

Psychological Flexibility as a Mediator of Body Image Acceptance

**Psychological Flexibility as a Mediator of Body Image Acceptance: Findings from a  
Multi-User Virtual Reality Early-Intervention for Individuals at High-risk for Eating  
Disorders**

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## Abstract

Increased psychological flexibility has been investigated as an outcome of Acceptance and Commitment Therapy (ACT) prevention and intervention efforts for eating disorders (Manlick, Cochran & Koon, 2013, Bluett et al., 2016). Psychological flexibility has not yet been examined as to whether it is indeed the mechanism via which intervention effects occur. The purpose of this study is to investigate whether psychological flexibility serves as a mediator between outcomes of a multi-user virtual reality intervention based on Acceptance and Commitment Therapy (values clarification and exposure therapy) and body image acceptance, in a sample of young women ( $n = 41$ , 18-25 years old;  $M_{\text{age}} = 20.65$ ,  $SD = 1.62$ ) identified at risk for developing an eating disorder. It was hypothesized that the ACT intervention group (values-based) will exhibit a lower risk of presenting an ED in the next 4 years, which will be mediated by changes in psychological flexibility. There were no significant differences by group or time, nor a mediation effect of psychological flexibility. However, it was found that psychological flexibility, values-based behavior and body image acceptance were generally correlated with one another. Additionally, both increased psychological flexibility and body image acceptance was associated with a lower EDs risk for the ACT intervention group during the follow-up phase. Findings could pave the way for further research on effective interventions based on user-friendly technology for preventing eating disorders and promoting the acceptance of body image and values-driven behavior, potentially through the cultivation of psychological flexibility as a mechanism of change.

Key words: high risk for eating disorders, acceptance and commitment therapy, psychological flexibility, body image acceptance, values-based behavior, mechanism of change.

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Early-Intervention for Individuals at High-risk for Eating Disorders

*Body Image and Related Conditions*

Body image (BI) dissatisfaction is defined as the negative subjective experience of how one's body looks (Stice & Shaw, 2002) and occurs when there is a discrepancy between the ideally perceived and the actual body image (Stanley & Burrow, 2015). Being concerned over body image (BI) is a common reason for suffering, especially among females (Holmqvist and Frisen, 2010; Grogan, 2021) who have to deal with greater pressure to look young and beautiful (Ahadzadeh, Sharif & Ong, 2017; Fardouly & Vartanian, 2016) and they are exposed to overwhelming media influences about the "ideal female body" (Holland & Tiggemann, 2016; Murnen & Don, 2012). In fact, BI dissatisfaction is so prominent in almost all modern societies, that it has been defined as a "normative discontent", regardless of the presence of an eating disorder (Tantleff-Dunn, Barnes & Larose, 2011; Matthiasdottir, Jonsson & Kristjansson, 2012)(Pearson et al., 2010). Also, it is resistant to change (Piran, 2015) as present-day socio-cultural factors appear to play a major role in the development of body image concerns and eating disorders. Specifically, cultures of abundance that greatly emphasize people's appearance and idealize slimness provide the context for body image and eating-related issues to emerge (Kurz et al., 2021; Williams & Ricciardelli, 2014).

Studies on eating pathology show that BI dissatisfaction is a common precursor of disordered eating-related problems (Harlowe, Farrar, Stopa & Turner, 2018; Rosen, 2013) both in their development and maintenance (Levine & Smolak, 2016; Jacobi et al., 2011). For example, body image dissatisfaction is associated with dieting and disordered eating, a fundamental predictor in eating disorder etiology (Stice & Shaw, 2010). Eating disorders can lead to serious

medical conditions and they even have a great risk of fatality, more than any other psychological disorder (Fichter & Quadflieg, 2016), leading to an enormous public health need of further research and development on their prevention and treatment (Samnaliev, Noh, Sonnevill & Austin, 2015).

