013) and with a mortality rate 12 times higher than the rate for all causes of death (Frank, Shott, & DeGuzman, 2019; Golden, 2003; Sullivan, 1995). AN is also characterized by important comorbidities (Marucci et al., 2018) including mood disorders, major depressive disorders (N. Godart et al., 2007), anxiety disorders (N. T. Godart, Flament, Perdereau, & Jeammet, 2002), obsessive-compulsive disorders, developmental disorders among autistic spectrum, and attention-deficit hyperactivity disorder (Rizk et al., 2020). Furthermore, problematic use of physical activity (PPA) is frequently observed in inpatients suffering from AN and depending on the definition of PPA, its prevalence concerns up to 54% of these inpatients. PPA is very challenging for AN inpatients (Dalle Grave, Calugi, & Marchesini, 2008) since it: (a) increases energy expenditure, interfering with nutrition rehabilitation (Rizk, Kern, & Godart, 2014); (b) increases somatic complications and risks of fractures and injuries (Rizk et al., 2014); (c) increases resistant to therapeutic treatment (Ng, Ng, & Wong, 2013); (d) increases length of hospitalization (Solenberger, 2001); (e) is a factor of poor treatment outcome (Dalle Grave et al., 2008); and (f) is frequently associated with negative psychological affects (Davis

et al., 1997). One way for the medical community to deal with these issues remains to prescribe PPA forced cessation in inpatient treatment programs. However, this action might be as problematic since it is often followed by irritability, anxiety (Beumont, Arthur, Russell, & Touyz, 1994; Junne et al., 2016), and a sense of guilt with an extreme fear of weight gain. Indeed in AN inpatients, physical activity is used as a compensatory behaviour to control weight and shape (Mond, Hay, Rodgers, & Owen, 2006) and to alleviate anxiety (Holtkamp, Hebebrand, & Herpertz-Dahlmann, 2004; Peñas-Lledó, Vaz Leal, & Waller, 2002), depressive symptoms (Peñas-Lledó et al., 2002) or stress (Casper & Jabine, 1996; Keyes et al., 2015) and paradoxically it improves nutritional status and heart function in severe AN (Rizk et al., 2019).

In activity based anorexia models, PPA is considered as a complex behaviour because it involves partly voluntary and involuntary aspects (Rizk, 2015b; Rizk et al., 2020). On one hand, voluntary PPA is consciously used since the beginning of the disorder to increase energy expenditure mainly for weight loss purposes and is often practiced in a secretive and ritualized manner (Rizk et al., 2015; Rizk et al., 2020). With time, individuals could voluntarily increase the duration and/or the intensity of PA, as well as daily activities (i.e., taking the stairs instead of the elevator). A parallel mechanism may also be at play between the amount of food ingested and the volume of physical activity: physical activity will

allow the inpatient to compensate for what he/she ate after a meal (Kohl, Foulon, & Guelfi, 2004). On the other hand, PPA could partially be or become involuntary with manifestation of persistent restlessness and constant need for movement which are the most striking features (Kohl et al., 2004). In fact inpatients are unable to stand still even for a short period of time (Rizk, 2015a). These involuntary features in PPA have been described by inpatients as more intense but more disorganized and aimless than the voluntary ones (Kron, Katz, Gorzynski, & Weiner, 1978).

Nowadays, there is still no clear consensus on how to treat PPA in AN. One possibility may be the inclusion of adapted physical activity (APA) sessions in the therapeutic treatment of AN (Cook et al., 2016). APA is an activity that supports active lifestyles and sports according to individual differences (i.e., psychiatric disorders, physical disability, elderly, etc.). APA is a generic term that links physical activities with adaptation of various environmental, social and individual systems (Hutzler & Sherrill, 2007). It has been defined by the International Federation of Adapted Physical Activity as “a cross-disciplinary body of knowledge directed towards the identification and solution of individual differences in physical activity” (Hutzler & Sherrill, 2007). APA programs have been associated with positive outcomes in AN; more specifically aerobic and resistance training result in significantly increased muscle strength, BMI and body fat percentage (Vancampfort et al., 2014). Aerobic exercise, yoga, massage and basic body awareness therapy significantly lowered scores of eating pathology and depressive symptoms. In addition, distorted feelings about food and exercise (emotional commitment to exercise and exercise involvement) were reduced, and cardiovascular fitness was also improved (Ng et al., 2013). Finally, APA does not seem to have a detrimental effect on nutritional status evaluated by body weight, BMI, and percentage of body fat or lean body mass (Hausenblas, Cook, & Chittester, 2008; Ng et al., 2013; Vancampfort et al., 2014; Zunker, Mitchell, & Wonderlich, 2011). However, APA seems to be safe (without deleterious effects on body composition and socio-psychological factors) only when it is managed by a specialist (Ng et al., 2013). Cook et al. (2016) wrote guidelines to propose physical activity programs for AN inpatients by highlighting the needs “to screen for exercise-related psychopathology”. They added the necessity to identifying individuals that endorse pathological attitudes and behaviours towards exercise (e.g., hyperactivity, exercise dependence, exercise addiction, and compulsive exercise) since these characteristics may indicate that unsupervised exercise could exacerbate ED pathology. With AN inpatients, despite

