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The “ACTyourCHANGE” study: promoting a healthy lifestyle in patients with obesity with Acceptance and Commitment Therapy

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Abstract

Obesity is one of the most serious health problems in global public health. Over the last four decades, obesity prevalence dramatically increased, reaching pandemic proportions. Treating obesity requires multidisciplinary interventions based on nutritional, physical, and psychological components, aimed at promoting the adoption of a healthy lifestyle. However, they do not necessarily produce successful weight loss over time. Most people with overweight or obesity who lose weight after a period of rehabilitation, fail to maintain a healthy lifestyle over time. As a consequence, they tend to regain about one-third of the weight lost over the following year after treatment.

Given the failure in maintaining weight loss over time, existing literature started to explore the factors involved in the onset and maintenance of dysfunctional eating habits, and considered barriers to adopting and maintaining a healthy lifestyle. In this field of research, the role of psychological inflexibility has been depicted as a core theme in a number of studies concerning unhealthy eating behaviors.

As the treatment of choice in reducing psychological inflexibility, and promoting psychological flexibility, Acceptance and Commitment Therapy (ACT) has received attention and empirical support for its effectiveness in weight management. However, the mechanism of action of psychological flexibility remains unclear.

Alongside obesity in adulthood, even childhood obesity has also become a major public health concern. As for adults, also for children providing long-lasting effective treatment for weight loss and healthy lifestyle promotion is urgent. To date, there is a paucity of evidence concerning the efficacy of ACT-based intervention in children and adolescents, although some preliminary results were promising.

Grounded in the field of obesity rehabilitation, the current PhD thesis is aimed at evaluating the effectiveness of an Acceptance and Commitment Therapy-oriented psychological intervention in promoting the adoption of a healthy lifestyle and improving the psychological conditions of patients with obesity, within a multidisciplinary rehabilitation program for weight loss.

Chapter 1 of the current thesis provides an overview of obesity disease, discussing its prevalence, its main causes, and its consequences on general physical and psychological health, and presenting guidelines that inform the treatment of obesity. Chapter 1 focuses also on psychological interventions for obesity with a particular emphasis on the challenge of maintaining weight loss over time. The conclusion of chapter 1 emphasizes that interventions for obesity management need to focus on emotional regulation and provide self-regulatory strategies.

Chapter 2 introduced Acceptance and Commitment Therapy (ACT), one of the most promising third-wave CBTs in targeting self-awareness and self-regulation. In chapter 2 the theoretical framework underlying ACT as well as empirical evidence to support the application of ACT in the field of obesity treatment have been discussed.

Chapter 3 and chapter 4 provided the first two empirical contributions of the current thesis. By assuming an ACT-oriented perspective, they have aimed to explore the impact of psychological inflexibility on emotional eating, both in adults (chapter 3) and adolescents (chapter 4).

Such premise was the basis for the subsequent empirical contributions of the current thesis (presented in chapters 5 and 6) both aimed at evaluating the effect of an ACT-oriented psychological intervention for individuals with obesity, attending a multidisciplinary rehabilitation program for weight loss.

The study presented in chapter 5 was specifically aimed at assessing the specific role of each subcomponent of the psychological flexibility model (Openness, Awareness, and Engagement),

in promoting weight loss and weight loss maintenance over time as well as improving psychological conditions in a sample of Italian adult individuals with obesity.

Finally, the study presented in chapter 6 was specifically aimed at assessing the effects of an ACT-based intervention added to a standard multidisciplinary rehabilitation program for weight loss in a group of adolescents with obesity to improve their psychological conditions

Chapter 1. The obesity pandemic

1.1. Definition and prevalence of obesity

Obesity is one of the most serious health problems in global public health (Castelnuovo et al., 2017; Musetti et al., 2018). According to the World Health Organization (WHO), obesity can be defined as a complex medical condition characterized by excessive adipose tissue in the human body to induce a significant increase in health risks (WHO, 2017).

The WHO (2017) has established criteria for the classification of obesity, taking into account the Body Mass Index (BMI) which expresses the ratio of body weight (in kilograms) and height (in meters squared) according to the following formula: $BMI = \frac{Kg}{m^2}$. Obesity is in turn classified as follows:

Body Mass Index (Kg/m ²)	Classification
BMI < 18.5	Underweight
18.5 < BMI > 25	Normal weight / healthy range
25 < BMI > 30	Overweight
30 < BMI > 34.9	I class obesity
35 < BMI > 39.9	II class obesity
BMI > 40	III class obesity / severe obesity

Recent estimates suggest that overweight and obesity cause more than 1.2 million deaths across the WHO European Region every year, becoming the fourth highest cause after high blood pressure, dietary risks, and tobacco and corresponding to more than 13% of total deaths. Overweight and obesity are also the leading behavioral factor increasing the risk for disability (WHO, 2022).

Over the last four decades, obesity prevalence dramatically increased, reaching epidemic proportions. The World Health Organization has estimated that in 2014, over 1.9 billion adults in the world were overweight and, of these, more than 650 million suffered from obesity (WHO, 2017). The WHO European Regional Obesity Report 2022 (WHO, 2022) pointed out that almost 60% of adults and about one in three children are affected by overweight and obesity. In addition, data revealed that the prevalence of obesity is still raising, with economic and public health consequences. The global prevalence of obesity nearly tripled between 1975 and 2016, with substantial rises in most countries, including low-income and middle-income nations. As such, the global spread of obesity has been labeled a pandemic.

Furthermore, early studies from a number of countries in Europe have indicated a rise in overweight and obesity in children and adolescents during the COVID-19 pandemic (Vogel et al., 2022).

1.2. Etiopathogenesis and consequences of obesity

Although obesity can be simply regarded as the result of an imbalance between the energy introduced into the body and the energy consumed, it is considered a complex disease with a multifactorial etiology. Genetic, familial, environmental, and cultural factors interact with each other leading to heterogeneous conditions and results (Castelnuovo et al., 2015; Marcus & Wildes, 2009; Price, 2004).

Behavioral factors, such as dysfunctional eating habits and low levels of physical activity, are typically key variables and are among the main modifiable and proximal causes of obesity and obesity-related comorbidities (Dombrowski et al., 2010; Gupta, 2014; Wadden et al., 2007).

Obesity is a significant risk factor for a plethora of non-communicable diseases, all of which can heavily impact health, quality of life, and global functioning. Obesity is frequently

associated with many physical comorbidities, including, among others, type II diabetes mellitus, cardiovascular and chronic respiratory diseases, hypertension, and osteoarthritis (Curry, 2017; Whitlock et al., 2009). In addition, patients with overweight and obesity are at risk for mental health problems, such as depression, anxiety, and eating disorders, particularly, Binge Eating Disorder (BED) (Giusti et al., 2020). Due to the higher presence of comorbidities, obesity is often accompanied by disability, reduced quality of life, and a high rate of mortality.

1.3. Interventions for obesity

Treating obesity is an important public health priority. Because obesity has a multifactorial etiology, evidence-based strategies to improve weight loss, maintain a healthy weight, and reduce related comorbidities typically integrate different interventions such as dietetic, nutritional, physical, behavioral, psychological, and if necessary, pharmacological, and surgical ones (Dalle Grave et al., 2020). Evidence-based guidelines (National Institutes of Health., 1998) for treating obesity recommend providing multidisciplinary rehabilitation programs aimed to support the patient in the long-term adoption of a healthy lifestyle in order to reduce weight, and consequently, also reduce comorbidities. The Obesity Guidelines recommend a healthy diet with high protein and low calories aimed at inducing a caloric deficit of 500–1,000 kcal/day and, thus, a weight loss of 0.5–1.0 kg/week. Very low-calorie diets (i.e., 800 kcal/day) produce greater initial weight loss than low-calorie diets. As for physical rehabilitation, recommendations suggest prescribing at least 150 min/week of physical activity moderate physical activity, particularly aerobic training aimed at producing a caloric deficit of at least 400 kcal/day.

Taking into account that obesity is related to psychological variables, clinical psychological interventions and psychotherapies are key elements to engaging patients in lifestyle

modification and motivating them to achieve weight loss with the help of multidisciplinary teams. Cognitive Behavioral Therapy (CBT) is traditionally recognized as the gold-standard treatment for obesity (Fabricatore, 2007; Castelnovo et al., 2007; Cooper et al., 2003; Cooper et al., 2010).

1.3.1. Cognitive Behavioral Therapy for obesity

Because obesity is related to psychological variables, psychological interventions are key elements of multidisciplinary treatment for obesity which is aimed at engaging patients in lifestyle modification and motivating them to achieve weight loss with the help of multidisciplinary teams (Cooper & Fairburn, 2001; Dalle Grave et al., 2020; McGuire et al., 1999).

Dalle Grave et al (2020) described the typical CBT protocol reporting a set of procedures necessary to address weight loss. Among them, the main strategies include goal setting, cognitive restructuring, self-monitoring, and stimulus control.

Through goal setting procedure, patients are guided to set a number of specific, realistic, quantifiable, and moderately challenging weekly goals to be achieved; Cognitive restructuring helps patients to notice how their thoughts influence their mood and behaviors and change their negative thinking patterns (Fabricatore, 2007); Self-monitoring is a practice in which patients are asked to systematically observe and record specific thoughts, body feelings, emotions, and behaviors. Patients are, hence, encouraged to write down the time, amount, type, and calories of foods and beverages they are going to consume in a monitoring record, as well as the physical activity they practice. In addition to these main techniques, during therapy patients are guided to recognize internal cues to eat, such as emotional cues, and replace them with alternative behaviors (Baker & Kirschenbaum, 1993; O'Neil & Brown, 2005); they are introduced to problem-solving in order to screen for problems that might influence eating and find alternative

solutions; they also learn to establish a weight maintenance plan with long-term self-monitoring of weight and build a long-term weight control mindset (Perri et al., 2001).

1.4. Efficacy of lifestyle modification program for weight loss

The Obesity Guidelines recommend participation for 6 months in a high-intensity multidisciplinary rehabilitation program for weight loss, with the promotion of a healthy lifestyle as the main focus, followed by a weight maintenance phase (Wadden et al., 2020).

Traditionally, lifestyle modification programs are provided in individual or group settings; sometimes in combinations of individual and group settings [as for the Look AHEAD study (Look Ahead Research Group, 2006) which is presented below].

Several randomized controlled trials evaluating the efficacy of lifestyle modification programs showed promising results. A meta-analysis evaluating the effect of lifestyle modification programs (treatment range 13–52 sessions) found that at one year, 28% of participants had a weight loss $\geq 10\%$ of baseline weight, 26% of 5%–9.9%, and 38% of $\leq 4.9\%$ (Christian et al., 2010). This amount of weight loss is associated with a significant reduction in the incidence of type 2 diabetes, as well as improvement in medical (eg, sleep apnea, diabetes, hypertension, and hyperlipidemia) and psychosocial (eg, mood, quality of life, and body image) outcomes (Dalle Grave et al., 2007). Unfortunately, participants regain about 30%–35% of the weight loss in the year following treatment, and after 5 years more than 50% of them return to their baseline weight (Perri & Corsica, 2002).

In several randomized controlled trials, participants achieved on average 8%–10% loss of initial weight in 30 weeks of treatment (Wadden & Butryn, 2003).

The Look AHEAD study (Look Ahead Research Group, 2006) is one of the most important randomized controlled trials conducted in the field of obesity treatment which enrolled more than 5,000 men and women (aged between 45 and 76) with overweight or obesity (BMI>25) and type 2 diabetes from the US. Participants were randomly assigned to intensive lifestyle intervention (ILI) or diabetes support and educational group (DSE). The ILI provided comprehensive behavioral weight loss counseling; DSE participants received periodic group education only. Over 8 years, participants in ILI lost significantly more weight than their counterparts in DSE. ILI participants, compared with DSE, achieved significantly greater increases in physical activity with higher energy expenditure and reported better outcomes in terms of self-monitoring of their physical activity. Over time, the majority of those who lost \geq 10% initial weight in 1 year, achieved a 10% loss at year 8, reported a higher activity-related energy expenditure, and a greater number of weeks reducing their calorie and fat intake than those who lost lower than 10% or regained their weight.

1.5. Psychological barriers to weight loss

Although Cognitive Behavioral Therapy (CBT) has been traditionally recognized as the gold-standard treatment for obesity and related comorbidities, including binge eating disorder (BED), it does not necessarily produce successful weight loss maintenance over time. In fact, most people with overweight or obesity who lose weight after a period of rehabilitation, fail to maintain a healthy lifestyle over time. As a consequence, they tend to regain about one-third of the weight lost over the following year after treatment (Grilo et al., 2011).

To increase the effectiveness of weight loss programs, research on obesity management focused its efforts on an understanding of the factors that are associated with regain, including strategies used in weight loss and the perceived barriers to successful weight loss maintenance.

Weight loss and maintenance may be influenced by many factors including behavior, physiology, psychology, and environment. Psychological factors - although only one of many others - are a critical component to consider. A review has analyzed the psychological factors associated with weight loss maintenance and relapse in obese identifying eight psychological factors affecting weight loss and weight loss maintenance: unrealistic weight loss expectations, failure to achieve weight loss goals, dichotomous thinking style, eating to regulate mood, disinhibition versus dietary restraint, perceived cost versus benefit, depression, and body image (Ohsiek & Williams, 2011).

One of the most important psychological factors related to weight loss and maintenance is emotional eating. Emotional eating, also known as stress eating and emotional overeating, is defined as the "propensity to eat in response to positive and negative emotions" (van Strien et al., 1986). It is associated with poor weight-related outcomes in terms of weight loss, weight loss maintenance and weight regain (Frayn & Knäuper, 2018).

One of the underlying mechanisms of emotional eating concerns emotional regulation. Emotional regulation is a broad process that includes the ability to control impulsive behaviors and act in accordance with long-term goals, even in the presence of negative emotions (Gratz & Roemer, 2004). It also concerns the flexibility to apply emotion regulation strategies to modulate emotional responses in order to achieve such goals. Poor emotion regulation skills may manifest as overeating in response to negative emotions when food is used to suppress or overcome unpleasant and aversive internal experiences (thoughts, emotions, and bodily sensations (Sainsbury et al., 2019) as indicated by the link between emotion dysregulation and eating disorders such as anorexia, bulimia (Harrison et al., 2010) and binge eating disorder (BED) (Gianini et al., 2013).

Such evidence suggests that emphasis needs to be placed on addressing emotional regulation and self-regulatory strategies throughout interventions for weight loss and weight loss maintenance

Psychological approaches targeting self-awareness and self-regulation such as third-wave Cognitive Behavioral Therapies are now emerging as a particularly deserving candidates for treatments achieving long-term successful outcomes in the field of obesity rehabilitation and treatment.

The following chapter presents Acceptance and Commitment Therapy, one of the most promising third-wave CBT approaches. In particular, the theoretical framework underlying ACT, as well as empirical evidence to support the application of ACT in the field of obesity treatment, are discussed.

Chapter 2 Acceptance and Commitment Therapy for obesity

2.1. Acceptance and Commitment Therapy

Acceptance and Commitment Therapy (ACT) (Steven C. Hayes et al., 2006) is one of the well-known third wave Cognitive Behavioral Therapies raised in the last twenty years.

Third-wave CBTs are a group of emerging psychotherapies that represent an evolution and extension of traditional cognitive behavioral treatment approaches. Third-wave therapies prioritize the holistic promotion of psychological and behavioral processes associated with health and well-being over the reduction or elimination of psychological and emotional symptoms. Concepts such as metacognition, acceptance, mindfulness, personal values, and spirituality are frequently incorporated into what might otherwise be considered traditional behavioral interventions. Rather than focusing on the content of a person's thoughts and internal experiences, third-wave behavioral therapists are instead more focused on the context, processes, and functions of how a person relates to internal experiences (i.e., thoughts, urges, sensations).

Examples of third-wave CBT interventions include ACT, dialectical behavior therapy (DBT; Linehan, 1993), mindfulness-based cognitive therapy (MBCT; Segal, Williams, & Teasdale, 2001), and meta-cognitive approaches (Wells, Herbert, & Forman 2011), among several others.

Among third-wave CBTs, ACT is a behaviorally-oriented therapeutic approach that aims to modify how a person relates and responds to their internal experiences (i.e., thoughts, emotions, physical sensations, and urges) in order to more fully engage in values-based behaviors.

ACT is theoretically grounded on Relational Frame Theory (RFT), which in turn has its roots in functional contextualism: a basic research program on how the human mind works (Hayes,

Barnes-Holmes, & Roche, 2001). Functional contextualism is a specific form of contextualism that is aimed to predict and influence events, with precision, scope, and depth and considers psychological events as "ongoing actions" of the whole organism interacting in and with historically and situationally defined contexts.

The core aim of ACT is to promote psychological flexibility, which is defined as the “ability to be in contact with the present moment fully as a conscious human being, and based on what the situation affords, changing or persisting in behaviors in the service of chosen values” (Hayes et al., 2012; Hayes et al., 2006).

ACT is designed to establish a workable, pragmatic, and positive set of psychological flexibility processes in lieu of negative processes of change that are hypothesized to be involved in behavioral difficulties and psychopathology. Such processes include cognitive fusion, experiential avoidance, and other related processes

Cognitive fusion entails the tendency of an individual to remain trapped in his thoughts and consider them as if they are literally and objectively true, instead of transitory and subjective mental events (Hayes et al., 2011). Cognitive fusion is related to experiential avoidance, which includes the unwillingness to remain in contact with aversive internal states and the tendency to take steps to alter the form or frequency of these states and the contexts when they occur (Hayes et al., 2006).