Although it is a risk factor, body image dissatisfaction is not the problem per se (Levine & Smolak, 2016). Almost all women will either feel dissatisfied with their body or exhibit disordered eating behaviors at least once in their life, but not all of them will end up being at risk or having eating pathology problems (Trindade & Ferreira, 2014; Wendell, Masuda & Le, 2012). Symptoms of eating pathology emerge not merely as a result of dysfunctional thoughts about one's body image or related negative experiences, but rather due to the individual's struggle and inability to prevent those experiences from impacting their well-being (Masuda, Price, Anderson, & Wendell, 2010; Sandoz, Wilson, Merwin, & Kellum, 2013). In fact, disordered eating symptoms and disordered eating cognitions seem to be related through inflexible and avoidant cognitive processes concerning body image (Wendell, Masuda & Ke, 2012). Thus, the problem seems to be how one relates to this dissatisfaction, i.e., by trying to control or struggling to avoid any thoughts or feelings related to it. This cognitive struggle in turn leads to behaviors such as restrictive eating, strict dieting etc. (Legenbauer, Radix, Augustat & Schütt-Strömel, 2018). Those inflexible and avoidant behaviors toward cognitions are indicative of lack of psychological flexibility (Sairanen et al., 2017; Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Kashdan & Rottenberg, 2010; Segal, Teasdale, & Williams, 2004).

### *Psychological Flexibility and Eating Disorders*

According to Hayes et al. (2006) psychological flexibility (PF) is defined as “the ability to contact the present moment fully as a conscious human being, and to change or persist in

behavior when doing so serves valued ends” (p. 7). It can be described as an alternative, acceptance-based behavior of experiencing events based on personal values, without trying to judge, fix, underestimate, change or avoid internal events such as distressing thoughts and emotions, including body image concerns (Masuda et al., 2010). Kashdan and Rottenberg (2010) classify psychological flexibility as “a fundamental aspect of health”, since it refers to a wide range of skills which allow people to shift mindsets and behaviors close to their personal values, in order to enhance their personal and social functioning and keep a healthy balance among various life domains, despite the presence of distress (Kashdan, Disabato, Goodman, Doorley & McKnight, 2020).

There is evidence that the opposite of PF (i.e., psychological inflexibility) is a mediator between risk factors and negative psychological outcomes (Makriyianis, Adams, Lozano, Mooney, Morton & Liss, 2019; Paulus, Vanwoerden, Norton & Sharp, 2016; Tull & Gratz, 2008). This suggests that people at risk of presenting mental health issues are more likely to develop them if they are psychologically inflexible (Wendell, Masuda, & Le, 2012). Indeed, a variety of psychological problems are found to be inversely related to PF (Hayes et al., 2006) including eating disorders (EDs) (Masuda et al., 2010; Masuda, Le, & Cohen, 2014; Merwin et al., 2010).

Psychological flexibility has been considerably studied in the area of eating pathology (Masuda, Price, Anderson & Wendell, 2010; Masuda, Boone & Timko, 2011; Wendell, Masuda & Le, 2012; Sandoz, Wilson, Merwin, & Kellum, 2013). Manlick, Cochran, and Koon (2013) stated that psychological inflexibility is an underlying major component which contributes to ED development and maintenance (Bluett et al., 2016). Specifically, dysfunctional strategies of regulation like avoidance, rumination and emotion inhibition (components of psychological



inflexibility), have been associated with eating pathology (Damiano, Reece, Reid, Atkins, & Patton, 2015) (Bluett et al., 2016; Yasinski et al., 2020). Research supports that even non-clinical ED populations or individuals, with mere tendencies to engage in disturbed eating habits, report significantly low psychological flexibility (Hill, Masuda, & Latzman, 2013; Sandoz et al., 2009; Wendell, Masuda, & Le, 2012). According to a summarizing article by Watson et al. (2016), prevention programs about EDs emphasize the enhancement of protective factors. Indeed, psychological flexibility is considered as a fundamental protective factor, which can contribute in deterring the onset of EDs.

In summary, PF predicts disordered eating conditions (Levine & Smolak, 2016; Manlick, Cochran & Koon, 2013) and there is evidence for its utilization in prevention (Stice, Ng & Shaw, 2010) and treatment of EDs (Juarascio et al., 2013; Merwin et al., 2010). Theoretically, changes in PF may actually mediate reduction in ED behaviors such as binge eating, suggesting that this is an important skill for actual behavior changes (Lillis et al., 2011).