the severe impact of PPA and the potential positive impact of APA, neither APA programs nor their impact were previously designed and published with the aim to minimize PPA among hospitalized AN patients. That is why our team, with the involvement of APA teachers and clinicians (nutritionists and psychiatrists), developed an 8-week APA program as relevant as possible to AN inpatients (Kern & Fautrelle, 2018a, 2018b). The first aim of this program is to normalize levels and patterns of physical activity. A second purpose is to raise and adjust awareness of bodily sensations in a more balanced cognitive appraisal. Based on therapeutic education protocol using balanced muscle fitness and shadow kickboxing, the Kern & Fautrelle APA program objective is that inpatient behaviours regarding physical practices move from PPA to a healthy physical practice with enhanced insight. As such, the present open study objectives are (i) to evaluate the impact of this APA program on physical (BMI) and psychological dimensions (physical activity perception, dependence to physical exercise, ED symptoms, quality of life) in hospitalized AN patients and (ii) to evaluate AN inpatients narratives on perceived effect of APA program using a qualitative method.

## 2 | MATERIALS AND METHODS

### 2.1 | Ethical statement

This research study was approved by the local ethical committee of the Institut Mutualiste Montsouris (Committee for the Evaluation of Protocols and Research Assistance [CEPAR] authorization number: 2016-002). Informed consents were obtained from all participants, along with an authorization from all parents of participants under 18 years of age.

### 2.2 | Participants

The inclusion criteria were: inpatients from 13 to 20 years of age, consecutively admitted in two ED centres (the Institut Mutualiste Montsouris, Paris, and the Poissy Pediatric Hospital) for AN according to French Guidelines (Haute Autorité de Santé, 2010), understanding, reading and writing French, and giving their informed consent—and their parents' informed consent if under 18 years. In this study, there was no lower BMI limit. For each patient, the clinical state was globally and regularly evaluated by the physician of the team who gave their authorization to participate based on results from the clinical exam (including ECG) and capacity to eat and

drink enough. The exclusion criteria were somatic complication forbidding any physical activity, and individuals refusing to participate in the research (for information, no approached inpatient refused to participate in this research). Structured physical activity was not permitted outside the APA program for patients included in our study.

The patients did not leave the hospital for at least the first half of the treatment. Then, outings were gradually re-authorized, with the patient's strict commitment to not practice any sport or structured physical activity during the outing.

Forty-one hospitalized AN women were included. These subjects came from two different French therapeutic centres: the Institut Mutualiste Montsouris, Paris ( $n = 31$  inpatients) and the Poissy Pediatric Hospital ( $n = 10$ , inpatients).

Among the included subjects only 10 were included in the qualitative part as the qualitative research needs less participants. We included this evaluation in the last session.

## 2.3 | APA program

The proposed APA program (Table 1) was specifically created for AN inpatients (Kern & Fautrelle, 2018) with or without PPA and was published (Kern et al., 2018). It was designed to follow three main objectives defined according to the PPA observed in person with AN both in the literature and in our clinical practice. The three objectives were as follow: (i) to do a controlled and safe practice; (ii) to do a balanced physical practice taking into account the agonist as well as the antagonist muscular chains; and (iii) to realize a PA collective practice introducing the notion of pleasure. The manual details the APA program's objectives, ability to implement for AN inpatients, the detailed teaching contents, the pedagogical principles to be followed along with the precautions to be taken in this context are described in the manual. Both the APA program manual, and the booklet of good practices in physical activities for inpatients suffering from AN, are free and available (Kern, Fautrelle, & Godart, 2018). Persons with AN often practice PA in a way that rise ethical question to PA instructors (Giordano, 2005). Our program allows to go beyond this question since it aims to maximize the benefits while minimizing the risks of PA for people with AN. It allows to put the patients in an empowerment position, and to go beyond the paternalistic position which would consist in completely banning the PA without making the patient responsible.

## 2.4 | Evaluation

Tests, questionnaires and BMI were collected during the first and the eighth session by APA teacher in collaboration with medical teams.

Participants were first asked to provide gender information, age, height, weight, and socio-demographic data. Self-reported questionnaires were used to evaluate the physical activity perception, the dependence to physical exercise, the ED symptomology, the health-related quality of life and the satisfaction of the program.