With ACT, through metaphor, paradox, and experiential exercises, patients learn how to make healthy contact with thoughts, feelings, memories, and physical sensations that have been feared and avoided. Patients also gain the skills to recontextualize and accept these private events, develop greater clarity about personal values, and commit to needed behavior change.

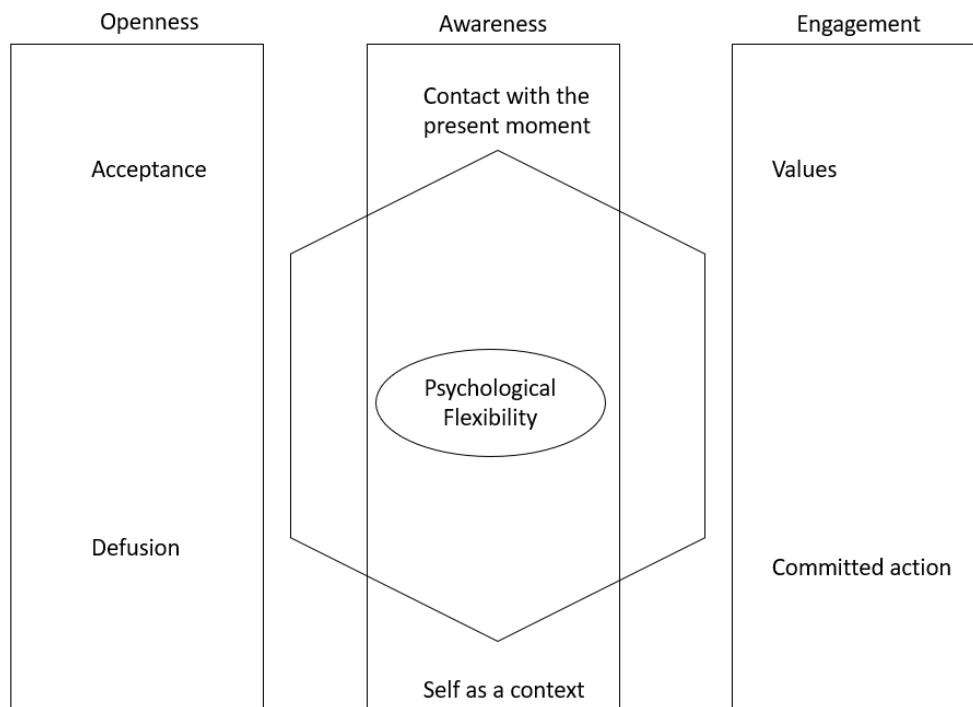
To do so, ACT uses both traditional behavior therapy techniques as well as others that are more recent "third-wave" methods, such as cognitive defusion, acceptance, mindfulness, values, and commitment methods.

2.1.1. Psychological flexibility

ACT targets each of these core problems with the general goal of increasing psychological flexibility, that is the capacity to act effectively in accordance with personal values and goals, even in the presence of psychological distress or suffering and associated cognitions and emotions. Psychological flexibility allows being fully present and open to experiences so that people can take actions guided by their own values. In sum, psychological flexibility is the ability to be present, open up, and do what matters in a rich and meaningful life (Hayes et al., 2009).

Psychological flexibility is considered a cornerstone of healthy personal and social functioning. It has been strongly associated with several positive psychological outcomes, such as increased psychological well-being, reduced stress, anxiety, and depressive symptomatology (Tyndall et al., 2020). The dimensions of flexibility are viewed as critical to promoting individual health and well-being and are therefore promoted within ACT. To do so, ACT applies mindfulness and acceptance processes, combined with values identification and behavior change processes. Psychological flexibility is resulting from the combined action of six core therapeutic processes which are represented in the "hexaflex" model (Hayes et al., 2012). (See Figure 1). Each of these areas is conceptualized as a positive psychological skill, not merely a method of avoiding psychopathology.

Figure 1. The Psychological flexibility model



2.1.2.1. Acceptance

Acceptance is offered as an alternative to experiential avoidance. Acceptance involves making full contact with internal experiences without attempting to escape, change, or control those events. Acceptance does not imply liking or wanting to suffer. Acceptance is not a goal in itself either. Acceptance is simply holding whatever occurs kindly. Truly accepting harmful thoughts and emotions does not necessarily mean to like, love, or wish them. Rather, it implies accepting that they are present and accepting them to be thought about and processed instead of avoided or fight against. Acceptance is promoted to refrain from putting energy and effort into unsuccessful attempts at controlling suffering, and redirect this energy and effort towards engagement in values-based living.

2.1.1.2. Cognitive defusion

In ACT, cognitive defusion refers to the process of stepping back from thoughts and observing their presence. According to ACT, thoughts aren't always bad until people become fused with their meaning and content and then react, frequently impulsively. When people defuse, they release control over their internal dialogue and reduce thought to the level of simple words. Concretely, this means that individuals are encouraged through multiple exercises to take perspective toward cognitive processes that do not stem from direct contextual experience and de-literalize the meaning of pain-related thoughts without necessarily changing their content. This is done in order to reduce personal attachment to, or believability of, these experiences.

2.1.1.3 Being in the present moment

Present-moment awareness has been described as a process of mindfulness that entails a process of non-judgmental, present-focused awareness and therefore has direct relevance to acceptance, defusion, and self-as-context. Human beings spend a lot of time worrying about the future and ruminating about the past. Even if this process seems to be adaptive in some ways, being dominated by our painful thoughts can also be overwhelming. Focusing on past experiences, for example, may prevent current movement in valued directions generating frustration. Being present is the therapeutic process most directly related to mindfulness. It entails a non-judgemental presence in the here-and-now, without being consummated by the past or the future. Through the use of mindfulness exercises, pain sufferers are encouraged to contact their pain experience and other psychological and environmental events without trying to change or alter these events.

2.1.1.4. Self-as-context

Self-as-context refers to a sense of self that transcends the content of one's experience. With ACT, people may recognize that there is a self that is observing all the internal and external experiences such as thoughts and feelings, without becoming the content of all these experiences. Self-as-context represents a psychological space in which one can observe, in a condition of pure awareness, one's experiences, in a position of acceptance. The process of self-as-context is applied to promote pure awareness. Patients are encouraged to differentiate between a sense of self which is composed of all the labels, ideas, thoughts, and judgments that they have about themselves and a sense of self from which they can take perspective and merely observe the ongoing stream of physical and psychological events that occur in their lives.

2.1.1.5. Values

In ACT values are freely chosen, intrinsically motivated qualities of meaningful and purposeful action, or rather, paths to be taken to lead a personally valuable and vital life. Values define who someone truly wants to be and moving towards valued directions makes life rich and worth living. According to ACT's perspective which is oriented in change behaviors, not changing internal experiences or reducing symptoms, values provide the road map for behavioral changes. During therapy, multiple exercises are applied to help individuals identify their values in different life domains (e.g. career, family life, social activities, spirituality). All the energy that serves as an output of engagement in the previously discussed therapeutic processes is fuelled to leading a values consistent life.

2.1.1.6. Committed actions

Committed action is a pure behavioral process and entails the formulation of short-term, concrete, and reachable goals based on identified values. Behavioral activation exercises and goal setting are used to help pain sufferers to perform these actions. Furthermore, barriers that can interfere with values-based living in the future are recognized and action plans for dealing with these barriers are formulated (Steven C. Hayes et al., 2006)

2.1.2. Advancement of psychological flexibility model

In the most recent explanation of ACT, the six core components of psychological flexibility are divided into three pillars of the model. Acceptance and cognitive defusion are paired together in the Openness process which means assuming an attitude of openness and acceptance toward private events. The processes of being in the present moment and self-as-a-context are put together in the Awareness process that entails avoidance of automatic responses and reactions, and intentional action made possible by awareness of one's cognitions and bodily sensations. Finally, values and committed actions are taken together within the commitment process that includes acting behaviors guided by chosen personal values (Hayes et al., 2012).

2.2. Acceptance and commitment therapy for obesity

ACT is designed to be applicable to a broad range of psychological problems. Several studies offer evidence for the effectiveness of ACT in a mix of disorders, for example, depression, anxiety, and OCD (Öst, 2008). Furthermore, experiential avoidance has been recognized as an important transdiagnostic risk factor in a plethora of mental and behavioral health problems (Biglan et al., 2008; Kashdan & Rottenberg, 2010).

In the context of obesity, ACT has been applied as an alternative treatment to the gold standard CBT as an attempt to improve the effectiveness of psychological treatment for weight loss and weight loss maintenance.

As discussed before, several factors have been depicted as barriers to weight loss and maintenance, such as binge eating, psychological distress, body-image dissatisfaction, and poor quality of life (Teixeira et al., 2015). Risk factors for weight regain also included psychosocial stressors, disinhibition, emotional or stress eating, depression, and feelings of food-related deprivation (Elfhag & Rössner, 2005; Wing, 1998; Rena, Wing & Phelan, 2005). From this, it is clear that coping with difficult or unwanted cognitive and emotional experiences plays a vital role in predicting long-term weight loss success and should be a target of intervention. It follows that mindfulness and acceptance based-intervention can be seen as providers of potential avenues for treatment development.

In fact, in standard CBT, the overarching treatment goal is to lose weight or prevent weight gain. In opposition, mindfulness and acceptance-based interventions, such as ACT, seek to change one's relationship with unwanted thoughts, feelings, or bodily sensations instead of trying to change or control them (Hayes et al., 2006). Thus, the overarching treatment goal of ACT is effective living, that is, behaving consistently with one's values. Healthy living often relates to the ability to engage in desired activities, set a positive example for family members, or live longer to continue to participate in valued relationships, and weight loss can be one pathway to these valued ends. Thus, in ACT, weight loss is situated broadly into values-based living across a variety of domains such as relationships, work, and so on (Hayes et al., 2006).

There is empirical support for using ACT methods to target weight-related issues, such as body image dissatisfaction (Pearson et al., 2012), disordered eating patterns (Juarascio et al., 2010),

physical activity (Butryn et al., 2011) reactivity to food cravings (Forman et al., 2007), and coping with bariatric surgery (Weineland et al., 2012).

For example, one RCT examined the efficacy of ACT for weight maintenance in a sample of participants who had recently completed a weight loss program (Lillis et al., 2009). Participants either received a one-day ACT workshop (5 contact hours) or were put on a waiting list and asked to maintain their existing strategies for weight management. The workshop was aimed to reduce experiential avoidance and increase psychological flexibility. Results showed that at the 3-month follow-up, ACT participants had lost an additional 1.6% of their body weight, while the control group gained 0.3%. In addition, a significantly higher proportion of the ACT participants had maintained or lost weight. Participants in the ACT condition also showed significant improvements in quality of life and reductions in psychological distress and self-stigma (Lillis et al., 2009).

Chapter 3. The Mediating Role of Psychological Inflexibility in the Relationship Between Anxiety, Depression, and Emotional Eating in Adult Individuals with Obesity

3.1. Introduction

In the previous chapter of the current dissertation, it has been seen that obesity is a complex chronic disease and its treatment involves two problems: how to lose weight and how to maintain weight loss. Many barriers to weight loss and weight loss maintenance have been discussed in the literature, including emotional eating which is the propensity to eat in response to positive and negative emotions.

How to self-regulate in eating requires an ability to recognize the physiological signals of hunger and satiety and full awareness of one's choices. Too often our behaviors are automatic, and a lack of self-regulation skills have been depicted as one of the underlying mechanism of emotional eating (Sainsbury et al., 2019).

According to an ACT-oriented perspective, psychological inflexibility can be considered a precursor of emotional eating, since it was found to play a significant role in the relationship between negative emotional states and the onset of emotional eating (Litwin et al., 2017). However, such evidence has been collected in non-clinical samples, while less is known about people with obesity.

For this reason, the first empirical contribution of the current dissertation has been conceived.

In particular, it is a cross-sectional study aimed to explore the role of psychological inflexibility in the relationship between negative internal states (anxiety and depression), and emotional eating. The study was conducted on a sample of Italian adult individuals with obesity.

3.2. Methods

3.2.1. Participants and procedures

One hundred twenty-three Italian adults with obesity participated in the study. They were recruited from Istituto Auxologico Italiano, IRCCS, in Piancavallo (Italy). Participants were included if they were Italian, aged between 35 and 65, with a BMI>30. They were excluded in case of any psychiatric disorder diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders (Structured Clinical Interview for DSM-5 for major DSM-5 diagnoses including mental health and personality disorders) criteria or any medical condition that could compromise participation in the study such as intellectual or physical disabilities. Once all the participants provided written informed consent, they were asked to fill in some questionnaires, aimed at assessing the variables of interest for the study. The study was approved by the Medical Ethics Committee of Istituto Auxologico Italiano. All the procedures were conducted following the Helsinki Declaration of 1975 and further advancements.

3.2.2. Measures

All the demographical and clinical variables were collected via self-report. The clinical variables were collected as follows.

Anxiety and Depression. To assess anxiety and depression, we used the relative subscales of the *Psychological General Well-Being Inventory* (PGWBI) (Dupuy, 1984), in its Italian validated version (Grossi et al., 2002). The PGWBI is a 22-items self-report questionnaire rated on a 6-point Likert scale aimed at assessing general psychological well-being. It addresses six dimensions: anxiety, depression, positive well-being, self-control, general health, and vitality. Higher total scores of PGWBI indicated greater well-being. Higher scores in the Anxiety and

Depression subscales indicated less anxiety and depression, while lower scores in those subscales suggest greater anxiety and depression. The Italian validated version showed good psychometric properties (Cronbach's alpha of the Anxiety subscale of the Italian validation= 0.85; Cronbach's alpha of the Depression subscale of the Italian validation= 0.80; Rossi et al., 2021).

Psychological inflexibility. To assess psychological inflexibility, we used the *Acceptance and Action Questionnaire* (AAQ-II) (Bond et al., 2011) in its Italian validated version (Pennato et al., 2013). It is a self-report questionnaire composed of 10 items rated on a 7-point Likert scale. Higher scores indicated higher inflexibility. The Italian validated version showed good psychometric properties (Cronbach's alpha=0.77).

Emotional eating. To assess emotional eating, we used the Emotional Eating subscale of the *Dutch Eating Behavior Questionnaire* (DEBQ-EE) (van Strien et al., 1986) in its Italian validated version (Dakanalis et al., 2013). This self-report questionnaire comprises 33 items of the DEBQ rated on a 5-point scale (1= never, 5= very often) addressing three subscales: external eating, internal eating, and emotional eating. The Emotional eating subscale is composed of 13 items. Higher scores indicated higher emotional eating. The Italian validated version showed good psychometric properties (Cronbach's alpha of Emotional eating subscale in the subsample of people with overweight = 0.97).

3.2.3. Statistical analyses

Descriptive statistics have been performed to assess the characteristics of the sample while Pearson correlations have been held to investigate the bivariate correlations between all the variables involved. An Analysis of Variance (ANOVA) was used to assess sex differences in emotional eating.

To explore our mediational hypothesis that anxiety and depression would be directly or indirectly related to emotional eating, via psychological inflexibility, we set a mediation model in which PGWBI-A and PGWBI-D were entered as predictors, AAQ-II as a mediator, and DEBQ-EE as an outcome measure. Sex was included as a covariate. The mediation analysis calculated the direct effect, the indirect effect, and the total effects (Preacher & Hayes, 2008). To test the significance of the indirect effects, bias-corrected (BC- CIs) bootstrap confidence intervals were computed following the procedures recommended by Preacher and Hayes (2008). The bootstrap estimates were based on 5000 bootstrap samples and a 95% CI was used. We used bootstrapping method with 5,000 samples with Maximum Likelihood (ML) as an estimator. According to Fritz and Mackinnon's suggestions (Fritz & MacKinnon, 2007), a sample of 148 is considerable enough to find a mediated small-to-medium effect (0.26) with a power of 0.80 We performed analyses using JASP [JASP Team (2020). JASP (Version 0.14.1) Computer software].

3.3. Results

The sample was composed of 69 (56.1%) females and 54 males (43,9%) aged between 35 and 65 (M= 53.7; SD=6.98), the average BMI was 41.4 (SD= 3.70). Descriptive statistics of the sample and measured variables were presented in table 1.

Table 1. Descriptive statistics of the sample

Variables	N (%)	Mean ± SD	Mean ± SD	Range
			Validation sample	
Sex				
Male	54(43.9)			
Female	69 (56.1)			
Age (in years)	123	53.7± (6.98)		36-64
BMI (Kg/m ²)	123	41.4 ± (3.70)		
Educational level				
Primary school	5 (4.1%)			
Secondary school	34 (28.1%)			
Higher school	57 (47.1%)			
Bachelor's degree	6 (5.%)			
Master's degree	19 (15.7%)			
Marital Status				
Single	37 (30.3%)			
Married	63 (51.6%)			
Divorced	15 (12.3%)			
Widowed	7 (5.7%)			
Work status				
Student	61 (49.6%)			
Employed	19 (15.4%)			
Housewife	24 (19.5%)			
Retired	19 (15.4%)			
PGWBI-A	122	15.5 ± (5.46)	17.3 ± (4.9)	3-25
PGWBI-D	119	11.8 ± (2.57)	12.4 ± (2.6)	4-15
AAQ-II	120	33.6 ± (11.4)		10-61
DEBQ-EE	120	3.01 ± (1.07)		1-5

Note: BMI: Body Mass Index; PGWBI_A: Psychological General Well-being Index_Anxiety subscale; PGWBI_D: Psychological General Well-being Index_Depression subscale; DEBQ- EE: Dutch Eating Behavior Questionnaire_Emootional Eating subscale; AAQ-II: Acceptance and Action Questionnaire-II;

Pearson's bivariate correlations showed that there was a significant correlation between PGWBI-A and DEBQ-EE, ($r=-0.384$; $p<.001$) as well as between PGWBI-D and DEBQ-EE ($r=-0.292$; $p<.001$). The AAQ-II was significantly and positively related to DEBQ-EE ($r=0.346$; $p<.001$). The independent sample t-test revealed that females ($M=3.18$; $DS=1.19$) reported

higher levels of DEBQ-EE than males (M=2.79; SD=0.85) (t=2.10; p=0.038) Results are presented in Table 2.