### Prevention of Eating Disorders

#### *Disordered Eating Continuum*

The concept of a disordered eating continuum was first proposed by Mintz, O'Halloran, Mulholland, and Schneider (1997), who assumed that eating behaviors range from asymptomatic eating patterns to specified clinical syndromes, depending on the levels of BI dissatisfaction, weight concerns and restriction of food (Tylka & Subich, 1999). Therefore, individuals who present body and weight concerns may proceed to dieting as a means to deal with their concerns. Although dieting is not always necessarily linked to the development of eating pathology, for example if it is a part of a reliable weight management programme (Schaumberg, Anderson,

Anderson, Reilly & Gorrell, 2016) nonetheless it has been found in many cases to increase risk for future onset of clinical eating behaviors (Levine & Smolak, 2016; Stice & Presnell, 2010).

However, according to Smolak (2006) and Stice, Ng and Shaw (2010) eating behaviors can be prevented or reversed, specifically by concentrating on individuals at high-risk for developing an eating disorder (Stice, Becker, & Yokum, 2013) and by targeting their symptoms while they are still at an early point on the continuum. High-risk individuals are those who present behaviors related to weight loss desire along with body image disturbance, but without actually meeting criteria of an ED diagnosis (Karekla, Nikolaou & Koushiou, 2020). Although in high-risk populations less eating pathology is exhibited compared to clinical cases, there is still a need for prevention due to other mental co-occurring conditions, such as lack of social adjustment, low self-esteem and other psychological disorders (Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011; Field et al., 2012; Fairburn et al., 2007; Schmidt et al., 2008). After all, concentrating on a high-risk subpopulation (selective level of prevention) is more effective than applying a universal preventive program (Stice, Shaw & Marti, 2007; Cororve-Fingeret, Warren, Cepeda-Benito & Gleaves, 2006). Therefore, any preventive approach must match the phase of the continuum where an individual falls and occur at the earliest possible time point, in an accordingly personalized way (WHO, 2004).

#### *CBT for Eating Disorders, Exposure Therapy and Experiential Avoidance*

Most prevention and treatment programs for eating disorders are based on Cognitive Behavioral Therapy (CBT) and they aim to replace dysfunctional thoughts about body and shape with more rational and positive ones through cognitive restructuring (Södersten, Bergh, Leon, Brodin, & Zandian, 2017) or exposure. Exposure to unpleasant stimuli (Kaczkurkin & Foa, 2015; McKay et al., 2015) and has been extensively studied specifically for EDs and BI

dissatisfaction (Butler & Heimberg, 2020; Griffen, Naumann & Hildebrandt, 2018; Levinson & Byrne, 2015; Koskina, Campbell & Schmidt, 2012). According to the CBT perspective, the aim of the exposure is for the individual to gather enough information for being able to disconfirm the distorted thoughts and to achieve new learning through the gradual extinction of fear (Arch & Craske, 2009; Craske & Mystkowski, 2006). Indeed, exposure therapy is found to be one of the most effective components of cognitive and behavioral interventions in CBT (Reilly et al., 2017; Voort, Svecova, Jacobsen, & Whiteside, 2010; Peterman, Read, Wei & Kendall, 2015)

However, individuals are often unwilling to deliberately face uncomfortable and fearful situations, even if they know this will help them in the long run (Gloster, Hummel, Lyudmirskaya, Hauke & Sonntag, 2012). CBT is currently considered the prominent treatment of choice for EDs and it has demonstrated considerable effectiveness in the treatment of eating disorders (Linardon, Wade, de la Piedad Garcia & Brennan, 2017) nonetheless, there is still room of further improvement concerning long-term outcome, since some critical aspects of EDs are often leading to symptom persistence after therapy (Fairburn, 2008; Juarascio et al., 2017; Juarascio et al., 2013).