### 2.4.1 | Physical activity

The Godin Leisure-Time Exercise Questionnaire (GLTEQ) (Godin, 2011; Godin, Jobin, & Bouillon, 1986) is a self-reported measure of the frequency of mild, moderate and high-intensity, leisure-time physical activity with satisfactory psychometric qualities. This questionnaire consists of three questions on the frequency of practice (light, moderate, and sustained) and a question on the frequency of PA practice in a typical week. A weekly leisure-time overall activity score is then calculated in terms of metabolic equivalents (METs). A higher score indicates higher levels of activity. A higher score is associate to increased declared energy expenditure, thus increased PA practice.

### 2.4.2 | Dependence to exercise

Dependence to exercise was evaluated with two instruments: The Exercise Dependence Scale-Revised (EDS-R) (Hausenblas & Downs, 2002) and the Exercise Dependence Questionnaire (EDQ) (Ogden, Veale, & Summers, 1997). Both tools have been validated and have satisfactory psychometric qualities. The EDS-R is a 21-item Likert-scale questionnaire that assesses the extent (1 = never to 6 = always) to which the respondent exhibits characteristics of exercise dependence. Higher scores show more symptoms of exercise dependence. The instrument has seven subscales (tolerance, withdrawal, continuance, lack of control, reduction in other activities, time, and intention effects) based on the DSM-IV criteria for substance dependence and a total score. A high score for each dimension and a higher total score indicate possible problematic practice. The EDQ is a self-report measure that conceptualizes exercise dependence within both traditional biomedical and psychosocial perspectives. It consists of 29 items Likert-type scale that assesses (1 = never to 6 = always) and eight factors (interference

**TABLE 1** PAPAPAM in brief

<b>Integration of PA into a multimodal therapeutic care concept consisting in:</b>	<b>The AN hospitalization care is in accordance with the French HAS Guidelines (2010) and is provided by multidisciplinary teams (occupational therapy, diet counselling, psychological therapy, psychiatric and medical care, psychometrician)</b>
Adapted physical activity program duration	Eight sessions, 90 min each, once per week S1 and S8: Pre- and post-APA program evaluations
Material	Sports hall (40 m <sup>2</sup> ) Sports mat, ball, traffic cones sports, hoop skirt
Aim of the APA program	To control the PA practice To learn to safely practice (education and posture) To develop a balanced physical practice taking into account the agonist as well as the antagonist muscular chains To develop and associate PA with collective practice To promote the pleasure notion when performing physical activities
Activities	Shadow French boxing Muscular workout Physical education: Sport nutrition, hydration, sleep, good practice rules
Typical content of a session	Welcome (5 min) General and specific warm-up (15 min) Muscular workout (25 min), with bodyweight or low resistance exercises Shadow French boxing: Low intensity cardiovascular endurance (25 min) Cool down: Back to homeostasis (10 min) Debriefing and take-home messages (10 min)
Educational precautions	Create a group dynamic Provide theoretical content in addition to practice Promote success, pleasure and communication Explain the instructions in diverse ways if necessary Respect the continuity of the session, and from one session to another (taking into account fatigue, wishes, ...) Give general information on the practice of physical activity, safety, hydration, and recovery (cf. “good practice book”). It should discuss during sessions, in an “informal” way, in the form of an exchange, not a lecture Promote work mainly in pairs, observation of the partner, correction of his/her position, exchange of information Value intermittent work (work/rest—passive, active) Promote progressive work in autonomy: Participation of practitioners in the warm-up and exercises starting Session 2 Propose appropriate rest period between each exercise to hydrate Propose toilet breaks in the middle of each session if necessary (in all cases, think to ask about it) Make sure participants are not too tired (observe fatigue indicators—sweating, shortness of breath, very red or white face, etc.) Regularly evaluate the progress of participants by asking them to suggest exercises for warm-up or stretching, or by asking them to identify which muscles are required for a particular exercise Encourage: Give positive reinforcement, value success, find solutions to successfully perform an exercise in case of failure

with social/family/work life, positive reward, withdrawal symptoms, exercise for weight control, insight into problem, exercise for social reason, exercise for health reasons and stereotyped behaviour). We excluded in this study the dimensions related to motivation for practice. A high score indicates a high motivation to practice PA for weight, health or social reasons.

### 2.4.3 | ED symptomatology

ED symptoms were assessed using the Eating Disorders Examination-Questionnaire (EDE-Q v.5.2) (Fairburn, Cooper, Shafran, & Wilson, 2008). The EDE-Q is a 28-item self-report questionnaire based upon the full-length eating disorder examination interview (Fairburn, Cooper, & O'Connor, 1993). It includes four subscales and a global score. It concerns behaviours over the past 28 days and provides a measure of the range and severity of ED features. It is scored on a 7-point scale from 0 to 6 and a higher score reflects more severe aspects of the psychopathology of the ED.