Table 2. Relations among variables

	Age	BMI	PGWBI-A	PGWBI_D	AAQ-II	DEBQ_EE	t	p
Age	-							
BMI	-0.094	-						
PGWBI-A	0.116	0.079	-					
PGWBI-D	-0.053	0.021	0.802***	-				
AAQ-II	-0.109	0.138	-0.400***	-0.488***	-			
DEBQ-EE	-0.147	-0.055	-0.384***	-0.292***	0.346***	-		
sex							2.10	0.038**

Note:PGWBI_A: Psychological General Well-being Index_Anxiety subscale; PGWBI_D: Psychological General Well-being Index_Depression subscale; DEBQ- EE: Dutch Eating Behavior Questionnaire_Emootional Eating subscale; AAQ-II:Acceptance and Action Questionnaire-II;

*** p < .001

** p < .05

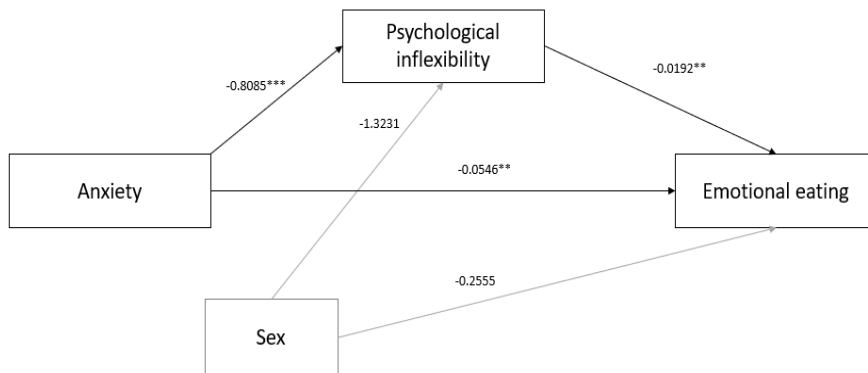
As for the mediation model, results showed that the indirect effect of PGWBI-A on DEBQ-EE through AAQ-II was significant [b=-0.0155; SE=0.076; 95% BC-CI (-0.0320 - -0.023)]. In addition, the direct effect PGWBI-A on DEBQ-EE was significant [b= -0.0546; SE=0.0179; p=0.0282; 95% BC-CI (-0.0900 - -0.0192)]. Finally, the total effect of PGWBI-A on DEBQ-EE was significant [b=-0.0701; SE=0.0168; p<0.001; 95% BC-CI (-0.1033– -0.0369)]. The results also suggest that the indirect mediated effect accounted for 19% (R2 =0.1993) of the variance.

Similarly, the indirect effect of PGWBI-D on DEBQ-EE through AAQ-II was significant [b=-0.0383; SE=0.0207; 95% BC-CI (-0.0810 - -0.0002)]. . In addition, the direct effect of PGWBI-D on DEBQ-EE was not significant [b=-0.07301; SE=0.0417; p=0.0823; 95% BC-CI (-0.1556 - 0.0095)]. Finally, the total effect of PGWBI-D on DEBQ-EE was significant [b=-0.1113; SE=0.0370; p=0.032; 95% BC-CI (-0.1846 - -0.0381)]. The results also suggest that the indirect mediated effect accounted for 12% (R2 =0.1284) of the variance.

Path models are presented in figure 1.

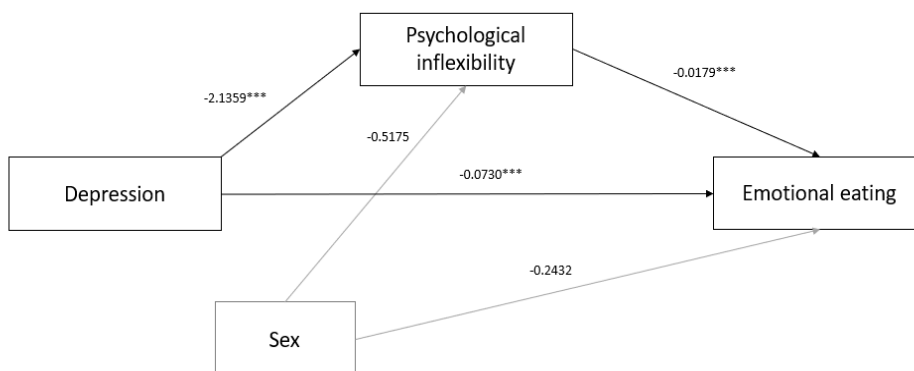
Figure 1. Path models of mediation analysis

- a) Relationship between anxiety, psychological flexibility, and emotional eating with sex as a covariate



Note: $***p < 0.001$; $**p < 0.05$

- b) Relationship between depression, psychological flexibility, and emotional eating with sex as a covariate



Note: $***p < 0.001$; $**p < 0.05$

3.4. Discussion

The present study was aimed at exploring the relationship between anxiety, depression, and emotional eating, as mediated by psychological inflexibility, in a sample of adult individuals with obesity.

As we hypothesized, we found significant associations between anxiety, depression, and emotional eating (Guerrini Usubini et al., 2021; Ouwens et al., 2009), suggesting that higher levels of anxiety and depression were related to higher emotional eating. We also found that anxiety and depression were significantly associated with psychological inflexibility. These results were consistent with the literature, suggesting that psychological inflexibility is related to some form of psychopathology, including mood disturbances and anxiety disorders (Venta et al., 2012). As far as the mediational hypothesis is concerned, results showed that psychological inflexibility played a significant indirect effect in the associations between depression and emotional eating, and between anxiety and emotional eating respectively.

These results are in line with previous findings exploring possible pathways between depression, anxiety, and dysfunctional eating behaviors (i.e., emotional and external eating). For example, Ouwens and colleagues found that psychological inflexibility was associated with both depression and anxiety (Ouwens et al., 2009). In another study by Litwin and colleagues (Litwin et al., 2017) researchers found that, among undergraduate female students, experiential avoidance was a significant mediator of the relationship between negative emotions and emotional eating. It is worth mentioning that in both of these studies, the samples consisted exclusively of female participants while we included a mixed sample of males and females. So, our study confirmed and extended previous results and provide additional evidence about the relationship between psychological inflexibility and disordered eating.

Our findings are also consistent with the affect regulation model which consider emotional eating as an attempt to reduce the intensity of negative emotions (Haedt-Matt et al., 2014; Litwin et al., 2017; Spoor et al., 2007)

Furthermore, these results are in agreement with the conceptual model of Forman and Butryn (Forman & Butryn, 2015) which theorized the protective role of some self-regulation skills (among them distress tolerance and values clarity) against emotional eating or other forms of overreacting to internal (e.g., emotions) and external (e.g., the availability of palatable food in the environment) cues. On the contrary, psychological inflexibility leads people to avoid negative internal thoughts, feelings, and physical sensations by controlling engaging in maladaptive behaviors such as emotional eating, at the expense of more meaningful actions (Levin et al., 2013).

Our findings also suggest that emotional eating may be used as a strategy to change or avoid unpleasant internal experiences, indicating that emotional eating is determined not only by the presence of negative emotions but also by the subject's response to them (i.e. avoidance). Therefore, a reduction of psychological inflexibility could also contribute to reducing emotional eating by promoting a greater willingness to accept negative emotions without trying to avoid them.

Our results can be seen in light of their clinical implications. Because psychological inflexibility appears to play a role in both the anxiety-emotional eating relationship and the depression-emotional eating relationship, interventions aimed at promoting psychological flexibility could have a significant impact on how both anxiety and depression are managed. In addition, our results suggest that interventions specifically aimed at reducing psychological inflexibility, such as Acceptance and Commitment Therapy (ACT) may be effective in reducing emotional

eating. Indeed, ACT has been shown to be effective in the treatment of eating disorders and weight issues (Forman et al., 2009b; Juarascio et al., 2010)

To sum up, the current study adds to our understanding of emotional eating. The findings presented fill a critical gap in the literature by implying that negative emotions are linked to increased levels of emotional eating via psychological inflexibility. However, psychological inflexibility has a partial indirect effect on the relationship between negative emotions and emotional eating, implying that other factors, such as self-efficacy or emotion dysregulation, should be investigated in future research.

Several limitations of the study must be discussed. This study used a cross-sectional design, and so, the nature of the current study warrants cautions in doing causality conclusions. To overcome this limitation, future studies should be planned with the inclusion of comparison with a normal-weight group and longitudinal measurements. Furthermore, in this study, we used only self-report measures that could be affected by bias and limitations (e.g., social desirability). Direct, instead of retrospective measures should be used in the future, in order to provide an objective assessment of the intended construct. Finally, quite small relationships were found, suggesting that there could be additional factors that we did not consider in our study that need to be addressed in future research replications. Another limitation concerns the sample representativeness. Indeed, we only included Italian adult individuals with obesity, without comorbid eating disorders undergoing a rehabilitation program for weight loss in a single clinical center for obesity management. Additional replications with different samples would be desirable. Finally, future advancements are also needed to explore the role of additional variables, including alexithymia and interoceptive awareness, which were found to be related to emotional eating (McDowell et al., 2002; van Strien et al., 2018).

Despite limitations, our study provides important strengths and clinical implications. By elucidating the role of psychological inflexibility between negative affect and emotional eating, our results deepen the understanding of mechanisms behind dysfunctional eating patterns, by providing specific evidence in a clinical sample of individuals with obesity. Our results suggest that psychological inflexibility has an indirect effect on the relationship between negative states of anxiety and depression and emotional eating in Italian adult individuals with obesity. Our findings also suggest that developing specific psychological interventions for overweight and obesity that target the process of psychological inflexibility might be beneficial for reducing emotional eating.

Chapter 4. Psychological inflexibility and emotional eating among adolescents with obesity. A cross-sectional study.

4.1. Introduction

Alongside obesity in adulthood, even childhood obesity has also become a major public health concern (Kelishadi, 2007; Nittari et al., 2019). In this regard, recent estimates showed that 124 million children and adolescents worldwide, between the ages of 5 and 19, were obese. Around 19% of children and adolescents in Europe are overweight or obese, with a higher incidence in southern European nations (WHO, 2022).

Children and adolescents who suffer from obesity are more likely to experience a number of physical and mental conditions that affect their emotional growth (Sagar & Gupta, 2018). According to research, obesity in children and adolescents has been linked to psychopathologies such as depression, anxiety, and attention deficit/hyperactivity disorder (Quek et al., 2017; Waring & Lapane, 2008). Because of their weight, children and adolescents who are obese are more prone to experience psychological disadvantages such as social exclusion, and bullying (Halfon et al., 2013; Rankin et al., 2016). Additionally, obesity in children and adolescents is linked to negative body perception, low self-esteem, and poor quality of life and well-being (Wang & Veugelers, 2008). This data points to obesity as a complicated illness that poses children's and teenagers' future development at risk. This aspect has spurred researchers to find a deeper comprehension of the risk factors involved and has called for a multidisciplinary approach that includes medical, nutritional, physical, and psychological components in order to address not only weight loss but also the treatment of comorbidities related to obesity and the improvement of psychological conditions (Carter & Jansen, 2012; Giusti et al., 2020).

According to Acceptance and Commitment Therapy (ACT) (Hayes et al., 2006), psychological inflexibility is expressed by cognitive fusion and experiential avoidance. Cognitive fusion

refers to the tendency of an individual to remain trapped in his thoughts and consider them as they are literally and objectively true, instead of transitory and subjective mental events (Hayes et al., 2011). Experiential avoidance includes the unwillingness to remain in contact with aversive internal states and the tendency to take steps to alter the form or frequency of these states and the contexts when they occur (Hayes et al., 2006). While avoiding internal experiences, people may engage in dysfunctional coping strategies to avoid situations, engage in distracting activities, or alternative behaviors with similar functions, such as drug use or alcohol abuse. In this perspective, disordered eating behaviors may be conceptualized as a set of maladaptive behaviors to avoid unwanted internal experiences (Masuda et al., 2010). Actually, eating may help individuals shift their attention away from their unpleasant internal states and temporarily alleviates negative mood states by means of avoidance (Stice et al., 2001). Although eating may initially serve as an impulsive behavior to escape one's negative mood states and one may act upon an urgent need to consume food in order to experience immediate relief from a negative mood, it may lead to undesirable long-term consequences. In fact, the temporary emotional relief that it offers can reinforce the maintenance of such eating patterns over time (Hilbert & Tuschen-Caffier., 2007).

Several relevant studies have reported that psychological inflexibility plays a key role in the development and maintenance of psychopathology (Gillanders et al., 2014; Krafft et al., 2019; Trinidad, Ferreira, & Pinto Guveira, 2020), including disordered eating behaviors (Hayes & Pankey, 2002; Duarte, Pinto Guveira, & Ferreira, 2017), weight and shape concerns, and emotional eating (Forman, et al., 2009).

Most of the research examining the relationship between psychological inflexibility and eating habits has focused specifically on adult populations, demonstrating a higher prevalence of avoidance in people with obesity and comorbid binge eating, and greater levels of cognitive fusion in people with impulsive responses to both food craving and binge eating (Lillis, et al.,

2011; Duarte, Pinto Guveira, Ferreira, & Silvia, 2016; Finger, de Freitas, & Oliveira, 2020. By contrast, few studies investigated the role of psychological inflexibility on eating habits in adolescents, in which disordered eating behaviors – including emotional eating – are actually common (Aparicio et al., 2016) and commonly associated with obesity and other obesity-related comorbidities (Goossens et al., 2009).

Taking into account the above considerations, the present cross-sectional study is intended to explore the association between psychological inflexibility (operationalized as cognitive fusion and avoidance) and emotional eating in a sample of Italian adolescents with obesity.

4.2. Methods

4.2.1. Participants and procedures

The sample was composed of fifty-six adolescents (twelve males, forty-four females), aged between 13 and 17 years, with an average Body Mass Index (BMI: Kg/m²) of 38 (SD=8.68). Participants were recruited at the Division of Auxology, Istituto Auxologico Italiano IRCCS, Piancavallo (VB), located in Northwest Italy, a specialized clinical center (i.e., third level) offering a 3-week in-hospital body weight reduction program. Inclusion criteria were: 1) age between 12 and 17; 2) BMI > 97th centile according to age- and sex-specific Italian growth charts (Cacciari et al., 2006); 3) Italian mother tongue. The patients were excluded in case of any psychiatric disorder diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders (Structured Clinical Interview for DSM-5 for major DSM-5 diagnoses including mental health and personality disorders) criteria or any medical condition that could compromise participation in the study such as intellectual or physical disabilities.

Participants were selected and screened for participating in the study after being informed about the research and obtaining written informed consent to participate from their parents. Assent from the adolescent was also obtained. Once enrolled, participants were asked to answer a set of self-report questionnaires. The diagnostic and assessment procedures were performed by researchers and clinical psychologists with specific expertise in clinical settings.

The study was approved by the Ethical Committee of the Istituto Auxologico Italiano, IRCCS, Milan, Italy (approval number: 2021_01_26_03). All procedures were conducted following the Helsinki Declaration and its later advancements

4.2.2. Measures

Demographical (gender, age, nationality, educational level, and family composition), physical (weight and height), and clinical data (cognitive fusion and emotional eating) were collected via self-report. BMI was calculated using the following formula: kg/m^2 . As for clinical data, we used the following Italian validated and widely adopted questionnaires.

The Avoidance and Fusion Questionnaire for Youth (AFQ-Y) (Greco et al., 2008), Italian version (Schweiger et al., 2017). It is a self-report questionnaire composed of 8 items rated on a 5-point Likert scale ranging from 0 (not at all true) to 4 (absolutely true), used to assess psychological inflexibility, specifically cognitive fusion and avoidance. In our sample, Cronbach's alpha was 0.904.

The Emotional Eating subscale of the Dutch Eating Behavior Questionnaire (DEBQ-EE) (van Strien et al., 1986), Italian version (Dakanalis, et al., 2013). It is a self-report questionnaire composed of 13 items, rated on a 5-step Likert scale ranging from 0 (never) to 4 (almost always) used to assess emotional eating. In our sample, Cronbach's alpha of the total score was 0.966.

4.2.3. Statistical analysis

An a priori power analysis was conducted using G*Power 3.1.9.4 for a Linear multiple regression: Fixed model, R² deviation from zero. Setting a medium-to-large effect size ($f^2=0.2$), an alpha of .05, and a power of 0.80, we found a required sample size of 52. Analyses were conducted using Jamovi (2.3.2).

Descriptive statistics were computed for all demographical, physical, and clinical variables. Pearson correlations were determined to assess the relations between all the continuous variables and to identify possible significant covariates to introduce into the model. An independent sample t-test was used to assess significant differences between males and females in the study variables. A multiple hierarchical linear regression was then computed to evaluate the impact of cognitive fusion and avoidance on emotional eating. Possible confounding variables (e.g., sex, age) were entered in the first block. The total score of AFQ-Y was set as the independent variable in the second block. The total score of DEBQ-EE was set as the dependent variable. ΔR^2 was used to compare the first and the second block in their amount of explained variance of the dependent variable.