First of all, the ego-syntonic nature of EDs causes the individuals to present an excessive, dysfunctional attachment to their weight and shape (Vanderlinden, 2008). As a result, they may feel too uncomfortable, distressed or unmotivated to comply with the key behavioral components of CBT (e.g self-monitoring of food intake) and therefore to reconstruct the dysfunctional cognitions, a primary target in a CBT treatment. Indeed, patients with EDs tend to lack motivation for entering the treatment (Juarascio et al., 2013, Juarascio et al., 2017) but also for engaging specifically in the procedure of exposure therapy (Koskina, Campbell & Schmidt, 2013).

Additionally, it seems that patients often need more in-depth cultivation of some additional skills that contribute to the successful implementation of the recommended behavioral elements, like emotion acceptance and regulation, and tolerance of distress (Juarascio et al., 2017). Individuals presenting with EDs display deficits in these skills (Harrison, Sullivan, Tchanturia, & Treasure, 2009; Merwin, Zucker, Lacy, & Elliott, 2010; Svaldi, Griepenstroh, Tuschen-Caffier, & Ehring, 2012) and thereafter it is more challenging for them to identify and replace their thoughts and feelings with more functional ones, during CBT. In fact, cognitive restructuring itself has been criticized for increasing the risk of suppression and experiential avoidance (Eifert & Forsyth, 2005; Karekla, 2004).

Experiential avoidance (EA) is the reluctance to allow oneself to experience difficult thoughts or feelings and instead attempts to suppress them, even when doing so is harmful on a long-term basis (Chawla & Ostafin, 2007; Levin, Pistorello, Seeley, & Hayes, 2014) and it is one indicator of psychological inflexibility (Hayaki, 2009; Hayes & Pankey, 2002; Kater, 2010, Litwin, Goldbacher, Cardaciotto & Gambriel, 2016). Indeed, it is shown that ED populations often avoid confronting their thoughts and feelings (Rawal, Park, & Williams, 2010) especially when they relate to their body image (Sandoz, Wilson, Merwin, & Kellum., 2013).

Body image-related experiential avoidance (BIEA) is found to be a crucial variable accounting for the relationship between body image dissatisfaction and disordered eating (Timko, Juarascio, Martin, Faherty, & Kalodner, 2014). BIEA is defined as the efforts to avoid, suppress, alter, or generally escape from distressing negative thoughts, feelings, or sensations specifically about the body and, afterward, any action which aims at modifying or warding off the triggering stimuli (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996; Orsillo, Roemer, Lerner, & Tull, 2004).

All of the above dysfunctional behaviors displayed by individuals with EDs (excessive emotional discomfort, fixed mindset) indicate the presence of psychological inflexibility, which sometimes can be an obstacle in maintaining long-term results after a CBT therapeutic process for an ED (Barnes & Tantleff-Dunn, 2010; Lavender, Jardin, & Anderson, 2009, Zendegui, West & Zandberg, 2014). Consequently, it seems that although CBT is generally shown to be effective, some important issues specifically about ED populations need to be further addressed (Juarascio et al., 2017).

*Acceptance and Commitment Therapy for EDs: Values clarification and Body Acceptance*

For dealing with eating disorders, alternative intervention approaches are needed that build upon CBT aspects found to be effective (e.g., exposure and behavior change techniques), and simultaneously promote acceptance, mindfulness and psychologically flexible interaction with thoughts and events (Fletcher & Hayes, 2005). This combination has been associated with greater reduction in ED symptoms (Atkinson & Wade, 2016; Merwin et al., 2010; Stice & Presnell, 2007) compared to traditional cognitive therapies (Juarascio et al., 2013). In other words, these approaches seem to fit well theoretically with the EDs maintenance factors (Manlick, Cochran, & Koon, 2013) discussed in this paper.