### 2.4.4 | Health-related quality of life

The DUKE Health Profile (Guillemin, Paul-Dauphin, Virion, Bouchet, & Briançon, 1997) is a 17-item Likert-type scale (0: never to 2: always) self-report generic health-related quality of life measure cross-culturally in French. It evaluates 10 dimensions (physical, mental, social, general, perceived health, self-esteem, anxiety, depression, pain) with scores varying from 0 to 100. A higher score (100) indicates better quality of life for physical, mental, social, general, perceived health, self-esteem. For anxiety, depression, anxiety-depression, pain, and disability, 100 indicates the worst health status and 0 indicates the best health status.

### 2.4.5 | The Narrative Evaluation of Intervention Interview

The Narrative Evaluation of Intervention (NEII) is a qualitative interview made of 16 open-ended question designed to evaluate the process and the outcome of interventions for persons with mental disorder (Hasson-Ohayon, Roe, & Kravetz, 2006).

## 2.5 | Statistics

Statistical analysis was performed using SPSS software (SPSS Statistics, version 23.0; Chicago, IL) for quantitative

data and IRaMuTeQ 0.7 alpha 2 software (Interface pour les Analyses Multidimensionnelles de Textes et de Questionnaires) (Ratinaud, 2009) for qualitative data.

First descriptive statistics were produced. Numerical variables were summarized as mean and *SD*, whereas counts and frequencies were used for categorical variables. In order to investigate the impact of the APA program on the recorded measures, we first checked that each variable was normally distributed (cf. Table 2). Then Student's *t*-test with repeated measures were conducted for each investigated variable. Moreover, to demonstrate more robustness of the observed APA program effects, effect sizes were tested using the partial eta squared (*ES*) variable. It was classified as small ( $0 < ES < 0.5$ ), medium ( $0.5 < ES < 0.8$ ), large ( $0.8 < ES < 1.3$ ), and very large ( $ES > 1.3$ ) according to (Cohen, 1988). Finally, due to sample size, number of analyses and the inherent risk of a statistical type 1 error (fixed to 5%), results with a *p*-value  $< .05$  and a moderate to large effect size were considered as significant and clinically meaningful.

IRaMuTeQ provides five types of analysis (clusteric text statistics; specificities of research groups; descending hierarchical clusterification or; similitude analysis and word cloud). The methods are detailed in Chaves, dos Santos, dos Santosa, and Larocca (2017). Lexicometric analysis of inpatient narratives were performed on both process and outcome textual data.

For our scope, first, we performed an analysis to obtain a word cloud, in order to highlight the 65 most used words in the corpus. Second, we carried out a simple classification on text segments with the Reinert's method (A. Reinert, 1983; M. Reinert, 1990). This method allows to create groupings of words most representative of the class. The present analyse will focus on the text segments of the collected corpus of titles. The results reports a classification summary (the average number of occurrences for each segment, and the number of classify segments in the whole corpus) which is plotted by a dendrogram, and some class profiles.

A similarity analysis (i.e., co-occurrences analysis) is also performed to obtain a graph in which the peak and the text sizes are proportional to the workforce and the edge sizes proportional to the index. This last analysis provides about the associations between thematic.

## 3 | RESULTS

### 3.1 | Inpatients' characteristics at baseline

The sample was composed of 41 hospitalized young women suffering from AN [17.1 ( $\pm 25$ ) 16.4 years old

**TABLE 2** Descriptive characteristics ( $N = 41$ )

		Min	Max	Mean	SD	Skewness	Kurtosis
Age	Age	14.00	19.00	16.35	1.33	0.34	-0.56
Body mass index	BMI	13.05	22.77	16.76	2.03	0.70	1.13
Physical activity	GLTEQ	3.00	119.00	34.02	26.81	1.15	1.11
Sedentarity	Sedentarity	0.00	1,080.00	353.40	258.70	0.65	0.05
Exercise dependence scale	Withdrawal	1.00	5.67	3.10	1.49	0.01	-1.22
	Continuity	1.00	6.00	2.53	1.46	0.93	-0.10
	Tolerance	1.00	6.00	3.65	1.67	-0.20	-1.29
	Lack of control	1.00	6.00	3.11	1.66	0.12	-1.23
	Reduction in other activities	1.00	6.00	2.67	1.56	0.75	-0.43
	Time	1.00	6.00	3.00	1.52	0.42	-1.11
	Intention	1.00	6.00	2.96	1.50	0.47	-1.00
	Total score	1.00	5.43	3.00	1.15	0.52	-0.37
Exercise dependence questionnaire (motivation)	Weight	1.00	6.00	4.02	1.18	-0.59	-0.19
	Social	1.00	4.67	2.65	1.10	0.15	-0.81
	Health	1.00	6.00	4.21	1.43	-0.60	-0.53
Quality of live (Duke)	Physical	20.00	100.00	65.53	18.39	-0.72	0.31
	Psychological	0.00	80.00	38.26	21.43	0.24	-0.70
	Social	10.00	100.00	55.53	20.62	-0.14	-0.19
	Total	16.67	83.33	53.04	15.18	-0.03	-0.54
	Perceived health	0.00	100.00	35.23	36.69	0.53	-0.94
	Self-esteem	0.00	90.00	45.32	20.41	-0.08	-0.50
	Anxiety	16.67	91.66	53.62	18.31	0.27	-0.61
	Depression	20.00	90.00	50.43	19.89	0.13	-1.05
	Pain	0.00	100.00	39.36	34.48	0.31	-0.83
	Limitation	0.00	100.00	88.30	29.88	-2.43	4.58
EDE-Q	Compulsivity item	0.00	35.00	9.62	11.31	0.86	-0.79
	Restraint	0.00	6.00	2.92	1.83	0.13	-0.92
	Eating	0.20	4.60	2.93	1.28	-0.32	-1.01
	Shape	2.50	6.00	5.02	1.02	-1.11	0.48
	Weight	1.60	6.00	4.12	1.32	-0.14	-1.10
	Global	1.67	5.60	3.76	1.16	-0.12	-1.23