4.3. Results

Descriptive (means and standard deviations) statistics of the study variables are reported in Table 1. Pearson's correlations showed that cognitive fusion was positively associated with emotional eating, as indicated by a significant and positive correlation between the total score of AFQ-Y and the total score of the DEBQ-EE ($r=0.716$; $p<0.0001$). Age ($r=0.002$; $p=0.989$) and BMI ($r=0.005$; $p=0.970$) were not significantly related to emotional eating. Independent sample t-test showed a significant difference between males ($M=0.558$; $DS=0.583$) and females ($M=1.92$; $DS=1.30$) in terms of emotional eating ($t=-5.26$; $p<0.001$), suggesting that females reported higher levels of emotional eating than males. In addition, significant differences were

also found between females (M=31.4; DS=15) and males (M=18.5; DS= 13.4) in cognitive fusion ($t= -2.70$; $p=0.009$)

The multiple hierarchical linear regression model was built to detect the effect of cognitive fusion on emotional eating by controlling for sex, the only demographical variable related to emotional eating which is entered in the first block. Consequently, the total score of AFQ-Y was entered in the second block.

The first model accounted for a significant amount of variance in emotional eating [$R^2 = 0.186$; Adjusted $R^2 = 0.171$; $F(1,54) = 12.3$; $p < 0.001$]. Then, when the total score of Y-AFQ was entered, the second model explained 55% of the variance for emotional eating [$R^2 = 0.551$; Adjusted $R^2 = 0.534$; $F(2,53) = 32.5$; $p < 0.001$]. The second model explained 36% more variance than the first [$\Delta R^2 = 0.365$; $F(1,53) = 43.1$; $p < 0.001$]. Results are shown in table 2.

Table 1 Descriptive statistics of the sample

	N (%)	Mean \pm SD
Sex		
Male	12 (21.4)	
Female	44 (78.6)	
Age (in years)	56	15.7 \pm 1.07
Nationality		
Italians	56 (100)	
Weight	56	107 \pm 22.8
BMI (Kg/m ²)	56	38 \pm 8.68
Educational level		
High school	56 (100)	
AFQ-Y	56	33.98 (11.56)
DEBQ-EE	56	28.6 (15.5)

Note. AFQ-Y: Avoidance and Fusion Questionnaire for Youth; DEBQ-EE: Dutch Eating Behavior Questionnaire-Emotional Eating

Table 2. Multiple hierarchical linear regression model examining the independent effect of demographic features and cognitive fusion (AFQ-Y) on emotional eating (DEBQ-EE).

	B	SE	β	95% CI	p-value
Block 1					
Confounding Factors					
Sex	0.6596	0.30915	0.505	0.0303 – 0.980	0.038
Block 2					
Cognitive fusion and avoidance					
AFQ-Y	0.0542	0.00826	0.644	0.4470 - 0.840	<0.001*

Note. B= unstandardized beta; CI= confidence interval; AFQ-Y: Avoidance and Fusion Questionnaire for Youth

*p < .001

4.4. Discussion

The present research conducted in a clinical sample of Italian adolescents with obesity obtained support for the hypothesis that cognitive fusion and avoidance are predictors of emotional eating (controlling for sex). This result was in line with findings that previously outlined the link between cognitive fusion and eating psychopathological symptoms (Ferreira, Palmeira, & Trindade., 2014) in adults. In addition, our study provides additional support and extends to young people a previously tested model which suggested that, when people are entangled with their thoughts, they are more likely to exhibit disordered eating patterns as an avoidant strategy to turn back unwanted and painful thoughts (Ferreira, Palmeira, & Trindade., 2014).

The model examined in the current study seems to contribute to the understanding of the processes involved in the vulnerability and persistence of disordered eating in patients with obesity.

Although research in the field is relatively new, our results are of particular interest and offer an important contribution to clinical work by suggesting that treating emotional eating may require focusing on cognitive fusion. Cognitive fusion, and its opposite, cognitive defusion, is one of the core targets of Acceptance and Commitment Therapy (ACT) (Hayes et al., 2006;

Hayes, Strosahl, & Wilson, 2011) which considers cognitive defusion as a valid alternative skill to deal with aversive thoughts that allows people to focus on meaningful behaviors and reducing the influence of dysfunctional thoughts (Hayes et al., 2006). ACT has been broadly and successfully applied in a wide range of psychopathologies and psychological difficulties, including eating behaviors. In this regard, promising results were achieved, suggesting that ACT is effective in targeting emotional avoidance which is a core factor in the development and maintenance of eating pathologies (Manlick, Cochran, & Koon., 2013). For example, in a study addressing the efficacy of an ACT intervention for eating behaviors and diet quality in adults with obesity, the authors found that ACT was able to reduce emotional eating, increase acceptance of food, and help people to perceive healthy eating as a chosen behavior driven from personal values and goals (Järvelä-Reijonen et al., 2018).

Several limitations of the study should be pointed out. First, the relative small sample size which requires future replications with a larger number of participants in order to achieve stronger results. In addition, in our sample of fifty-six participants, forty-four were females and only twelve were males. This unbalance concerning sex need to be considered in interpreting the results of the study with caution. For example, although we found a sex difference in cognitive fusion and emotional eating that is in line with the literature, we are obliged to use caution in interpretation since the result may be attributable to the higher prevalence of women in the sample instead of a real sex-related difference. To overcome this limitation, future replications of the study should collect data over samples with equal males and females. In addition, the sample consisted of Italian adolescents recruited from a single clinical center for obesity rehabilitation. This limits the generalizability of the study. Furthermore, we involved only self-report measures that could be affected by biases, even if we used valid and widely adopted questionnaires. Finally, the cross-sectional nature of the study limits the formulation of causal hypotheses. Despite the above limitations, the current study constitutes a preliminary

contribution to the development of this line of research, contributing to motivate the development of future studies on this relevant topic.

Chapter 5. The ACTyourCHANGE study: promoting a healthy lifestyle in patients with obesity with Acceptance and Commitment Therapy.

5.1. Introduction

As we elucidated before, Acceptance and Commitment Therapy (ACT) (Hayes et al., 2006) is a behaviorally-oriented therapeutic approach that aims to modify how a person relates to and responds to their internal experiences in order to more fully engage in values-based behaviors. Through acceptance, mindfulness, and using metaphors and practical exercises, ACT guides individuals to live a meaningful life while accepting the pain and the suffering that naturally is part of the human experience. The core concept of ACT is psychological flexibility which has been defined as the ability to fully contact with the present moment and engage in values-oriented behaviors. As traditionally described by Hayes and colleagues (Hayes et al., 2012) the model of psychological flexibility comprises six core components: acceptance, cognitive defusion, being present, self as a context, values, and committed actions which are referable to three pillars: *Openness* to internal states – thoughts, feelings and bodily sensations – despite the suffering they cause (comprising acceptance and defusion); *Awareness* of self, without automatically react to stressful internal states (comprising being present at the moment and self as a context); *Engagement* of self in pursuing committed behaviors related to personal values (comprising values and committed actions).

Although it has been well-established that psychological flexibility emerged as the core mechanism of action in ACT-based interventions, there is a paucity of research about how the subcomponents of psychological flexibility interact with each other and specifically impacted on therapy process and treatment outcomes, even if over the past twenty years the model of

psychological flexibility has been well-described and tested in their effectiveness (Villatte et al., 2016).

To date, one of the few studies with the purpose to examine the specific treatment effects of the subcomponents of the psychological flexibility model has been proposed by Villatte and colleagues (2016) who explored the influence of two subcomponents of the model – *openness* and *engagement* – in a sample of adults seeking treatment for depression and anxiety disorders. Results of the study showed that both *openness* and *engagement* produced significant improvements in anxiety and depression symptoms and quality of life. However, while *engagement* produced greater improvements in quality of life, *openness* was more effective in producing greater symptom reduction. These results provide additional support to the hypothesis that there is a distinction between well-being promotion and symptoms reduction (Villatte 2016), consistent with the theoretical model of ACT

In the field of health promotion, psychological flexibility has been proposed as a core ingredient of psychological health. Kashdan and Rottenberg (Kashdan & Rottenberg, 2010) argued the importance of psychological flexibility in helping individuals to recognize and adapt their own mindsets and behavioral repertoires to many situations to maintain personal and social functioning, with a balance among personal life domains and be aware, open, and committed to behaviors that are congruent with chosen life directions. There is a large body of research suggesting the potential benefits of promoting psychological flexibility for health promotion, including in obesity treatment (Cattivelli et al., 2018; Forman & Butryn, 2015; Levin et al., 2021) In this respect, there was a recent randomized group treatment trial that compared an ACT-based intervention with a CBT-based intervention for weight loss maintenance in a sample of adult individuals with obesity seeking treatment for weight loss (Cattivelli et al., 2021). Results found that individuals who received the ACT intervention were more likely than those who received CBT in achieving a $\geq 5\%$ (Naseer et al., 2018) weight loss from baseline to

follow-up and maintaining the weight loss after discharge. The main focus of the present work is to provide preliminary results of the “ACTyourCHANGE” study, an RCT aimed at assessing the specific effect of each subcomponent of the ACT model (*Openness, Awareness, and Engagement*), in promoting weight loss and weight loss maintenance over time as well as improving psychological conditions in a sample of Italian adult individuals with obesity. The intervention was part of a multidisciplinary 3-week-multidisciplinary rehabilitation program for weight loss.

5.2. Materials and Methods

5.2.1. Participants

A total sample of eighty-six Italian adults aged between 18 and 65, with obesity (BMI: $\text{Kg/m}^2 \geq 30$) was enrolled for the study. Participants were recruited at Istituto Auxologico Italiano IRCCS, Piancavallo (VB), located in the North-West of Italy, a specialized clinical center for obesity rehabilitation. Exclusion criteria comprised any psychiatric disorder diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders (Structured Clinical Interview for DSM-5 for major DSM-5 diagnoses including mental health and personality disorders) criteria or any medical condition that could compromise participation in the study such as intellectual or physical disabilities.

5.2.2. Measures

All the primary and secondary outcomes were collected at three measurement timepoints: at admission to the hospital (pre-test), at the end of the intervention (post-test), and at three months after discharge from the hospital (3flw-up).

5.2.2.1. Primary outcomes

Primary outcomes were changes over time (from pre-to-post-to-3flw-up) in weight status, BMI, and psychological conditions (including psychological well-being, treatment outcomes, psychological inflexibility, psychological distress, emotional dysregulation, and emotional eating).

At pre-test weight and height (to calculate BMI according to the following formula: Kg/m^2) were measured by the medical team, and then (post-test and 3flw-up) were self-reported. Other outcome measures were self-reported in all three measurement timepoints using the following questionnaires.

Psychological well-being. The *Psychological General Well-Being Inventory* (PGWBI) (Dupuy, 1980), Italian version (Grossi et al., 2002). It is a self-report questionnaire used to assess subjective well-being. It is composed of 22 items, rated on a 6-point Likert scale assessing six subscales and the total score (PGWBI_TOT). Subscales are anxiety (PBWBI_A), depression (PGWBI_D), positive well-being (PGWBI_P), self-control (PGWBI_SC), general health (PGWBI_GH), and vitality (PGWBI_V). In our sample, the Cronbach's alpha of each subscale were respectively 0.92, 0.85, 0.90, 0.72, 0.61, and 0.85. The Cronbach's alpha of the total score (PGWBI_TOT) was 0.96.

Treatment outcomes. The *Outcome Questionnaire 45.2* (OQ-45.2; Lambert et al., 2004), Italian version (Chiappelli et al., 2008) is a self-report questionnaire used to assess the effectiveness of the clinical intervention. It is composed of 45 items rated on 5-point Likert scale assessing three subscales and the total score (OQ_TOT): symptoms distress (OQ_SD), difficulties in interpersonal relations (OQ_IR), and difficulties in social role functioning (OQ_SR). In our sample, the Cronbach's alpha of each subscale was respectively 0.94, 0.81, and 0.74. The Cronbach's alpha of the total score (OQ_TOT) was 0.95.

Psychological inflexibility and experiential avoidance. The *Acceptance and Action Questionnaire* (AAQ-II) (Bond et al., 2011), Italian version (Pennato et al., 2013) is a self-report questionnaire used to assess psychological inflexibility and experiential avoidance. It is composed of 10 items, rated on a 7-point Likert scale; In our sample, the Cronbach's alpha of the total score (AAQ_TOT) was 0.91.

Psychological distress. The *Depression Anxiety and Stress Scale 21* (DASS-21) (Lovibond & Lovibond, 1996), Italian version (Bottesi et al., 2015) is a self-report questionnaire used to assess psychological distress. It is composed of 21 items, rated on a 4-point Likert scale assessing three subscales: depression (DASS_D), anxiety (DASS_A), and stress (DASS_S). In our sample, the Cronbach's alpha of each subscale was respectively 0.90, 0.84, and 0.90.

Emotional dysregulation. The *Difficulties in Emotional Regulation Scale* (DERS) (Gratz & Roemer, 2004), Italian version (Giromini et al., 2012). It is a self-report questionnaire used to assess emotion dysregulation. It is composed of 36 items, rated on a 5-point Likert scale assessing six subscales and the total score (DERS_TOT): non-acceptance (DERS_NA), goals (DERS_G), impulse (DERS_I), awareness (DERS_A), strategies (DERS_S), and clarity (DERS_C). In our sample, the Cronbach's alpha of each subscale was respectively 0.92, 0.86, 0.90, 0.83, 0.90, and 0.78. The Cronbach's alpha of the total score (DERS_TOT) was 0.96.

Emotional eating. The Emotional eating subscale of the *Dutch Eating Behaviors Questionnaire* (DEBQ_EE) (van Strien et al., 1986), Italian version (Dakanalis et al., 2013) was used to assess emotional eating. It is composed of 13 items, rated on a 5-point Likert scale. In our sample, the Cronbach's alpha of DEBQ_EE was 0.96.

5.2.2.2. Secondary outcomes

Secondary outcomes were changes from pre-to-post-to-3flw-up in all the subcomponents of the psychological flexibility model assessed as follows.

Acceptance. The subscale “Nonjudge” of the *Five Facet Mindfulness Questionnaire* (FFMQ_NJ) (Baer et al., 2006), Italian version (Boffito et al., 2009), is used as a measure of acceptance. It is composed of 8 items, rated on a 5-point Likert scale. In our sample, the Cronbach’s alpha of FFMQ_NJ was 0.87.

Cognitive fusion. The *Italian-Cognitive Fusion Questionnaire* (I-CFQ) (Gillanders et al., 2014), Italian version (Oppo et al., 2019). Was used to assess cognitive fusion. It is composed of 13 items rated on a 7-point Likert scale. In our sample, the Cronbach’s alpha of the total score (I-CFQ_TOT) was 0.90.

Mindfulness. The *Five Facet Mindfulness Questionnaire* (FFMQ) (Baer et al., 2006), Italian version (Boffito et al., 2009) was used to assess mindfulness. It is composed of 39 items rated on a 5-point Likert scale, assessing five subscales: observe (FFMQ_O), describe (FFMQ_D), act with awareness (FFMQ_AA), non-react (FFMQ_NR), and nonjudge (FFMQ_NJ). In our sample, the Cronbach’s alphas of each subscale were respectively 0.65, 0.89, 0.87, 0.82, and 0.87. The Cronbach’s alpha of the total score (FFMQ_TOT) was 0.92.

Values. The *Brief Values Inventory* (BVI) (McCracken & Yang, 2006), Italian version (Baroni et al., 2019) was used to assess living in accordance with personal values. It is composed of 12 items rated on a 6-point Likert scale assessing six domains of values: family, intimate relations, friends, work, health, and growth/learning. Subscales are importance of values (BVI_I) and success at living in accordance with values (BVI_S). The Cronbach’s alpha of BVI_I and BVI_S were respectively 0.50 and 0.82.

Committed action. The *Committed Action Questionnaire* (CAQ) (McCracken, 2013), Italian version (Baroni et al., 2017) was used to assess the ability to engage in committed actions driven by values. It is composed of 18 items rated on a 7-point Likert scale assessing positive (CAQ_P) and negative (CAQ_N) aspects of committed actions. In our sample, the Cronbach's alpha of CAQ_P and CAQ_N was respectively 0.89 and 0.85. The Cronbach's alpha of the total score (CAQ_TOT) was 0.90.

5.2.3. Procedures

Participants were informed about the study and selected and the admission to the rehabilitation program at the hospital (pre-test) and screened for participating in the study with a clinical interview conducted by a clinical psychologist blinded to research aims, to provide information about the study and assess the eligibility criteria. Once obtained informed consent to participate, participants were asked to fill in a battery of self-report questionnaires to collect demographical and clinical variables of interest for the study (pre-test). After completing the pre-intervention assessment, participants were randomly assigned to three experimental conditions:

- Group *Openness*: Participants assigned to this group attended the standard multidisciplinary rehabilitation program plus a brief ACT-based intervention targeting the process of *Openness*
- Group *Awareness*: Participants assigned to this group attended the standard multidisciplinary rehabilitation program plus a brief ACT-based intervention targeting the process of *Awareness*
- Group *Engagement*: Participants assigned to this group attended the standard multidisciplinary rehabilitation program plus a brief ACT-based intervention targeting the process of *Engagement*

All the ACT-based interventions comprised two group sessions, provided twice a week, lasting about 1 hour each, delivered by an ACT therapist, blind to the research aims. During the first session, the therapist guided patients in understanding the ACT model and the specific subcomponent targeted. In the second session, the therapist presented specific experiential activities and metaphors (described below). All the ACT-based interventions were delivered within the context of a 1-month multidisciplinary rehabilitation program for weight loss (described below). After the intervention, all participants completed the same assessment (post-test) and then were asked to complete again the battery of self-report after three months from discharge (3flw-up). The pre-test assessment was completed before the randomization, in order to ensure similar baseline characteristics of groups. Randomization with 1:1:1, allocation ratio was performed using the proper website [<http://www.randomization.com>].