Acceptance and Commitment Therapy is one such therapy that combines these aforementioned aspects (Kahl, Winter, & Schweiger, 2012). It is a third-wave cognitive-behavioral therapy rooted in the acceptance of personal thoughts and feelings with an emphasis on a values-based healthy lifestyle, even in the presence of distressing thoughts and feelings (Hayes, Strosahl, & Wilson, 1999; Merwin, 2011; Merwin, Zucker, & Wilson, 2019). Specifically, individuals learn how to recognize the inevitability of having difficult thoughts and

sensations, and instead adopt an alternative attitude of willingness and nonjudgmental acceptance towards them (Luoma, Hayes, & Walser, 2007; Merwin, 2011; Sandoz et al., 2013).

In ACT, psychological flexibility is purported to be the central mechanism to induce clinical change during therapy (Hayes, 2006). Therefore, the goal of ACT is to increase it through six interrelated and overlapping core processes: cognitive defusion, acceptance, contact with the present moment, self-as-context, values clarification, and committed values-based action (Hayes, Strosahl, & Wilson, 2011; Karekla, Karademas & Gloster, 2018). Those processes lead the individual to a more holistic understanding of their situation, because they realize that they are not defined by their negative thoughts and emotions per se, but from their ability to choose their values-based actions (Manlick, Cochran & Koon, 2013).

Considerable supporting evidence presents ACT as a viable and effective means of prevention (Gloster, Walder, Levin, Twohig & Karekla, 2020; Linardon, Gleeson, Yap, Murphy, & Brennan, 2019; Nikolaou, 2017) and treatment of EDs (Berman, Boutelle, & Crow, 2009; Juarascio et al., 2013; Lillis, Hayes, Bunting, & Masuda, 2009). For example, a study about strategies of preventing overeating and healthy food intake showed that cognitive defusion was an effective technique, and even presented some benefits over cognitive restructuring (Karekla et al., 2020).

Two core parts of cultivating psychological flexibility are the promotion of acceptance and the clarification of one's personal values (Clarke, Kingston, James, Bolderston & Remington, 2014) which are main components of ACT and the strategies of interest in this study. People with EDs and at high risk for presenting EDs are inflexibly attached to their body image (BI) and control of food intake, making it difficult for them to notice and identify things in life which they value (Juarascio et al., 2017). Values work may help individuals who struggle with BI

concerns gain motivation and strength, and even prevent the onset of an ED. This way, they will be able to receive help and to prepare for further proceeding to treatment (Fairburn, 2008). Along these lines, Nicolaou & Karekla (2015) concluded that the most beneficial procedure of change for females with high risk of developing EDs was the values components of an ACT early-intervention program. Furthermore, Karekla et al. (2015) state that values work seems to help in preparing individuals to enter into the exposure part of the therapeutic process.

A substantial aim of ACT is addressing dysfunctional experiential avoidance, which inhibits psychological flexibility by setting an individual's behavioral responses on a basis of distressing feelings and thoughts, and therefore impeding the ability of accepting them and engaging in values-driven behaviors (Hayes et al., 2012). Exposure interventions can be conceptualized within ACT to place the individual directly in contact with their previously avoided content and particularly with unpleasant thoughts (Halliberton & Cooper, 2015; Scott & McCracken, 2015).

Exposure activities are an integral part of ACT interventions (Berman, Boutelle, & Crow, 2009; Juarascio et al., 2013). During exposure therapy, the individual has conscious, repeated contact with fearful stimuli, while not attempting to avoid or escape from them. As a result, the ability to deal with negative affect is enhanced, and subsequently the frequency of adaptive behavioral responses is also increased (Boswell, Anderson & Anderson, 2015). Via exposure, the individual can gradually accept the negative thoughts and feelings as part of human nature, and can instead focus on valued behaviors (Hayes, 2016).

The ACT approach may be better suited to tackle the unwillingness of individuals with EDs to enter exposure to fearful stimuli. According to Karekla et al. (2015), the investigation of personal values in ACT can serve as a preparation exercise for exposure and as a motivator for

engaging in this difficult task. Subsequently, the motivation established by clarifying personal values may help the individuals reach the goal of living their life according to their desires through effectively confronting unpleasant stimuli during exposure therapy. These authors state that many individuals may drop out of treatment immediately before exposure (Karekla et al., 2019) because they are unwilling to face their unpleasant situations - and particularly, their deepest fears. Values work is thus proposed as a providing of a personalized reason to engage in exposure and experience feared emotions and thoughts. Indeed, resistance to therapy is shown to decrease through values clarification work (Clarke, Kingston, James, Bolderston & Remington, 2014). Specifically, if exposure treatments are based on an ACT approach, they can be especially effective for individuals with EDs, which tend to present increased resistance to therapy (Stice et al., 2013).