Abbreviations: BMI, body mass index; GLTEQ, Godin Leisure-Time Exercise Questionnaire; EDE-Q, Eating Disorders Examination-Questionnaire.

( $\pm 1.3$ ), BMI = 16.8 ( $\pm 2$ )]. Their characteristics reflects the different AN inpatients profiles observed in clinical practice concerning physical activity (Table 2). Specifically, a high heterogeneity was found for the declared sedentary lifestyle ( $353.4 \pm 258.7$ ) and the quantity of physical activity measured with the GLTEQ ( $34 \pm 21.1$ ). Similarly, heterogeneity was also reported for the quality of life in the overall dimensions of the Duke Health Profile (with an average  $SD$  equal to 25.3), and for the item 18 of the EDE-Q scale that measures “compulsory

exercise” ( $9.6 \pm 11.3$ ). To a lesser extent, such a result can also be reported in the different dimensions and the total score of the EDS-R. We noticed that 24% of the inpatients report never done physical activity, 32% rarely, 18% sometimes and 20% often. Finally, the results coming from the EDS-R demonstrated that the mean is 3.11 (6 max), with high score in the dimensions of tolerance ( $3.8 \pm 1.6$ ), time ( $3.3 \pm 1.5$ ; withdrawal ( $3.2 \pm 1.6$ ), lack of control ( $3.2 \pm 1.7$ ), and in the total score ( $3.1 \pm 1.1$ ).

### 3.2 | Follow-up

From the 41 inpatients which were included and evaluated during the pre-test session (Session 1 of the APA program), 29 performed entirely the eight APA sessions and the overall pre and post-tests. Twelve—including two who had only final evaluation—did not complete the program.

Discharged before the end of the program, went back to school during hospitalization, or had to have other treatments during the evaluation moment). From this step, the inpatients having missed the post-test session or two APA sessions (or more) were excluded ( $n = 12$  excluded inpatients).

#### 3.2.1 | Evolution of the recorded parameters after 8 weeks of APA program

Significant and beneficial effects of the global inpatient treatment program including APA sessions were highlighted with an increase in BMI from 16.7 to 17.9 ( $T = 6.6$ ;  $df = 28$ ;  $p < .001$ ) with a moderate effect size ( $ES = -.6$ , Cohen, 1988). Moreover, results show a significant improvement in three out of the four dimensions measured by EDE-Q. ED measured by EDE-Q global score, significantly decreased from 3.6 to 3 ( $T = 2.8$ ;  $p = .01$ ;  $ES = .6$ ). The dependence to PA evaluated by EDS-R score also significantly decreased in its three dimensions (lack of control, reduction in other activities, time) from 3.1 to 2.7 (Table 3). Such an EDS-R global score evolution revealed an improvement of the relation to physical activities in the inpatients. We also reported a significant improvement of the perceived health of the DUKE Health Profile score from 30.4 to 52.6 ( $T = 2.7$ ;  $p = .01$ ;  $ES = -.7$ ). Finally, inpatients reported on the Godin Leisure-Time Exercise Questionnaire score doing more conscious physical activities (32.8–66;  $T = 2.9$ ;  $p = .01$ ) with a large effect-size ( $ES = 1.2$ ).