The study protocol was registered on ClinicalTrials.gov (ID: NCT04474509) and approved by the Ethical Committee of Istituto Auxologico Italiano (approval number: 2020_06_16_08). All procedures were conducted following the Helsinki Declaration and its later advancements. The whole procedure of the study was scheduled in Table 1.

Table 1. Schedule of enrollment, assessment, and intervention.

	Pre-intervention		Intervention	Post-intervention	3flw-up
Eligibility screen	X				
Informed consent	X				
Allocation		X			
Data collection		X		X	X
Intervention: Openness			X		
Intervention: Awareness			X		
Intervention: Engagement			X		

5.2.4. Interventions

5.2.4.1. The 3-week multidisciplinary rehabilitation program for weight loss

All participants recruited for the study attended a multidisciplinary rehabilitation program for weight loss composed of medical, nutritional, physical, and psychological components. As for nutritional component, patients were placed on a hypocaloric balanced diet provided by dietitians (1200–1700 kcal/day) containing about 21% protein, 53% carbohydrates, and 26% lipids and received nutritional counseling provided both in individual and group sessions. As for physical component, patients performed physical activity once a day (1h) for five days per week, with trainers and physiotherapists consisting of indoor and outdoor walking, dynamic

exercises at moderate intensity, and 15-20 min aerobic exercise. As for psychological component, patients received individual, and group weekly psychological counseling provided by licensed psychologists and psychotherapists. In addition to the standard multidisciplinary rehabilitation program, participants received the ACT-based intervention.

5.2.4.2. The ACT-based intervention targeting Openness

The specific subcomponents targeted within the *Openness* group sessions were Acceptance and Defusion. Participants attending the *Openness* group sessions were introduced at acceptance and presented as an alternative to avoid thinking about and being focused on negative experiences such as stressful thoughts and feelings. Then, defusion is primarily used to detach, separate, or get some distance from our thoughts and emotions.

5.2.4.3. The ACT-based intervention targeting Awareness

The specific subcomponents targeted within the *Awareness* group sessions were Being in the present moment and Self as a Context. Participants attending the *Awareness* group sessions were encouraged to develop an aware attitude toward difficult thoughts and feelings. In particular, being present means engaging in the present moment without trying to stop difficult thoughts or suppress unpleasant feelings but just noting what is happening in life with acceptance. Participants are also introduced to the self-as-context, a concept by which a person is guided to stop identification with personal stressful thoughts and feelings, in order to create a psychological space in which simply observing self and personal thoughts and feelings instead of being overwhelmed by them.

5.2.4.4. The ACT-based intervention targeting Engagement

The specific subcomponent targeted within the *Engagement* group sessions were Values and Committed actions. Participants attending the *Engagement* group sessions were guided to recognize their values which are life-long directions that give life meaning and purpose. Once identified values, these were connected to committed actions, which means how to behave in service of chosen life directions in everyday life.

The description of the ACT-based intervention is proposed in Table 2.

Table 2. Description of the ACT-based intervention

Domains	Goals and therapeutic processes	Experiential activities and metaphors
Openness	<p>The purpose of this session is to develop the willingness to experience distress and undesirable private events as part of human experience, without judgment or attempts to avoid or control internal states, even if they are unpleasant.</p>	<p>Metaphor: “Passenger on the bus” (Hayes et al., 1999)</p> <p>“Imagine life is like a journey, and you’re the driver of your bus. You want to go places and do what’s important to you. Over the course of your life, various passengers have boarded your bus. They reflect your thoughts, feelings, and all kinds of inner states. Some of them you like, and some you feel neutral about. And then, there are some passengers you wish had not boarded the bus; they can be ugly, scary, and nasty. So, you are driving your bus of life with all sorts of passengers on board. The scary passengers can threaten you and want to be at the front of the bus where you see them. You take this very seriously and stop the bus to struggle and fight with them. You may try to avoid them, distract yourself, or throw them off the bus, but they are your inner states, so you can’t get rid of them. However, while the bus is stopped, you’re not moving in the direction that’s important to you. You may also try to make deals with the passengers; you’ll give in and do what they tell you to do if they agree to keep quiet in the back of the bus. This may feel a little easier than fighting with them, but it means the passengers are in control of the direction your bus is heading. By fighting and struggling with the passengers or giving in to them, you, the driver, are not in control of your journey of life, and it’s likely that you are not heading in a direction that is important to you. But what if, even though these passengers look scary, nasty, and threatening, they can’t take control unless you allow them to? There can be different ways to respond to the passengers so that you can head in the direction that is important.</p>
Awareness	<p>The purpose of this session is to promote the ability to be present at the moment and face events as contextually situated. To be aware means stepping back from suffering situations and seeing them in the context where they occur.</p>	<p>Experiential exercise: “Body scan”</p> <p>The body scan is one of the most effective ways to begin a mindfulness meditation practice. The purpose is to tune in to your body—to reconnect to your physical self—and notice any sensations you’re feeling without judgment. While many people find the body scan relaxing, relaxation is not the primary goal. The goal is to train the mind to be more open and aware of sensory experiences—and ultimately, more accepting.</p>

Engagement	<p>The purpose of this session is to foster values clarification and engagement in actions linked to personal values, such as relationships, and personal growth. If a person engages himself in committed actions driven by chosen life directions can pursue a meaningful and coherent life.</p>	<p>Metaphor: “80th birthday” (Oliver Hill & Morris, 2015)</p> <p>Imagine what you will look like on your 80th birthday. And, I invite you to imagine who you would most want to be at your 80th birthday party. Now the time has come for the party where people are starting to give speeches. They are taking turns standing up and speaking about what you have meant to them. They are speaking about what you have stood for as a person, and the impact you have had. Again, I’m inviting you to imagine, if you were to be bold at this moment, what you would most want them to say. Deep down in your heart, imagine what you would most want others to say about what you’ve meant. Imagine the first person standing up to speak. Imagine it’s someone very close to you. Take a moment now and imagine what you would most want them to say about the impact you’ve had. Try to really hear them saying that. Now thank your mind for this experience, and gently bring your attention back to the present moment. Take a moment to get centered here, noticing your breath and how your body feels.</p>
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5.2.5. Statistical analysis

Descriptive statistics were run to examine the demographic and baseline profile of the sample. To compare groups, a series of mixed between-within 3 (groups: openness awareness, engagement) \times 3 (times: pre-test vs. post-test vs. 3flw-up) repeated measures analyses of variance (ANOVAs) were conducted to examine changes in means of all the primary and secondary outcome measures between groups over three measurement timepoints. Levene's test was performed to check for homogeneity assumptions. For multiple comparisons, post-hoc tests have been used with Bonferroni's correction in case of violation of the homogeneity assumption. Effect size (η^2) was used to quantify the global difference between the two groups across times. Effects sizes were interpreted with the following benchmarks (J. Cohen, 1988): null ($\eta^2 < 0.003$); small ($0.003 < \eta^2 > 0.003$ to 0.039); moderate ($0.110 < \eta^2 > 0.40$); and large ($\eta^2 > 0.110$).

5.3. Results

5.3.1. Descriptive characteristics of the sample

The sample was composed of eighty-six participants, 29 males (33.7%) and 57 (66.3%) females. The mean age was 49.6 (SD=11.9). Of the 86 participants recruited for the study, 29 were allocated to the *Openness* group, 29 were allocated to the *Awareness* group and 28 were allocated to the *Engagement* group. In the *Openness* group, 11 were males, while 18 were female. The mean age was 50.3 (SD= 11.8). In the *Awareness* group, 8 were males while 21 were females. The mean age was 48.2 (SD=13.0). In the *Engagement* group, 10 were males, while 18 were females. The mean age was 50.3 (SD=11.3).

5.3.2. Differences between groups from pre-to-post-to-3flw-up in all the primary outcomes

A series of mixed 3x3 (between-within) repeated measures ANOVAs were performed to analyze differences between the three groups of intervention (group *Openness* vs. group *Awareness* vs. group *Engagement*) at three measurement timepoints (pre-test vs. post-test vs. 3flw-up) in weight, BMI, psychological well-being (PGWBI), treatment outcomes (OQ45.2), psychological inflexibility (AAQ-II), psychological distress (DASS-21), emotional dysregulation (DERS), and emotional eating (DEBQ-EE).

As for weight, results showed a significant main effect of time suggesting that weight significantly decreased from pre-to-3flw-up [$F(2,64)=3.76$; $p=0.029$; $\eta^2=0.022$], independently from the group condition. The main effect of group [$F(2,32)=0.384$; $p=0.684$; $\eta^2=0.018$] as well as the interaction effect of time x group were no significant [$F(4,64)=1.18$; $p=0.329$; $\eta^2=0.014$].

Similarly, results on BMI showed a significant main effect of time suggesting that BMI significantly decreased from pre-to-3flw-up and from post-to-3flw-up [$F(2,64)=4.38$; $p=0.016$; $\eta^2=0.027$], independently from the group condition. The main effect of group [$F(1,32)=1.02$; $p=0.371$; $\eta^2=0.046$], as well as the interaction effect of time x group [$F(4,64)=1.20$; $p=0.319$; $\eta^2=0.015$] were no significant.

As for treatment outcomes, we found a significant main effect of time on the difficulties in the interpersonal relation subscale (OQ_IR). The OQ_IR subscale significantly improved from pre-to-3flw-up and from post-to-3flw-up [$F(2,60)=3.32$; $p=0.043$; $\eta^2=0.028$] independently from the group condition. The main effect of group [$F(1,32)=1.02$; $p=0.371$; $\eta^2=0.046$], as well as the interaction effect of time x group [$F(4,64)=1.20$; $p=0.319$; $\eta^2=0.015$] were no significant. We also found a significant interaction effect time x group on the difficulties in social role

functioning subscale suggesting that OQ_SR significantly changed from pre-to- 3flw-up between group *Openness* vs. group *Awareness* [$F(4,60)=2.7490$; $p= 0.036$; $\eta^2=0.048$]. The main effect of time [$F(2,60)=0.0195$; $p=0.981$; $\eta^2=0.000$], and the main effect of group [$F(2,30)=0.812$; $p=0.453$; $\eta^2=0.036$] were no significant. No other significant effects on the OQ_SD and OQ_TOT were found.

As for psychological inflexibility, results on AAQ-II showed a significant main effect of time suggesting that AAQ-II significantly decreased from pre-to-3flw-up and from post-to-3flw-up [$F(1.69,54.19)=4.32$; $p= 0.023$; $\eta^2=0.018$,], independently from the group condition. The main effect of group [$F(2,32)=0.909$; $p= 0.413$; $\eta^2=0.045$], as well as the interaction effect time x group [$F(3.39,54.19)=1.78$; $p= 0.155$; $\eta^2=0.015$], were no significant.

As for psychological distress, we only found a significant main effect of time on anxiety suggesting that DASS_A significantly decreased from pre-to-post and from pre-to-3flw-up [$F(2,56)=3.798$; $p= 0.028$; $\eta^2=0.020$], independently from the group condition. The main effect of group [$F(2,28)=1.15$; $p= 0.330$; $\eta^2=0.063$], and the interaction effect time x group [$F(4,56)=0.309$; $p= 0.871$; $\eta^2=0.003$], were no significant. No other significant changes in DASS_D and DASS_S were found.

Similarly, we found a significant main effect of time on emotional eating suggesting that DEBQ_EE significantly changed from pre-to-post [$F(1.49,47.81)=3.351$; $p= 0.057$; $\eta^2=0.030$], independently from the group condition. The main effect of group [$F(2,32)=1.09$; $p= 0.347$; $\eta^2=0.043$], and the interaction effect time x group [$F(2.49,47.81)=0.546$; $p= 0.652$; $\eta^2=0.010$], were no significant.

Finally, as for psychological well-being and emotion dysregulation, we did not find neither a significant main nor an interaction effect of group and time in changes from pre-to-post-to-

3flw-up in PGWBI and DERS (both the total scores and their respective subscales) between groups.

Descriptives of the primary outcomes are depicted in table 3

Table 3. Descriptives of the primary outcomes

<i>Variables</i>	<i>Groups</i>	<i>Pre-test</i>			<i>Post-test</i>			<i>3flw-up</i>		
		N	Mean	DS	N	Mean	DS	N	Mean	DS
Weight	Openness	27	115	21.2	23	116	23.9	11	110	19.4
	Awareness	28	118	20.8	21	115	18.1	15	106	17.0
	Engagement	27	118	14.0	20	118	15.0	13	109	13.2
BMI	Openness	27	42.0	6.86	23	41.0	11.3	11	39.6	5.18
	Awareness	28	42.2	5.02	21	40.8	4.7	16	36.1	11.1
	Engagement	27	43.0	4.87	21	41.7	10.7	13	40.3	5.42
OQ_SD	Openness	26	29.8	17.6	23	29.8	14.9	10	33.3	19.1
	Awareness	27	38.0	20.0	21	28.8	24.5	15	38.4	20.7
	Engagement	27	28.0	15.0	20	25.8	13.1	11	23.9	14.8
OQ_IR	Openness	26	11.7	7.32	23	13.5	6.91	10	16.8	5.03
	Awareness	27	12.9	7.26	21	10.4	8.59	15	16.6	5.37
	Engagement	27	13.3	7.96	20	12.0	6.73	12	13.1	6.14
OQ_SR	Openness	26	9.88	4.84	23	10.0	3.94	10	11.4	5.25
	Awareness	27	12.0	3.97	21	10.0	7.40	15	13.9	7.29
	Engagement	27	10.5	5.27	20	10.9	5.46	12	9.00	6.05
AAQ_TOT	Openness	23	29.8	9.88	29	23.9	14.8	10	29.6	10.6

	Awareness	27	36.9	16.6	27	22.4	20.6	15	36.7	16.9
	Engagement	28	29.0	14.4	27	22.9	18.4	11	26.5	14.6
DASS_D	Openness	26	8.77	7.11	23	10.5	7.17	10	9.20	9.53
	Awareness	27	13.3	11.0	19	12.1	13.4	15	12.7	12.9
	Engagement	27	7.19	8.49	19	9.16	8.83	12	6.83	7.00
DASS_A	Openness	26	8.62	6.19	23	8.78	5.96	10	8.00	6.80
	Awareness	27	10.4	10.2	19	8.74	10.0	15	8.27	10.2
	Engagement	27	6.22	5.88	19	6.74	5.22	12	3.67	4.33
DASS_S	Openness	26	10.8	7.78	23	11.7	6.17	10	12.6	6.40
	Awareness	27	14.0	9.70	19	10.6	12.2	15	14.5	12.5
	Engagement	27	9.19	7.85	19	11.5	8.45	12	9.33	6.23
DEBQ_EE	Openness	26	2.97	1.49	29	2.49	1.58	10	3.25	1.31
	Awareness	28	3.10	1.44	27	1.84	1.77	15	3.04	1.37
	Engagement	28	3.05	1.49	28	2.37	1.86	11	3.15	1.18
DERS_NA	Openness	22	12.1	5.21	22	11.6	5.34	10	10.5	2.27
	Awareness	26	13.8	7.32	17	11.9	7.67	14	13.6	7.60
	Engagement	23	12.4	5.75	19	10.2	4.35	11	9.36	3.35
DERS_G	Openness	23	9.96	3.99	23	10.3	3.38	10	9.40	2.80
	Awareness	25	12.0	5.01	17	11.2	5.66	14	12.6	6.22
	Engagement	23	10.8	3.68	19	10.6	3.73	10	9.90	4.28
DERS_I	Openness	22	10.3	4.56	23	9.91	4.96	10	9.60	2.95
	Awareness	25	11.2	5.52	17	10.2	6.79	15	11.7	7.53
	Engagement	23	9.57	4.15	19	10.6	4.99	11	9.91	4.72
DERS_A	Openness	23	17.1	5.24	23	17.7	5.64	10	16.0	3.65