We could say that the ultimate goal of exposure therapy with ACT elements for individuals with ED symptoms, is body image acceptance (BIA) via cultivating a psychologically flexible approach to living. BIA is the exact opposite process of BIEA, and defined as the acceptance of all internal experiences concerning body image -even the negative ones- and subsequently the engagement in activities aligned with the individuals' personal values, even if this provokes unwanted emotions (Gloster and Karekla, 2020). A promising and innovative addition to exposure therapy has in recent years gained ground. We are referring to virtual therapy enhanced exposure.

### Virtual Therapy for Eating Disorders

#### *Virtual Therapy*

Virtual reality technology is an important addition in exposure therapy advancements. In the case of virtual therapy, exposure takes place within a virtual environment. Virtual Reality



Exposure Therapy offers both high ecological (location of specific real-world stimuli in the context of virtual simulations) and internal validity (controlling of the exposure parameters; Ferrer-Garcia, Gutiérrez-Maldonado, & Riva, 2013). A more dynamic exposure technique to fearful or uncomfortable stimuli is offered through VR, which does not require the individual to use their imagination (Eichenberg & Wolters, 2012). The VR environment helps being present during the therapeutic procedure and having access to a variety of stimuli (Pla-Sanjuanelo et al., 2016). Furthermore, the client can experience the whole procedure like they are in the real world, but still within the safety and the given control established in the consulting environment (Botella, Osma, García-Palacios, Quero, & Baños, 2004). This way, the therapist has the opportunity to intervene, if needed (Gregg & Tarrier, 2007) while the client is more willing to explore the virtual environment and engage freely in the therapeutic procedure, leading to more efficient results (Eichenberg & Wolters, 2012). Furthermore, the stimuli in the virtual environment can trigger the same psychological and physiological responses as the stimuli in the real world (Gorini, Griez, Petrova & Riva, 2010). - good

As for body image perception and satisfaction, the human body can be represented in VR through two different ways. Based on recent research specifically about using VR for EDs, first we have "reference frameshifting" where the individual within VR is exposed to a negative situation about their body either as a subject/first-person or as an object/third-person (e.g., experience teasing or provide support to their avatars; Manzoni et al., 2016). Then, there is "body-swapping", where an illusion is created through VR about having another type of virtual body. VR treatments through body exposure exercises can have a key role in improving the experience and the perception of the body. VR exposure to uncomfortable stimuli can modify the way that emotion-based negative memories about the body are stored and retrieved

(Ferrer-Garcia et al., 2019) and in the process, the person becomes more aware of their body-related thoughts and emotions within a non-threatening context. This awareness can help encounter and combat avoidance of feelings and in the process become more accepting with one's body image (Ferrer-Garcia et al., 2013). Improved body-image satisfaction can then act to prevent eating disordered symptomatology and the development of EDs (Rosen, 2013;

*Multi-User Virtual Reality: A further Innovatio to Virtual Reality Exposure*

Multi-User Virtual Reality (MUVR) is a remote VR system that gives the ability to the patient to explore a specific Virtual Environment (VE) where the therapeutic process will take place. The therapist and the patient are located in different rooms and their meeting is exclusively virtual. This new technology provides the opportunity of anonymity but still allows the interaction with a real therapist. In turn, the client feels comfortable to share their inner thoughts and feelings. Individuals with EDs often experience stigma, which often prevents them from seeking help (Lipson, Lattie, & Eisenberg, 2019), therefore ensuring anonymity may encourage them to freely discuss any concerns they have (Matsangidou et al., 2020). In addition, MUVR can promote a personalized platform for the client which can further facilitate engagement in treatment.