### 3.3 | Narrative Evaluation of Intervention

For the 29 inpatients who performed entirely the eight APA sessions 10 could be interviewed (cf. Results section 3.2). Herein the database included 2,206 occurrences, 491 lemmas, and 347 active forms. The word cloud, composed by the 65 most used words in our corpus (Figure 1), is characterized by the words “groups”, “physical”, “activity”, “muscle”, “strengthening,” and “learning”. Three classes were highlighted (Figure 2). The Class 3 is composed by the terms “session, let off steam, feel

pleasure, continue, love, activity, pass”. The Class 1 is composed by the terms “muscular, strengthening, shadow-box”. Lastly the Class 2 is composed by the terms “muscles, movement, workout, and body”. Six peaks are also reported: “strengthening, muscular, shadow-box, physical, activity and group”. They maintain relations between different co-occurrences which are schematized by the size of the line which connects them (Figure 3). For example, the links between “strengthening” and “muscular” or between “physical” and “activity” were very strong because these couples of words were used together in language expressions.

## 4 | DISCUSSION

The first aim of this open study was to evaluate the impact of AN specific APA program (Kern & Fautrelle, 2018) on physical (body mass index, BMI) and psychological dimensions (physical activity perception, dependence to physical exercise, ED symptoms, quality of life) in hospitalized AN patients. The second aim was to evaluate AN inpatients narrative on perceived effect of this APA program using a qualitative method. As such, the aims of this work are fully in line with the recommendations of the health-enhancing physical activity network (HEPA) supported by the WHO. According to HEPA guideline, the present pilot study focus on AN patient for the promotion of health-enhancing physical activity using scientific evidences. Fully sharing the HEPA ideas that exchange, dissemination and sharing of experience and knowledge are key-principles, the whole contents precisely described for each session of the present APA program, exercises by exercises (objectives, material and methods, given instructions, evolution of the exercises...) as well as the booklet that serving to support the good practice of the APA given to each patient integrated into this APA program are shared publicly in open source and free of charge.

In the present pilot study and after the APA program, BMI and perceived PA score significantly increased, ED and exercise dependence scores significantly decreased ( $p < .01$ ). Participants appreciated the program.

### 4.1 | BMI increased

The present study highlights in an inpatient program that adding APA leads to an improvement in BMIs of hospitalized AN inpatients (1.14 kg m<sup>2</sup>/8 weeks) who completed the 8 weeks of the APA program. This positive result is in line with previous meta-analysis of Ng et al. (2013) which found that supervised exercise



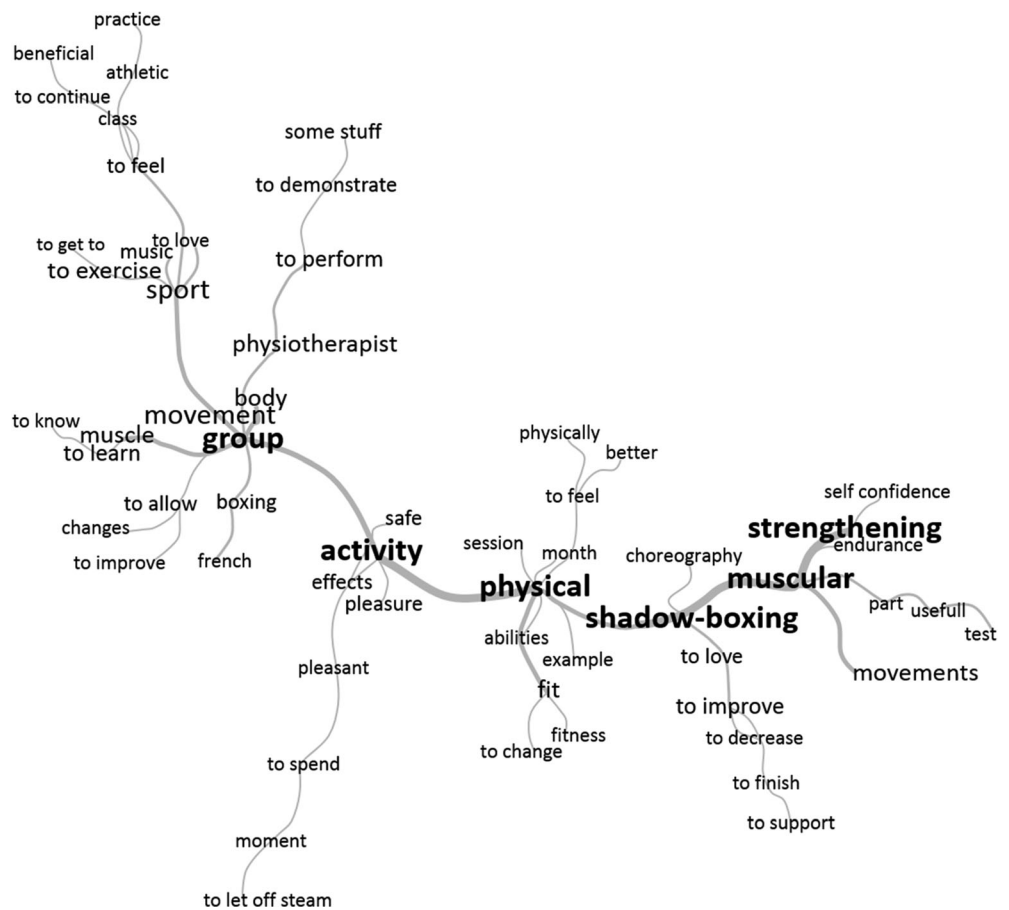
**TABLE 3** Pre-post tests ( $N = 29$ )