	Awareness	26	15.9	5.77	18	14.2	6.41	15	17.4	4.14
	Engagement	23	14.0	5.06	20	14.1	6.46	12	14.8	7.31
DERS_S	Openness	22	14.4	5.23	23	15.3	5.75	10	13.7	4.22
	Awareness	25	19.2	8.50	16	17.4	10.7	15	17.7	9.54
	Engagement	23	13.7	6.05	19	14.8	5.82	11	12.4	5.12
DERS_C	Openness	22	10.4	2.02	23	10.6	2.11	10	10.5	2.55
	Awareness	20	8.70	4.71	18	9.67	3.87	15	10.4	2.53
	Engagement	20	9.95	3.19	19	10.5	2.22	11	10.8	2.82
DERS_TOT	Openness	24	69.3	24.7	23	75.0	21.0	10	69.7	15.6
	Awareness	26	77.1	31.1	18	70.8	38.3	16	76.6	38.2
	Engagement	24	66.2	22.7	19	71.5	18.7	11	67.5	19.9
PGWBI_A	Openness	26	13.9	6.93	23	18.4	4.75	10	15.5	4.14
	Awareness	27	16.6	6.00	21	18.1	7.93	15	14.9	5.95
	Engagement	27	16.7	5.73	20	17.8	5.85	11	18.9	6.33
PGWBI_D	Openness	26	10.1	4.46	23	12.2	2.33	10	11.9	3.81
	Awareness	27	11.1	3.64	21	10.7	5.25	15	11.6	3.31
	Engagement	27	11.4	3.58	20	12.7	3.30	11	13.1	1.45
PGWBI_P	Openness	26	8.58	4.82	23	11.8	4.22	10	11.2	3.97
	Awareness	27	9.89	4.75	21	11.5	6.01	15	10.5	5.30
	Engagement	27	10.9	4.98	20	12.6	4.26	11	13.1	4.87
PGWBI_SC	Openness	26	10.2	4.65	23	11.5	2.73	10	11.0	2.36
	Awareness	27	10.7	3.18	21	10.9	5.15	15	10.5	3.80
	Engagement	27	10.9	3.45	20	11.8	3.41	11	12.3	2.41
PGWBI_GH	Openness	26	7.23	3.50	23	9.22	2.75	10	9.00	3.27

	Awareness	27	8.89	2.79	21	9.67	3.93	15	9.53	2.59
	Impegno	27	9.41	3.69	20	9.70	3.39	11	11.4	2.01
PGWBI_V	Openness	26	9.42	4.59	23	12.9	3.32	10	12.3	2.26
	Awareness	27	10.8	4.17	21	12.5	5.81	15	11.5	4.03
	Engagement	27	11.9	4.53	20	13.4	3.98	11	13.7	4.20
PGWBI_TOT	Openness	26	59.4	27.3	23	76.0	17.1	10	70.9	16.5
	Awareness	27	68.0	22.0	21	73.4	33.0	15	68.5	22.9
	Engagement	27	71.3	24.2	20	77.9	22.2	11	82.5	18.0

BMI: Body Mass Index; OQ_SD: symptoms distress subscale of Outcome Questionnaire 45.2; OQ_IR: interpersonal relations subscale of Outcome Questionnaire 45.2; OQ_SR: social role functioning of Outcome Questionnaire 45.2; AAQ_TOT: Acceptance and Action Questionnaire_total; DASS_D: Depression subsclae of Depression Anxiety and Stress Scale; DASS_A:Anxiety subscale of Depression Anxiety and Stress Scale; DASS_S: Stress subscale of della Depression Anxiety and Stress Scale; DEBQ_EE_ Emotional eating subscale of Dutch Eating Behaviors Questionnaire; DERS_NA: Non-Acceptance subscale of Difficulties in Emotional Regulation Scale; DERS_G: Goals subscale of Difficulties in Emotional Regulation Scale; DERS_I: Impulse subscale of Difficulties in Emotional Regulation Scale; DERS_A: Awareness subscale of Difficulties in Emotional Regulation Scale; DERS_S: Strategies subscale of Difficulties in Emotional Regulation Scale; DERS_C: Clarity subscale of Difficulties in Emotional Regulation Scale; PGWBI_A: Anxiety subscale of Psychological General Well-Being Inventory; PGWBI_DD:Depression subscale of Psychological General Well-Being Inventory; PGWBI_P: Positive well-being of Psychological General Well-Being Inventory; PGWBI_SC: Self-control subscale of Psychological General Well-Being Inventory; PGWBI_GH: General health subscale of Psychological General Well-Being Inventory; PGWBI_V: Vitality subscale of Psychological General Well-Being Inventory.

5.3.3. Differences between groups from pre-to-post-to-3flw-up in all the secondary outcomes

A series of mixed 3x3 (between-within) repeated measures ANOVAs were performed to analyze differences between the three groups of intervention (group *Openness* vs. group *Awareness* vs. group *Engagement*) at three measurement timepoints (pre-test vs. post-test vs. 3flw-up) in values (BVI), committed actions (CAQ), cognitive fusion (I-CFQ) and mindfulness (FFMQ).

As for values, we found a significant main effect of time on importance of values suggesting that BVI_I significantly changed from pre-to-post and from post-to-3flw-up [$F(1.50,51.06)=5.218$; $p=0.015$; $\eta^2=0.072$], independently from the group condition. The main

effect of group [$F(3,00,51.06)=0.941$; $p= 0.428$; $\eta^2=0.026$], and the interaction effect of time x group [$F(2,32)=1.09$; $p= 0.347$; $\eta^2=0.043$] were no significant. No other significant results were found for BVI_S.

As for committed actions, we only found a significant effect of time on negative aspects of committed actions suggesting that CAQ_N significantly changed from pre-to-post and from post-to-3flw-up [$F(2,60)=5.24$; $p= 0.008$; $\eta^2=0.050$], independently from the group condition. The main effect of group [$F(2,30)=0.198$; $p= 0.822$; $\eta^2=0.008$], and the interaction effect time x group [$F(4,60)=1.13$; $p= 0.350$; $\eta^2=0.021$], were no significant . No other significant results were found for CAQ_P and CAQ_TOT.

As for cognitive fusion, we found a significant effect of time suggesting that I-CFQ significantly changed from pre-to-post and from post-to-3flw-up [$F(1.53,51.93)=4.137$; $p= 0.031$; $\eta^2=0.038$], independently from the group condition. The main effect of group [$F(2,34)=0.101$; $p= 0.904$; $\eta^2=0.004$], and the interaction effect time x group [$F(3.05,51.93)=0.719$; $p= 0.548$; $\eta^2=0.013$], were no significant.

As for mindfulness, we only found significant results for the act with awareness and describe subscales. In particular, we found a significant main effect of group on FFMQ_AA suggesting that there was a significant difference between *openness* and *awareness* [$F(2,32)=3.43$; $p= 0.045$; $\eta^2=0.097$], independently from the time of intervention. The main effect of time [$F(1.62,52.00)=2.151$; $p= 0.135$; $\eta^2=0.028$] and the interaction effect time x group [$F(3.25,52.00)=0.446$; $p= 0.736$; $\eta^2=0.011$] were no significant. We also found a significant main effect of time on FFMQ_D that significantly changed from post-to-3flw-up [$F(2,58)=5.013$; $p= 0.010$; $\eta^2=0.064$], independently from the group condition. The main effect of group [$F(2,29)=0.692$; $p= 0.509$; $\eta^2=0.025$] and the interaction effect time x group [$F(4,58)=0.896$; $p= 0.472$; $\eta^2=0.023$] were no significant. No other significant results were

found for each subscale and total score of FFMQ. Descriptives of the primary outcomes are depicted in table 4

Table 4. Descriptives of the secondary outcomes

<i>Variables</i>	<i>Groups</i>	<i>Pre-test</i>			<i>Post-test</i>			<i>3flw-up</i>		
		N	Mean	DS	N	Mean	DS	N	Mean	DS
BVI_I	Openness	27	24.4	4.88	29	19.7	10.8	11	23.9	5.24
	Awareness	28	24.8	5.10	29	17.2	12.0	15	24.8	3.21
	Engagement	28	25.3	5.46	28	17.3	11.6	12	25.8	4.22
BVI_S	Openness	26	18.5	6.63	29	16.8	9.74	11	20.5	6.65
	Awareness	28	15.9	7.89	29	14.2	10.8	15	17.3	7.32
	Engagement	28	19.3	6.90	28	14.6	10.2	12	20.1	5.73
CAQ_P	Openness	26	3.62	1.02	23	3.30	0.804	11	3.36	1.03
	Awareness	27	3.56	1.27	21	3.54	1.72	15	3.69	1.55
	Engagement	27	3.98	0.859	20	3.57	0.542	12	4.21	0.816
CAQ_N	Openness	26	3.08	0.797	23	3.56	0.866	11	3.17	0.888
	Awareness	27	3.19	1.20	21	3.29	1.52	15	3.24	1.14
	Engagement	27	3.33	1.10	20	3.56	0.930	12	3.36	0.869
CAQ_TOT	Openness	26	0.372	0.082	23	0.381	0.80	11	0.363	0.084
	Awareness	27	0.375	0.124	21	0.379	0.172	15	0.385	0.144
	Engagement	27	0.406	0.094	20	0.396	0.065	12	0.421	0.077
I-CFQ_TOT	Openness	26	45.4	11.9	21	41.1	14.0	11	41.8	15.1
	Awareness	27	51.4	15.9	19	46.8	19.7	14	50.0	18.4
	Engagement	27	44.2	12.1	19	43.8	11.7	12	38.3	13.6

FFMQ_NJ	Openness	24	28.0	6.36	29	23.0	13.1	10	26.2	4.47
	Awareness	28	25.2	8.82	28	19.3	15.4	15	25.7	6.13
	Engagement	28	24.7	8.89	28	19.1	14.3	11	25.6	10.5
FFMQ_O	Openness	24	25.7	4.75	29	21.3	12.1	9	25.8	7.41
	Awareness	28	26.2	7.18	27	18.1	13.1	15	26.8	5.23
	Engagement	28	25.6	8.59	27	18.6	12.9	10	23.8	7.13
FFMQ_D	Openness	24	29.8	4.70	29	23.6	13.1	9	33.1	3.86
	Awareness	28	28.6	8.64	27	21.0	15.1	14	30.9	7.57
	Engagement	28	28.5	9.90	27	21.0	14.6	10	34.7	6.45
FFMQ_AA	Openness	24	31.7	5.26	29	25.0	13.7	10	32.5	6.35
	Awareness	28	27.0	8.75	28	19.5	15.3	15	26.9	7.98
	Engagement	28	27.8	9.03	28	20.4	15.0	10	32.4	6.67
FFMQ_NR	Openness	26	21.3	5.30	29	18.2	10.7	10	22.8	5.20
	Awareness	28	19.5	6.39	28	14.8	11.8	15	21.6	6.60
	Engagement	28	20.0	7.68	27	14.9	10.6	10	23.3	7.48
FFMQ_TOT	Openness	24	136	17.1	29	111	59.9	10	135	27.6
	Awareness	28	127	32.4	28	91.3	67.5	15	130	26.0
	Engagement	28	127	40.0	28	92.0	65.6	11	129	48.1

Note: BVI_I: Importance of values subscale of Brief Values Inventory; BVI_S: success subscale of Brief Values Inventory; CAQ_P: Positive aspects subscale of Committed Action Questionnaire; CAQ_N: Negative aspects subscale of Committed Action Questionnaire; I_CFQ: Cognitive Fusion Questionnaire; FFMQ_NJ: Nonjudge subscale of Five Facet Mindfulness Questionnaire; FFMQ_O: observe subscale of Five Facet Mindfulness Questionnaire; FFMQ_D: Describe subscale of Five Facet Mindfulness Questionnaire; FFMQ_AA: Act with awareness subscale of Five Facet Mindfulness Questionnaire; FFMQ_NR: Non-react subscale of Five Facet Mindfulness Questionnaire.

5.4. Discussion

As for primary outcomes, no evidence was found for the specific effects of subcomponents of the psychological flexibility model on treatment outcomes. In all groups, we found significant improvements over time (from pre-to-3-flw-up) in weight, BMI, psychological inflexibility, anxiety, and emotional eating, with no significant differences among them. Difficulties in interpersonal relationships increased over time with no differences among groups. The only between-group difference that we detected concerned the Difficulties in social role functioning subscale that worsen in patients of the *Awareness* than those in the *Openness* group.

Weight and BMI decreased from pre-to-3flw-up, suggesting that all participants were able to lose weight not only during the period of rehabilitation program but also over the following months, independently from the condition they attended. Consequently, also BMI decreased. These results were in line with a previous study (Cattivelli et al., 2021) which compared ACT vs CBT as psychological components of a multidisciplinary rehabilitation program for weight loss in patients with obesity. Results of the study showed that participants in the ACT condition were more able to maintain weight loss over time than those in the CBT condition, as shown by a significant decrease in weight and BMI from discharge from the hospital to 6-month follow-up.

Interestingly, difficulties with interpersonal relations increased over time, more specifically, from the period of rehabilitation to the follow-up measurement. This result was unexpected since ACT has been previously assessed for its effectiveness in reducing interpersonal problems (Azadeh et al., 2015). However, it is possible to speculate that the difficulties in interpersonal relations that the OQ-45.2 explored – which were related to isolation, sense of inadequacy, social withdrawal, and social conflict – have been probably influenced by the condition of hospitalization of our patients. Actually, several studies have found that hospitalization is a

stressful condition that patients live with uncertainty about the future, anxiety, and depression (Boey & Boey, 2016; De Fazio et al., 2017). Hospitalization has been also associated with poorer psychological well-being, worst emotional functioning, and worst ability to cope and adjust (Chiarchiaro et al., 2013). Such evidence could probably explain also the worsening of social role functioning subscale, one of the dimensions of the FFMQ, particularly in those who attended the *Openness* condition when compared to those in the *Awareness* group. However, further explorations are needed to better address the results that we achieved. Our results also showed a general reduction of anxiety over time – with no specific difference among groups – along with a reduction in psychological inflexibility and a reduction in emotional eating. Taken together, these findings can be seen in light of a recent mediation model previously suggested by the authors, according to which psychological inflexibility seems to play a significant mediating role between anxiety and emotional eating (Guerrini Usubini et al., 2022).

As for secondary outcomes, which were related to specific measures of the subcomponents of the psychological flexibility model, we did not find so many differences among groups. However, all patients improved in recognizing the importance of values and increased their ability to describe internal experiences. Such evidence is particularly relevant from a clinical point of view. Values, along with committed actions, increase motivation and reinforce meaningful behaviors. In addition, the importance of living in line with personal values was found to be related to higher psychological well-being, greater perception of purposes in line, and less psychological distress (Williams et al., 2015). Similarly, describing internal experiences has been considered one of the five facets of being mindful, which has been associated with reduced psychological symptoms and increased health and well-being (Baer et al., 2006). Act with awareness, a dimension of FFMQ, was higher in those who attended the *openness* than those of the *awareness* group, regardless of time. Even if we might have expected improvements in the act with awareness subscale as a specific effect of the *awareness* group,

this result is consistent with previous studies that have considered awareness as a common process simultaneously targeted by openness and engagement (Villatte et al., 2016).

The general paucity of significant results in terms of significant differences among groups, which would indicate specific effects of each subcomponent of the psychological flexibility model on treatment outcomes would lend itself to several explanations. Firstly, the small sample size makes it difficult to determine if an outcome is a true finding and, in some cases, a type II error may occur and so, the null hypothesis would be incorrectly accepted and no difference between the study groups would be reported. In this regard, we are planning to continue data collection and improve our sample size. Secondly, the short duration of the intervention may affect the lack of significant results, even if there is evidence on how ACT is particularly well suited for brief interventions. Lillis and colleagues (Lillis et al., 2009) provide a 1-day ACT workshop targeting acceptance, values, and mindfulness to reduce distress, the impact of stigma, and improve the quality of life in a group of adults with obesity after completing a weight loss program, in comparison with a waiting list control group. At three months of follow-up, participants who attended the ACT workshop showed less psychological distress, improved quality of life, and less stigma than those in the control group. Forman and colleagues (Forman et al., 2009a) compared a standard CBT vs an ACT-based coping strategy group lasting 2 hours in reducing craving for sweets in a community sample of women with overweight and obesity ($BMI \geq 25$). Results showed reduced craving and sweet consumption in the acceptance-based coping strategies group than in the CBT one.

Searching for alternative explanations, one can argue that the intervention may not have been well suited to the ACT principles, or the original structure of the intervention may not have been respected once implemented. However, as we previously reported, the planned intervention was developed following the main ACT-based manuals (Hayes et al., 2012) with adjustments according to the context of the study implementation. In addition, adherence to the

protocol has been constantly checked and guaranteed by two independent observers who attended all sessions.

Even with small results, this work is one of the first attempts to assess the differential impact of each subcomponent of the psychological flexibility model (*Openness, Awareness, and Engagement*) (Strosahl et al., 2012) on treatment outcomes of an ACT-based psychological intervention for adults with obesity.

In addition, the study is intended to clarify the proper functioning of the psychological flexibility model which, although it has been already tested under several conditions and settings, raises some questions about the mechanisms of action of each subcomponent. Limitations of the study relate to the small sample size, which warrants caution in the interpretation of the results, and the lack of a direct comparison to a complete ACT intervention with the application of the entire – and not divided in each subcomponent – psychological flexibility model, and/or a condition of no psychological intervention or alternative therapy-based interventions (i.e., CBT). Further replications of the study with a larger sample and a longer period of follow-up are needed. In addition, future replications will also need to consider patients with eating disorders, specifically Binge Eating Disorder, a common comorbid clinical condition related to obesity.

Chapter 6. The ACTyourCHANGE in Teens study: promoting a healthy lifestyle in patients with obesity with Acceptance and Commitment Therapy.

6.1. Introduction

As for adults, also for children providing long-lasting effective treatment for weight loss and healthy lifestyle promotion is urgent. To date, there is a paucity of evidence concerning the efficacy of ACT-based intervention in children and adolescents, although some preliminary results were promising. Teenagers with a variety of diseases, including cystic fibrosis (Casier et al., 2011), chronic pain (Gauntlett-Gilbert et al., 2013), ADHD, and at-risk adolescents (Luciano et al., 2011; Murrell & Kapadia, 2011), have benefited from the use of several ACT-based protocols. For example, in a pilot study conducted by Hayes, Boyd, and Sewell (Hayes et al., 2011) an ACT-based intervention was compared to a standard one for depression, in a sample of thirty adolescents who were referred to a psychiatric outpatient service. The results showed that patients receiving the ACT intervention saw a significant reduction in depressed symptoms. An ACT-based intervention was given to adolescents with chronic pain and their families in research by Kemani and colleagues (Kemani et al., 2018). The findings indicated that psychological flexibility and acceptance of chronic pain had improved in teenagers, and depression in their parents also decreased. Additionally, ACT has been used with teenagers who have post-traumatic stress disorder (Woidneck et al., 2014), with results showing a decrease in symptoms following a 10-week intervention.