Since research on VR yields promising results regarding presence in therapy and effective exposure to related stimuli (Riva, Wiederhold, & Mantovani, 2019) it is assumed that MUVR will provide further opportunities over the advancements in these interventions. To date, there is only one study coming from our laboratory, where MUVR is presented and utilized as an intervention tool, specifically for body image concerns (Matsangidou et al., 2020). We believe that bringing together effective intervention components which promote PF, like values clarification and exposure therapy combined with MUVR technology, can lead to more effective

prevention of EDs. Specifically, it is expected that the connection with deeply held life values will serve as a motivational factor for the individuals to successfully complete the exposure part of the therapeutic intervention. Effectiveness is purported to be achieved through improvements in perceived BI. Ultimately, prevention and early intervention programs for individuals at high-risk of developing Eds can be developed based on these grounds.

The current study: Psychological Flexibility as a Mediator for Body Acceptance

Despite the fact that psychological flexibility and acceptance are empirically related to fewer disordered eating behaviors (Deming and Lynn, 2010; Masuda, Price, Anderson & Wendell, 2010) there are still very few studies investigating their relationship with eating-related pathology (Karekla, Mavraki, Nikolaou & Koushiou, 2020) and especially regarding prevention or early intervention (Watson et al., 2016).

The present study attempts to address this scarcity in the research field, by investigating whether psychological flexibility serves as a mechanism of change in an ACT values infused MUVR intervention (ACT values infused MUVR + exposure vs. MUVR play therapy techniques + exposure) leading to a lower risk for an eating disorder.

*Hypothesis 1:* The values-based ACT MUVR intervention along with exposure therapy will contribute to improvements in the individual's range of value-driven life and behavior, psychological flexibility and body image acceptance, from pre- to post-intervention and compared to the control (play therapy) group.

*Hypothesis 2:* In a 1-month follow-up, the ACT values-based MUVR intervention group will present lower risk of developing an ED, compared to the control group.

*Hypothesis 3:* Psychological flexibility (both in general but also in terms of body image) will serve as a mediator between the treatment (values-based ACT MUVR intervention) and the outcomes (lower risk of presenting an eating disorder).

## Methodology

### *Participants*

The sample consisted of 41 young Greek/Cypriot female young adults with a mean age of 20.65 ( $SD = 1.62$ , 18 - 25 years old) judged to be at increased risk for developing an E who completed the lab experiment (Experimental group = 27, Control group = 14). The inclusion criteria for participating in this study was to be a female from 18 to 25 years old, and at high risk of presenting an ED. Initially, to determine the sample size, a power analysis was conducted using G\*Power 3.1.9.7 (effect size  $f^2 = 0.15$ ,  $\alpha = 0.05$ , power  $1 - \beta = 0.85$ ) (Faul, Erdfelder, Lang, & Buchner, 2007). It should be noted that the results showed that a minimum of 76 participants in total (38 participants in each group) were needed to achieve an appropriate power level for this study. Therefore, there wasn't a sufficiently large sample size to provide an answer to the research question of interest.

Up until the completion of the data collection for the present study, 177 people completed the Screening questionnaire. Males ( $n = 13$ ) were excluded, due to the differences in the expression of eating disorders among the genders (Stanford & Lemberg, 2012) and also because MUVR was designed only to include a female avatar figure for participants, due to financial purposes. Moreover, 66 participants were considered to be at low risk ( $WCS < 47$ ) and were excluded. In addition, 24 participants did not proceed to the MUVR part of the study (reasons: because of insufficient contact details, living abroad, being above 25 years old, or due to COVID-19 pandemic/lockdown factors) and 15 were no longer interested when contacted after

having completed the screening. Participants considered to be at high risk of presenting an ED ( $n = 59$ ) based on their WCS screening score ( $> 47$ ) were invited to come to the ACT *healthy* laboratory for the main part of the study. Twelve individuals did not appear at their meeting or declined participation due to lack of time or interest, while 5 of them participated in the experimental part of the study but did not complete the follow-up questionnaires after the email reminders they received, without providing an explanation. Finally, one individual was found to be at low-risk of presenting an ED at the pre-treatment phase, hence was excluded from analysis. It is important to note that due to pandemic lockdowns, it took a few months for some cases between screening and contact for arranging an appointment for the MUVR lab study.