	Pre ( $N = 29$ )		Post ( $N = 29$ )		Mean difference	Cohen's $d$	CI (95%)		$t$	$p$	
	Mean	SD	Mean	SD			Inf	Sup			df
Physical activity											
<b>BMI***</b>	16.74	1.99	17.88	2.21	-1.14	-0.57	-1.50	-0.78	28	-6.51	.00
<b>GLTEQ**</b>	32.78	28.48	66.04	55.43	-33.26	-1.17	-57.2	-9.29	28	-2.85	.01
Sedentarite	360.69	264.10	296.38	155.25	64.31	0.24	-9.62	138.24	28	1.78	.09
Exercise dependence scale											
Withdrawal	3.21	1.55	3.07	1.29	0.38	0.09	-0.26	0.52	28	0.72	.48
Continuity	2.44	1.44	2.17	1.36	0.26	0.18	-0.16	0.69	28	1.27	.21
Tolerance	3.80	1.63	3.32	1.25	0.48	0.30	-0.04	1.00	28	1.90	.07
<b>Lack of control*</b>	3.23	1.72	2.70	1.49	0.53	0.31	0.03	1.03	28	2.17	.04
<b>Reduction in other activities*</b>	2.79	1.52	2.24	1.03	0.55	0.36	0.04	1.07	28	2.20	.04
<b>Time**</b>	3.31	1.46	2.71	1.26	0.60	0.41	0.19	1.01	28	3.00	.01
Intention	2.97	1.38	2.66	1.23	0.31	0.22	-0.10	0.72	28	1.54	.14
<b>Total score**</b>	3.11	1.12	2.70	0.95	0.41	0.37	0.12	0.70	28	2.88	.01
Exercise dependence questionnaire (motivation)											
<b>Weight*</b>	4.05	1.09	3.68	1.17	0.37	0.34	0.06	0.68	28	2.43	.02
Social	2.77	1.04	2.69	1.00	0.08	0.08	-0.27	0.43	28	0.47	.64
Health	4.38	1.22	4.32	1.36	0.06	0.05	-0.32	0.43	28	0.31	.76
Quality of live (Duke)											
Physical	70.00	15.35	76.90	15.14	-6.90	-0.45	-14.4	0.65	28	-1.87	.07
Psychological	41.11	21.36	42.22	30.80	-1.11	-0.05	-10.9	8.66	28	-0.23	.82
Social	57.59	18.64	63.45	18.95	-5.86	-0.31	-12.7	1.00	28	-1.75	.09
Total	56.67	12.71	60.37	19.33	-3.70	-0.29	-10.0	2.62	28	-1.20	.24
<b>Perceived health**</b>	30.36	34.26	53.57	40.66	-23.21	-0.68	-41.1	-5.33	28	-2.66	.01
Self-esteem	47.93	19.53	51.38	24.75	-3.45	-0.18	-12.2	5.25	28	-0.81	.42
Anxiety	48.76	15.79	46.29	26.89	2.47	0.16	-6.15	11.09	28	0.59	.56
Depression	46.55	16.75	44.14	27.32	2.41	0.14	-7.10	11.93	28	0.52	.61
Pain	32.76	30.69	29.31	31.39	3.45	0.11	-10.9	17.76	28	0.49	.63
Limitation	89.66	27.96	89.66	30.99	0.00	0.00	-11.4	11.37	28	0.00	1.00
EDE-Q											
Restraint	2.79	1.59	2.62	1.65	0.17	0.11	-0.77	1.11	28	0.37	.72
<b>Eating*</b>	2.86	1.21	2.29	1.48	0.57	0.47	0.01	1.12	28	2.08	.05
<b>Shape***</b>	5.03	0.92	4.21	1.65	0.82	0.88	0.35	1.28	28	3.61	.00
<b>Weight***</b>	3.93	1.13	3.15	1.71	0.78	0.69	0.38	1.18	28	3.97	.00
<b>Global**</b>	3.56	1.03	2.97	1.49	0.59	0.57	0.16	1.02	28	2.82	.01
Item 18-compulsion	9.97	11.64	8.45	10.75	1.52	0.13	-1.75	4.78	28	0.95	.35

Abbreviations: BMI, body mass index; GLTEQ, Godin Leisure-Time Exercise Questionnaire; EDE-Q, Eating Disorders Examination-Questionnaire. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .



**FIGURE 3** Similarity analyses with a minimum of two co-occurrences between words



Vandereycken, 2006), (3) it seems that either this definition was only partially assimilated by the inpatient at pre-test, or that denial was very important and thus the inpatient could have omitted to state some physical activities (as typically the PA linked to travels, leisure, household chores ...) despite the fact that GLTEQ questionnaire was answered after that PA was explained and concretely illustrate (Bratland-Sanda et al., 2010; Caspersen, Powell, & Christenson, 1985).

The second hypothesis to explain the increase of GLTEQ scores is linked to the significant increase in BMI. Indeed, such increase reveals the improvement of the general health status of the inpatients and could explain a greater time of physical practices. Moreover, the present results show that inpatients controlled better their PA after the APA program compared to before it, so they no longer had to hide compulsive phases of PA during the post-test comparatively to pre-test.

#### 4.5 | Motivations for physical practices changed

In the same line, the Exercise Dependence Questionnaire score dealing with practice motivations to weight control

highlighted a significant decrease. This promising result means that after the APA program, AN inpatients state that they no longer practice PA in order to control their weight. The APA program allowed them to reconsider PA as a healthy and fun practice improving health. The APA program reaches here one of its original goals, which was to transform a useful PA practice for initially used for weight-control, into a pleasurable and healthy practice. This last result is also supported by the qualitative analysis of the APA satisfaction survey.

#### 4.6 | The APA program was very well received by the hospitalized AN inpatients

AN inpatients perceived the physical activity program absolutely conform to what the program was supposed to do. Indeed, Class 1 refers to the teaching supports, aimed at in Objective 2 of PAPAPAM (Programme d'activité physique adaptée pour Personne avec une Anorexie Mentale; Adapted Physical Activity Program for Person with Anorexia Nervosa) which was to pass from a physical activity only centred on certain muscular groups to a more global and balanced practice. The Class 2 is representative of the first objective of the PAPAPAM program,

namely, to move from an uncontrolled/compulsive practice, to a controlled and safe practice. The targeted skills were linked to learning and compliance with the rules of good practice, coupled with the learning to manage their own biological resources.

Throw the Class 3, we saw that positive adjectives of judgement were addressed to the program and body perception, this class refers to the third PAPAAM's aim. To sum-up the qualitative analysis of the APA satisfaction survey: first of all, the program was very positively perceived by the AN inpatients. Second the APA session is a place where they can let off steam and learn to feel body sensations. Interestingly, the "group" notion was systematically associated with the words "change", "learn" and "activities". Finally, the Class 3 was composed by the terms "session, let off steam, feel pleasure, continue, love, activity, pass". Such terms corresponded perfectly to our Objective 3, which was focused on PA practice for pleasure, and not by automatic routine or unconscious practice.

#### 4.7 | Study limitations

The study has some limitations which should be addressed. First, the study had a small sample size due to the design itself, which was conceived to test the APA program in this specific population. A second limitation is the lack of randomization. Again, given the objectives, the study design could not include randomized groups, but we rather opted for an open double centre study. Third the lack of a control group is a major limitation of the present pilot study. Some results, especially about the BMI, cannot be solely attributed to the APA program itself, but to the overall therapeutic care including the adapted physical practices. However, the APA program does not seem to have harmful effect either, and the present pilot study clearly plead for the possibility a randomized clinical trial study in a near future. [...]"

Furthermore, the qualitative analysis relied on only 10 patients, as based on the load of the units only these patients were interviewed.

## 5 | CONCLUSION

PPA is one of the symptoms of AN inpatients and can constitute a problematic practice. On the opposite side, when safely and well adapted, it can also be a therapeutic lever (Kern, Fautrelle, & Godart, 2017), even if this is far from achieving consensus and that "there are no harmonized stances which might contribute to defining the methodology of the implementation of physical activity

in the treatment of anorexia and resocialization" (Brighter Side of Exercise project <http://bsoe.eu/>). Other structured programs are starting to emerge (Brighter Side of Exercise project <http://bsoe.eu/>). Without consulting each other, researchers and therapeutic teams including professionals teacher in APA are emphasizing fundamental points (acquisition of knowledge and best practices, multidisciplinary approach) and a common philosophy (inclusion in PA external structures at the hospital).

In the present pilot-study, the effect sizes for the promising EDS and EDQ pre-post results remained small. These statistical analyses were conducted with the data measured from 29 AN patients who completed 8 weeks (six without counting the sessions with the pre and post-tests) of APA program. Such a duration is short with regard to the AN troubles evolution in a classical therapeutic care. These results lead to raise the issue of the optimal duration for the APA program in AN patients. Moreover, such care plan is very well received by the hospitalized AN inpatients. These promising results has to be confirmed by future research and this primary study is leading our team to conduct a randomized control trial in order to even more better evaluate the impact of this APA program for hospitalized AN inpatients.

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#### CONFLICT OF INTEREST

None of the authors has declared a conflict of interest.

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