Unfortunately, there is not much research in the literature about using ACT protocols with teenagers who have weight-related issues. There was only one pilot study (Tronieri et al., 2019) evaluating the efficacy of an ACT-based psychological intervention used in combination with a 16-week program for lifestyle change in a sample of adolescents with obesity. This study

showed that the intervention was successful in encouraging a decrease in BMI as well as a general improvement in physical activity and psychological state in teenagers.

Given these premises, the study presented in the latest chapter has inspired the current one, which is presented in the following sections.

In particular, the aim of the study was to evaluate the effectiveness of a brief ACT-based psychological intervention, compared to the treatment as usual (TAU) in improving psychological conditions in a sample of adolescents with obesity attending a multidisciplinary rehabilitation program for weight loss.

6.2. Materials and Methods

6.2.1. Participants and procedures

Thirty-four adolescents aged between 13 and 17 years, with obesity (mean BMI of 38.2) participated in the study. Participants were recruited at the Division of Auxology Istituto Auxologico Italiano IRCCS, Piancavallo (VB), a specialized clinical center for obesity rehabilitation located in the North-West of Italy. Inclusion criteria were a) age between 12 and 17; b) BMI > 97th centile according to age- and sex-specific Italian charts (Cacciari et al., 2006); c) Italian mother tongue. Exclusion criteria comprised any psychiatric disorder diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders (Structured Clinical Interview for DSM-5 for major DSM-5 diagnoses including mental health and personality disorders) criteria or any medical condition that could compromise participation in the study such as intellectual or physical disabilities.

Participants were selected at the admission to the hospital (Time 0), informed, and screened for participating in the study with a clinical interview conducted by a clinical psychologist. Once

obtained written informed consent from parents and assent from adolescents, they were asked to fill in a battery of self-report questionnaires to collect demographical and clinical variables of interest at pre-test. Weight and height, to calculate BMI (kg/m^2), were assessed by the medical team. After completing the pre-test assessment at Time 0 (week 1), participants were randomly assigned into the following two conditions:

- ACT+TAU group: Participants assigned to this group attended the standard 3-week multidisciplinary rehabilitation program plus a brief ACT-based intervention.
- TAU only group: Patients received the standard 3-week multidisciplinary rehabilitation program only.

At the end of the 3-week residential rehabilitation program, just before discharge, all participants were asked to complete the same post-test assessment at Time 1 (week 3).

In order to ensure similar baseline characteristics of groups, the pre-test assessment was proposed before the randomization. Randomization procedure followed 1:1 allocation ratio and it was performed using the Web site Randomization.com [<http://www.randomization.com>, accessed on].

The published study protocol of the study was registered on ClinicalTrials.gov (ID: NCT04896372) and approved by the Ethical Committee of the Istituto Auxologico Italiano (approval number: 2021_01_26_03). All procedures were conducted following the Helsinki Declaration and its later advancements. The procedures of the study were scheduled in Table 1.

Table 1. Schedule of enrollment, assessment, and intervention.

	Pre-intervention		Intervention	Post-intervention
	week 1	week 1	week 1-2-3	week 3
Eligibility screen	X			
Informed consent	X			
Allocation		X		
Data collection		X		X
Intervention: ACT+TAU			X	
Intervention: TAU only			X	

6.2.2. Measures

Demographical (gender, age, nationality, educational level, and family composition), primary (psychological well-being), and secondary outcomes (psychological distress, experiential avoidance and fusion, emotion dysregulation, and emotional eating) were collected via self-report as follows.

The Psychological Well-Being Scales (PWB) (Ryff, 1989), Italian version (Ruini et al., 2003) is a self-report questionnaire composed of 18 items rated on a 4-point Likert scale ranging from 1 (completely disagree) to 4 (completely agree) measuring psychological well-being and its six dimensions: self-acceptance, positive relationships with others, autonomy, environmental control, personal growth, and life purpose. In our sample, the Cronbach's alpha of the total score was 0.70.

The Depression Anxiety Stress Scale (DASS-21) (Lovibond & Lovibond, 1996), Italian version (Bottesi et al., 2015) is a widely used measure of psychological distress. It consists of 21 items rated on a 4-point Likert scale, ranging from 0 to 3. The questionnaire is composed of three subscales: depression (DASS-D), anxiety (DASS-A), and stress (DASS-S). In our sample, the Cronbach's alpha of depression, anxiety, and stress subscales were, respectively, 0.91, 0.88, and 0.86.

The Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004), Italian version (Giromini et al., 2012) was used to assess difficulties in emotional dysregulation. It is a self-report questionnaire consisting of 36 items, rated on a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always), exploring six subscales: Nonacceptance of emotional responses, Difficulty engaging in goal-directed behavior, Impulse control difficulties, Lack of emotional awareness, Limited access to emotion regulation strategies, Lack of emotional clarity. In our sample, the Cronbach's alpha of the total score was 0.94.

The Avoidance and Fusion Questionnaire for Youth (AFQ-Y) (Greco et al., 2008), Italian version (Schweiger et al., 2017) was used as a measure of experiential avoidance and fusion in adolescents. It consists of 8 items rated on a 5-point Likert scale ranging from 0 (not at all true) to 4 (absolutely true). In our sample, the Cronbach's alpha was 0.90.

The Emotional Eating subscale of the Dutch Eating Behavior Questionnaire (DEBQ) (van Strien et al., 1986), Italian version (Dakanalis et al., 2013) was used to assess emotional eating (DEBQ-EE). The DEBQ is a self-report questionnaire used to detect eating behaviors. The Emotional Eating subscale consists of 13 items, rated on a 5-step Likert scale ranging from 0 (never) to 4 (almost always). In our sample, the Cronbach's alpha of the total score was 0.97.

6.2.3. Interventions

6.2.3.1. The 3-week-multidisciplinary rehabilitation program for weight loss (TAU)

The hospital where the study was conducted offers a multidisciplinary inpatient treatment program for weight management with medical, dietetic, physical, and psychological components (Lazzer et al., 2020; Rigamonti et al., 2020), which was followed by all participants according to the Italian National Health System recommendations. The nutritional component of the intervention comprised a nutritional assessment carried out by the nutritionist staff, an individualized hypocaloric diet entailing an energy intake about 500 kcal lower than the resting energy expenditure, composed of 53% carbohydrates, 26% fat, and 21% protein (Nutrition ISO, 1996), and a fluid intake of at least 1500 mL per day, and a daily nutritional counseling program comprising dietetics lessons. The physical rehabilitation was composed of a physical activity program consisting of two 30-minute sessions per day of cycling, walking, stationary rowing, and stretching under the supervision of physical trainers and medical monitoring. The psychological component of the intervention comprised weekly individual psychological counseling sessions, lasting about one hour each, aimed at promoting a healthy lifestyle and addressing psychological factors related to the onset of dysfunctional lifestyle habits.

6.2.3.2. The Acceptance and Commitment Therapy-Based Intervention (ACT)

The proposed intervention was designed on the basis of previous ACT-based weight management interventions (Cattivelli et al., 2018) and adapted for this specific population. It was developed following the main ACT-based manuals (Halliburton & Cooper, 2015), with adjustments according to the users (Turrell & Bell, 2016) and the context of the study implementation. As detailed in the published study protocol, the intervention was aimed at promoting the three pillars of the psychological flexibility model (Hayes et al., 2012) namely Openness, Awareness, and Engagement using theoretically rooted and manualized experiential

exercises and key metaphors in the field of ACT. The intervention was composed of three sessions, provided once a week lasting about one hour each. The sessions were carried out by a licensed clinical psychologist with proven expertise in ACT clinical practice for adolescents both in individual and group settings, blinded to research aims.

The description of the ACT-based intervention is proposed in Table 2.

Table 2. Description of the ACT-based intervention

Session number	Domains	Goals and therapeutic processes	Experiential activities and metaphors
Session 1 Week 1	Openness	The purpose of this session is to develop the willingness to experience distress and undesirable private events as part of human experience, without judgment or attempts to avoid or control internal states, even if they are unpleasant.	Experiential exercise: “How would my life be if...” In this experiential activity, young patients are guided to answer the key question: “How would my life be if I didn’t have...(my problem that I have)”. The problem could be their weight or anything else related to their condition of obesity or any other perceived problem in their life. Participants are encouraged to describe what they desire to do if they did not have obesity, in order to take distance, observe and accept their conditions and related thoughts and feelings.
Session 2 Week 2	Awareness	The purpose of this session is to promote the ability to be present at the moment and face events as contextually situated. To be aware means stepping back from suffering situations and seeing them in the context where they occur.	Metaphor: “The sky and weather metaphor”(Harris, 2009) In this metaphor personal thoughts and feelings are presented like the weather and the self like the sky. The weather naturally changes. Despite that, it can never harm or change the sky. No matter how bad the weather, the sky always has room for it. Sometimes we forget that the sky is there but is still there. In the same way, difficult thoughts and feelings can occur. No matter how harmful they are, the self is still there. We can always learn how to access this part of ourselves. It is a safe space that contains difficult thoughts and feelings.
Session 3 Week 3	Engagement	The purpose of this session is to foster values clarification and engagement in actions linked to personal values, such as relationships, and personal growth. If a person engages himself in committed actions driven by chosen life directions can pursue a meaningful and coherent life.	Experiential exercise: “The treasure hunt”. In this experiential exercise, young patients are asked to draw a treasure hunt in which the treasure is a value in their life and the route is made of behaviors that need to be engaged to reach a meaningful life.

6.2.4. Statistical analysis

Descriptive statistics were conducted to explore the demographic and baseline profile of the sample and to check if the study variables were normally distributed. Frequencies and percentages were computed for categorical variables, means, and standard deviations for continuous variables. A series of independent samples t-tests were also conducted to examine whether the two treatment groups (ACT+TAU vs. TAU only) were different in any demographical and clinical variables at pre-test.

To compare groups, mixed between-within 2 (groups: ACT+TAU vs. TAU only) \times 2 (times: pre-test vs. post-test) repeated measures analyses of variances (ANOVAs) were conducted to examine changes in means of scores of PWB, subscales of DASS-21, DERS, AFQ-Y, and DEBQ (Emotional Eating subscale) between groups over two measurement timepoints. Homogeneity of variances was tested using Levene tests. Effect size (η^2) was used to quantify the global difference between the two groups across times. Effects sizes were interpreted with the following benchmarks (Cohen, 1988): null ($\eta^2 < 0.003$); small ($0.003 < \eta^2 < 0.039$); moderate ($0.110 < \eta^2 < 0.40$); and large ($\eta^2 > 0.110$).

As part of the exploratory analysis, a series of moderation analyses were carried out. Specifically, we first tested the presence of a significant interaction between pre-test psychological distress (i.e., anxiety, depression, and stress) and the treatment groups (ACT+TAU vs. TAU only) in predicting emotional eating at post-test. Secondly, we examined the presence of a significant interaction between experiential avoidance and cognitive fusion at pre-test and the treatment groups (ACT+TAU vs. TAU only) in predicting emotional eating at post-test. Psychological distress and experiential avoidance and cognitive fusion were mean centered, in order to reduce potential problems of multicollinearity and improve the interpretation of the coefficient in the interaction. In the first set of moderations, we controlled

for changes in experiential avoidance and cognitive fusion from pre-test to post-test, while in the second moderation, we controlled for experiential avoidance and cognitive fusion at post-test. To provide a visual summary of moderations, values of pre-test psychological distress, and experiential avoidance and cognitive fusion (i.e., high = one standard deviation above the mean, average = mean, and low = one standard deviation below the mean) were selected, and the conditional effect of the treatment groups at those values of pre-test psychological distress and experiential avoidance and cognitive fusion were estimated, and a final plot was created.

Participants who reported missing data or did not complete questionnaires or dropped out from the program were excluded and their data were not analyzed. Analyses were performed using Jamovi (The jamovi project 2021). jamovi (Version 1.6) [Computer Software]. Retrieved from <https://www.jamovi.org>.

6.3.Results

6.3.1. Descriptive characteristics of the sample

Of the thirty-four adolescents recruited for the study, seventeen were assigned to the ACT+TAU group and seventeen were assigned to the TAU only group. In the ACT+TAU group thirteen were females, while four were males. The mean age was 15.5 (SD = 1.37) and the mean BMI at pre-test was 38.5 (SD = 6.00). In the TAU only group, fourteen were females, while three were males. The mean age was 15.6 (SD = 1.06) and the mean BMI at pre-test was 36.8 (SD = 6.47).

A series of independent samples t-tests revealed that at pre-test there were no significant differences between the groups (ACT+TAU vs TAU only) in psychological well-being (PWB) depression (DASS-D), anxiety (DASS-A), stress (DASS-S), emotion dysregulation (DERS), experiential avoidance and fusion (AFQ-Y), and emotional eating (DEBQ-EE). Results are shown in Table 3.

Table 3. Baseline descriptive of the sample

Variables	Group	N	Mean	SD	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
PWB	TAU	17	46.38	5.19	0.6902	0.495	0.2404
	ACT+TAU	17	44.94	6.61			
DASS-D	TAU	17	14.71	11.40	0.4265	0.673	0.1463
	ACT+TAU	17	13.06	11.12			
DASS-A	TAU	17	14.35	13.18	0.2133	0.832	0.0732
	ACT+TAU	17	13.53	8.93			
DASS-S	TAU	17	18.71	10.15	0.0955	0.924	0.0328
	ACT+TAU	17	18.35	11.36			
DERS	TAU	17	90.24	29.14	-1.1235	0.270	-0.3854
	ACT+TAU	17	101.71	30.37			
AFQ-Y	TAU	17	25.00	15.94	-0.9238	0.363	-0.3169
	ACT+TAU	17	29.88	14.86			
DEBQ-EE	TAU	17	1.52	1.38	-0.3053	0.762	-0.1047
	ACT+TAU	17	1.67	1.36			

Note: PWB: Psychological Well-Being; DASS-D: Depression subscale of the Depression Anxiety and Stress scale; DASS-A: Anxiety subscale of the Depression Anxiety and Stress scale; DASS-S: Stress subscale of the Depression Anxiety and Stress scale; DERS: Difficulties in Emotion Regulation Scale; AFQ-Y: Avoidance and Fusion Questionnaire for Youth; DEBQ-EE: Emotional Eating subscale of the Dutch Eating Behavior Questionnaire.

6.3.2. Differences between groups from pre-to-post- intervention

A series of mixed 2 x 2 (between-within) repeated measures ANOVAs were performed to analyze differences between the two groups of interventions (ACT+TAU vs TAU only) at two measurement timepoints (pre-test vs. post-test) in psychological well-being (PWB), psychological distress, specifically depression (DASS-S), anxiety (DASS-A) and stress (DASS-S), emotional dysregulation (DERS), experiential avoidance and fusion (AFQ-Y), and emotional eating (DEBQ-EE).

As for psychological well-being, results showed no significant interaction effect of time x group on PWB from pre-test to post-test ($F(1,29) = 0.000159$; $p = 0.990$; $\eta^2 = 0.000$) and no significant main effect of the within factor of time ($F(1,29) = 0.152$; $p = 0.699$; $\eta^2 = 0.002$). The main effect of the between factor of group was not significant ($F(1,29) = 0.00314$; $p = 0.0956$; $\eta^2 = 0.000$).

As for depression, the results showed no significant interaction effect of time x group on DASS-D from pre-test to post-test ($F(1,32) = 0.0762$; $p = 0.784$; $\eta^2 = 0.000$) and no significant main effect of the within factor of time ($F(1,32) = 1.4943$; $p = 0.230$; $\eta^2 = 0.006$). The main effect of the between factor of group was not significant ($F(1,32) = 0.102$; $p = 0.752$; $\eta^2 = 0.003$).

As for anxiety, results showed a significant interaction effect of time x group on DASS-A from pre-test to post-test ($F(1,32) = 5.11$; $p = 0.031$; $\eta^2 = 0.017$) and a significant main effect of the within factor of time ($F(1,32) = 159.00$; $p < 0.001$; $\eta^2 = 0.534$). The main effect of the between factor of group was not significant ($F(1,32) = 1.06$; $p = 0.312$; $\eta^2 = 0.011$).

As for stress, results also showed no significant interaction effect of time x group on DASS-S from pre-test/Time 0/week 1 to post-test/Time 1/week 3 ($F(1,32) = 0.0395$; $p = 0.844$; $\eta^2 = 0.000$) and no significant main effect of the within factor of time ($F(1,32) = 2.3192$; $p = 0.138$; $\eta^2 = 0.016$). The main effect of the between factor of group was not significant ($F(1,32) = 1.16 \times 10^{-31}$; $p = 1.000$; $\eta^2 = 0.000$).

As for emotion dysregulation, results showed no significant interaction effect of time x group on DERS from pre-test to post-test ($F(1,32) = 0.971$; $p = 0.332$; $\eta^2 = 0.001$) and no significant main effect of the within factor of time ($F(1,32) = 2.350$; $p = 0.135$; $\eta^2 = 0.003$). The main effect of the between factor of group was not significant ($F(1,32) = 1.88$; $p = 0.180$; $\eta^2 = 0.053$).

As for experiential avoidance and fusion, results showed no significant interaction effect of time x group on AFQ-Y from pre-test to post-test ($F(1,32) = 1.11$; $p = 0.299$; $\eta^2 = 0.003$) and no significant main effect of the within factor of time ($F(1,32) = 3.61$; $p = 0.067$; $\eta^2 = 0.011$).

The main effect of the between factor of group was not significant ($F(1,32) = 0.385$; $p = 0.539$; $\eta^2 = 0.011$).

As for emotional eating, results showed no significant interaction effect of time x group on AFQ-Y from pre-test to post-test ($F(1,32) = 0.0173$; $p = 0.896$; $\eta^2 = 0.000$) but a significant main effect of the within factor of time ($F(1,32) = 7.3942$; $p = 0.010$; $\eta^2 = 0.011$). The main effect of the between factor of group was not significant ($F(1,32) = 0.0865$; $p = 0.771$; $\eta^2 = 0.003$).

Means scores are summarized in Table 4.

Table 4. Differences between ACT+TAU vs TAU only from pre-to-post intervention in all the outcome variables.

Variable	Group	N	Pre-test		Post-test	
			Mean	SD	Mean	SD
PWB	ACT+TAU	17	44.9	6.61	46.7	5.68
	TAU	17	46.4	5.19	46.7	5.93
DASS-D	ACT+TAU	17	13.1	11.1	11.6	13.3
	TAU	17	14.7	11.4	12.5	12.5
DASS-A	ACT+TAU	17	13.5	8.93	40.2	11.1
	TAU	17	14.4	13.2	32.9	8.34
DASS-S	ACT+TAU	17	18.4	11.4	16.0	11.5
	TAU	17	18.7	10.1	15.6	11.0
DERS	ACT+TAU	17	102	30.4	101	32.8
	TAU	17	90.2	29.1	84.8	25.4
AFQ-Y	ACT+TAU	17	29.9	15.9	24.9	17.3
	TAU	17	25.0	14.9	23.6	13.3
DEBQ-EE	ACT+TAU	17	1.67	1.36	1.38	1.30
	TAU	17	1.52	1.38	1.27	1.25

Note: PWB: Psychological Well-Being; DASS-D: Depression subscale of the Depression Anxiety and Stress scale; DASS-A: Anxiety subscale of the Depression Anxiety and Stress scale; DASS-S: Stress subscale of the Depression Anxiety and Stress scale; DERS: Difficulties in Emotion Regulation Scale; AFQ-Y: Avoidance and Fusion Questionnaire for Youth; DEBQ-EE: Emotional Eating subscale of the Dutch Eating Behavior Questionnaire. Data are reported in means and standard deviations.

Results were subjected to an a posteriori power analysis for repeated measures with a mixed within-between interaction. Results revealed that given a sample size of 34, an α of 0.05, and a small effect size obtained (0.2), the achieved power ($1-\beta$) was 0.61.

6.3.3. Moderation analyses

To address moderation hypotheses, a series of moderation analyses were run. The first set of moderations assessed the influence of depression (DASS-D), anxiety (DASS-A), and stress (DASS-S) at pre-test as predictors, and on emotional eating (DEBQ-EE) at post-test as an outcome, considering the treatment group (ACT+TAU vs. TAU only) as a moderator.

As for depression, results showed a significant interaction between the pre-test and the two treatment groups (ACT+TAU vs TAU only) in predicting post-test DEBQ-EE (unstandardized coefficient = -0.0876 , SE = 0.0348 , $p = 0.0175$, $\Delta R^2 = 0.1493$). Among those in the TAU only group, higher levels of DEBQ-D at pre-test were significantly associated with a higher DEBQ-EE at post-test (unstandardized coefficient = 0.0893 , SE = 0.0245 , $p = 0.0011$). Among those in the ACT+TAU group, there was no significant relationship between pre-test DASS-D and the subsequent DEBQ-EE at post-test (unstandardized coefficient = 0.0017 , SE = 0.0251 , $p = 0.9479$).

As for anxiety, the results showed no significant interaction between pre-test DASS-D and the two treatment groups (ACT+TAU vs TAU only) in predicting post-test DEBQ-EE (unstandardized coefficient = -0.0214 , SE = 0.0347 , $p = 0.5425$, $\Delta R^2 = 0.0077$).

As for stress, results showed a significant interaction between pre-test DASS-S and the two treatment groups (ACT+TAU vs TAU only) in predicting post-test DEBQ-EE (unstandardized coefficient = -0.0776 , SE = 0.0367 , $p = 0.0430$, $\Delta R^2 = 0.1040$). Among those in the TAU only group, higher levels of DEBQ-S at pre-test were significantly associated with a higher DEBQ-

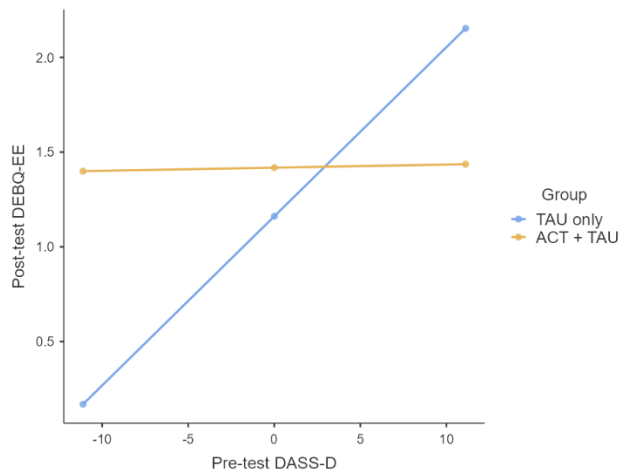
EE at post-test (unstandardized coefficient = 0.0991, SE = 0.0275, $p = 0.0012$). Among those in the ACT+TAU group, there was no significant relationship between pre-test DASS-S and subsequent DEBQ-EE at post-test (unstandardized coefficient = 0.0215, SE = 0.0242, $p = 0.3809$).

Additionally, we ran a moderation assessing the influence of emotion dysregulation (DERS) at pre-test in predicting emotional eating (DEBQ-EE) at post-test, considering the group as a moderator (ACT+TAU vs. TAU only). The results showed no significant interaction between pre-test DERS and the two treatment groups (ACT+TAU vs TAU only) in predicting post-test DEBQ-EE (unstandardized coefficient = -0.0030 , SE = 0.0110, $p = 0.7850$, $\Delta R^2 = 0.0012$).

Finally, a moderation analysis was conducted to assess the impact of experiential avoidance and fusion (AFQ-Y) at pre-test in predicting emotional eating (DEBQ-EE) at post-test considering the group as a moderator (ACT+TAU vs TAU only). The results showed a significant interaction between pre-test AFQ-Y and the two treatment groups (ACT+TAU vs TAU only) in predicting post-test DEBQ-EE (unstandardized coefficient = -0.0417 , SE = 0.0199, $p = 0.0443$, $\Delta R^2 = 0.0626$). As predicted, among those in the TAU only group, higher levels of AFQ-Y at pre-test were significantly associated with higher DEBQ-EE at post-test (unstandardized coefficient = 0.0437, SE = 0.0189, $p = 0.0282$). In contrast, among those in the ACT+TAU group, there was no significant relationship between pre-test AFQ-Y and subsequent DEBQ-EE at post-test (unstandardized coefficient = 0.0019, SE = 0.0195, $p = 0.9224$). The results are depicted in Figure 1.

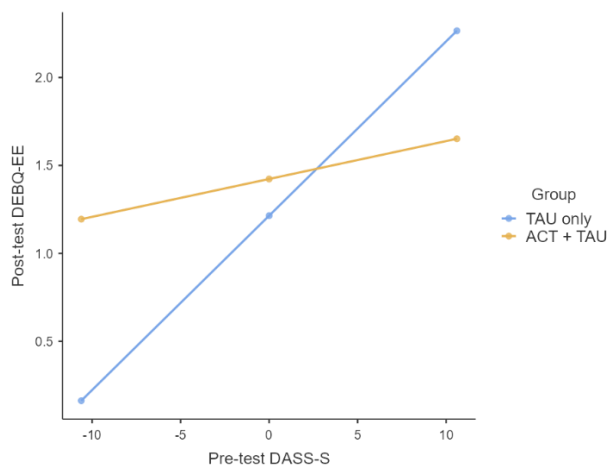
Figure 1. Moderation effects

a) Moderation effect of group in the relationship between depression and emotional eating



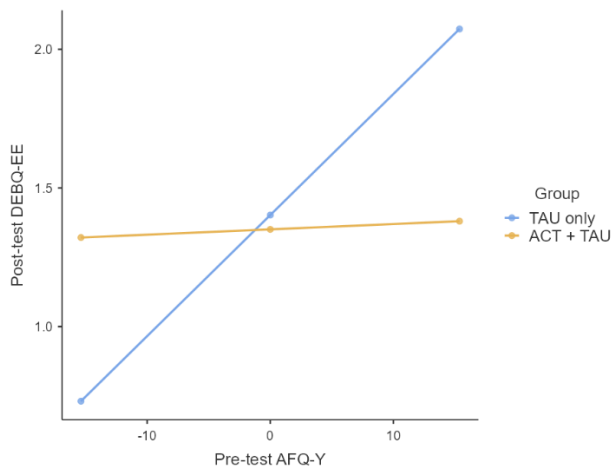
Note: DASS-D: Depression subscale of the Depression Anxiety and Stress scale; DEBQ-EE: Emotional Eating subscale of the Dutch Eating Behavior Questionnaire.

b) Moderation effect of group in the relationship between stress and emotional eating



Note: DASS-S: Stress subscale of the Depression Anxiety and Stress scale; DEBQ-EE: Emotional Eating subscale of the Dutch Eating Behavior Questionnaire

c) Moderation effect of group in the relationship between experiential avoidance and fusion and emotional eating



Note: AFQ-Y: Avoidance and Fusion Questionnaire for Youth; DEBQ-EE: Emotional Eating subscale of the Dutch Eating Behavior Questionnaire

6.4. Discussion

The main purpose of this study was to assess preliminary evidence of the efficacy of an ACT-based intervention added to a standard multidisciplinary rehabilitation program for weight loss in a group of adolescents with obesity to improve their psychological conditions.

The preliminary, but well-promising results showed that participants in both interventions (ACT+TAU vs. TAU only) reduced emotional eating. This result was in line with our initial expectations, even if the reduction of emotional eating we observed was independent of the intervention received and so, it cannot be directly attributable to our intervention. However, the reduction in emotional eating is supposed to be a promising achievement for psychological interventions for childhood obesity since emotional eating was found to be a significant well-known risk factor for weight gain in children (Webber et al., 2009).

As for other outcomes, it was found that levels of anxiety differently and significantly increased over time in the two groups, with a higher increase in anxiety in the ACT+TAU group than in the TAU only group over time. Even if this finding was unexpected, it may be reasonably

attributable to many factors that, however, require further investigations. For example, since the DASS-21—the questionnaire we used to assess anxiety—asked participants to refer to the last week in their responses, it is possible to hypothesize that the results reflected an effect of hospitalization (especially in the post-test). Hospitalization was considered a stressful condition that most patients live with uncertainty about the future, anxiety, and depression (Boey & Boey, 2016; De Fazio et al., 2017), even at pediatric age (Luo et al., 2018). Hospitalization has been also associated with poorer psychological well-being, worst emotional functioning, and worst ability to cope and adjust (Chiarchiaro et al., 2013). Another ACT-consistent hypothesis, and so, more suitable to explain the specific effect of the intervention, is that ACT promotes a change in relationships between individuals and their private events, such as thoughts, feelings, and sensations, and not the events themselves. Specifically, by promoting psychological flexibility, ACT suggests that the focus of the intervention should be on how the individual interacts with these thoughts, rather than reducing their form or frequency. In light of this perspective, an increase in anxiety could reflect improved awareness about personal thoughts and emotional experiences and not necessarily, an increase in suffering. Consistent with this hypothesis, in our sample, we found that levels of emotional eating—which generally is positively related to anxiety or stress (Guerrini Usubini et al., 2022)—decreased.

The second aim of the study, given its preliminary nature, was to explore associations between the variables of interest to speculate about the mechanism of action of our intervention. Moderation analyses revealed some interesting—but preliminary—findings. In fact, only in those who attended the TAU only intervention, higher levels of depression, stress, and experiential avoidance and fusion before the interventions were significant in predicting higher levels of emotional eating after the intervention, even if emotional eating decreased from pre-to-post intervention. The same relations did not emerge in those who received the ACT+TAU intervention, in which the link between initial psychological distress (specifically depression

and stress) and emotional eating at the end of the intervention is not maintained. Such results may be considered the most significant clinical evidence of the action of our intervention, according to which, by promoting psychological flexibility it is possible to improve a willing and open attitude of experiencing internal events (such as depression, anxiety, and stress) and – however – produce long-standing behavioral changes.

Our results need to be viewed in light of some limitations. In the present study, the small sample size prevents findings from being extrapolated, and warrants caution in drawing and interpreting conclusions. Another limitation concerns the lack of follow-up measures that may help to define the long-term effect of the intervention. Future replications of the study need to recruit a larger sample and provide long-term follow-up measures.

In addition, the high specificity of the context (third level Obesity clinic) where the study took place and the sample that was recruited limits the generalizability of the results. However, the highly controlled environment where participants lived for 3 weeks—during research—allowed us to control for possible confounding factors related to childhood obesity (i.e., food intake, physical activity, and family factors). Another limitation concerns the battery of self-report instruments used in the present study, which could be limited in measuring the multidimensional core process of psychological flexibility and could be affected by biases. In particular, it could be helpful to use the Multidimensional Psychological Flexibility Inventory to assess global psychological flexibility and each sub-component: acceptance, defusion, present moment awareness, self as a context, values, and committed actions (Landi et al., 2021), after being validated in adolescents. In addition, research about emotional eating suggests that using direct instead of retrospective measures to assess emotional eating and implementing innovative methodological tools such as the Ecological Momentary Assessment (Chwyl et al., 2021), could be free from the biases of self-report forms.

Even if preliminary, our results suggest that ACT could be a promising approach to be implemented in a context of an obesity rehabilitation program for adolescents, supporting the suitability of ACT in healthcare settings. However, the research program remains open, since further results need to be collected. Future directions of the study are oriented to achieve a larger sample size and collect data over time adding follow-up measures. Doing so, it could also be interesting to assess whether any improvements in psychological flexibility would have a potentially positive impact on weight management over time since preliminary evidence of reductions in emotional eating was found. Data collection of weight, BMI, and other physical measures at pre-test, post-test, and follow-up will be implemented. In addition, we are also planning to compare the experimental conditions with a control group in order to better understand the impact of the rehabilitation program on treatment outcomes and to add other specific measurements for emotional eating.

6.5. General conclusions

As discussed in chapter 1, the worldwide prevalence of obesity is continuously rising. Available psychological interventions are effective in promoting a healthy lifestyle, but adherence over time remains challenging. This requires additional interventions. One of the most promising alternatives to the standard interventions for obesity management is ACT - which was described in chapter 2 - but additional evidence is required.

For this reason, this thesis was aimed at providing additional empirical support for the efficacy of ACT in the context of obesity rehabilitation.

By assuming an ACT-oriented perspective, the first two empirical contributions of the current thesis (chapters 3 and 4) have been aimed to explore the impact of psychological inflexibility on emotional eating, both in adults (chapter 3) and adolescents (chapter 4). In line with expectations, results in chapters 3 and 4 suggested that psychological inflexibility was a significant predictor of emotional eating in both populations. Such results provided an additional contribution to the existing literature supporting a significant role of psychological inflexibility in eating habits and strengthens the need for psychological interventions for obesity to target psychological flexibility (the opposite of psychological inflexibility).

Such premise was the basis for the subsequent empirical contributions of the current thesis (presented in chapters 5 and 6) both aimed at evaluating the effect of an ACT-oriented psychological intervention for individuals with obesity, attending a multidisciplinary rehabilitation program for weight loss.

The study presented in chapter 5 was specifically aimed at assessing the specific role of each subcomponent of the psychological flexibility model (Openness, Awareness, and Engagement), in promoting weight loss and weight loss maintenance over time as well as improving psychological conditions in a sample of Italian adult individuals with obesity. Results suggested

that there was no evidence for specific effects of subcomponents of the psychological flexibility model on treatment outcomes. However, in all groups involved in the study, there were significant improvements over time in weight, BMI, psychological inflexibility, anxiety, and emotional eating.

Finally, the study presented in chapter 6 was specifically aimed at assessing the effects of an ACT-based intervention added to a standard multidisciplinary rehabilitation program for weight loss in a group of adolescents with obesity to improve their psychological conditions. The main result achieved suggested that participants in both interventions (comparisons have been made between those who attended the ACT intervention added to the standard rehabilitation program for weight loss and those who attended the standard rehabilitation program for weight loss only) reduced emotional eating, a dysfunctional eating habit related to obesity which is considered one of the barriers to weight loss and weight loss maintenance.

Even if their preliminary nature, the results of the current thesis suggest that ACT could be a promising approach to be implemented in the context of obesity rehabilitation. However, the research program remains open, since further results need to be collected. Future directions of the research are specifically oriented to continue data collection in order to achieve larger sample sizes and to implement additional follow-up measures to collect data over time. In addition, further insights concerning how to measure the research outcomes and additional improvements to the ACT interventions may help the research to develop and grow up over time.

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