### *Measures*

All participants who came to the VR laboratory had to complete questionnaires at four different time-points: 1) Screening, 2) Pre-intervention, 3) Post-intervention and 4) One-month follow-up. Measures completed at each time point are presented in Table 1. A demographics questionnaire was included in the screening procedure, which assessed age, gender and educational level.

Table 1

*Questionnaires completed at each study time point.*

	Screening	Pre-Intervention	Post-Intervention	1-month Follow-Up
<b>Demographics</b>	X			
<b>WCS</b>	X	X		X
<b>VQ</b>	X		X	X
<b>Psyflex</b>	X		X	X

**BI-AAQ**

X

X

Note: WCS=Weight Concern Scale, VQ=Valuing Questionnaire, BI-AAQ=Body Image-Acceptance and Action Questionnaire.

*Weight Concerns Scale (Killen et al., 1994, Greek version: Papageorgiou, Zacharia & Karekla, 2018).* WCS is a five statement self-report 7-point Likert scale which detects the risk for developing an ED in the next four years (Killen et al., 1996). It assesses body and shape concerns, worry and fear of gaining weight, dieting habits, the importance of weight in one's life and the feelings of fatness (Aspen et al., 2015; Forbush, Wildes & Hunt, 2014). The WCS demonstrated good test-retest reliability and good predictive validity of identifying individuals who will develop an ED (Killen et al., 1994, Killen et al., 1996). Scores of 47 and above are indicative of an increased risk of developing an eating disorder within the next 4 years (Lipson et al., 2017, Jacobi et al., 2011, Taylor et al., 2006). In this study, WCS was used to determine the individual's risk level of presenting an ED. Cronbach's alpha in this study was  $\alpha = .62$  for the Screening and Pre-Intervention time frame, and  $\alpha = .69$  for the Follow-up, therefore it is considered an acceptable one (Ursachi, Horodnic & Zait, 2015).

*Valuing questionnaire (Smout, Davies, Burns, & Christie, 2014, Greek Version: Anagnostopoulou, 2019).* VQ assesses the range of whether the individuals' lives and behavior are guided by their values. The VQ items are derived from ACT theories and techniques, and they are considered as valid and representative by ACT authors and practitioners (Smout, Davies, Burns, & Christie, 2014). It consists of two factors: the progress towards a valued-based life (Cronbach's  $\alpha = .89$ ) and the obstructions to valued living (Cronbach's  $\alpha = .87$ ) (Smout,

Davies, Burns, & Christie, 2014). The 10-item Likert scale ranges from 0 to 6 (0=Never true and 6=Always true). Higher values progress subscale scores reflect higher consistency of one's actions in life with their self-determined values. Higher values obstruction subscale scores represent greater interference and misalignment between one's way of life and personal values. For the purposes of this study, VQ was used in order to determine if the ACT values MUVR intervention contributed to improvements in values progress and obstruction. H For purposes of this study, subscale scores were combined into a single score as follows: Each participant's Obstruction score was reverse-scored and the resulting number was added to the Progress score, yielding a new score (composite variable) which will be referred to as the VQ score. A composite variable is made up of two or more variables or measures that are highly related to one another conceptually or statistically (Ley, 1972). Using composite variables is a common practice for controlling Type I error rate (e.g., when a sample size is not sufficient for testing multiple comparisons), addressing multicollinearity for regression analysis, or organizing multiple highly correlated variables into more digestible or meaningful information (Song et al., 2013). Consequently, a higher VQ score in our study indicates a higher consistency of living with the individual's values. Cronbach's alpha in this study was  $\alpha = .88$  (Screening)  $\alpha = .85$  (Post) and  $\alpha = .81$  (Follow-up) for the Progress, and  $\alpha = .86$  (Screening)  $\alpha = .82$  (Post) and  $\alpha = .86$  (Follow-up) for the Obstructions to valued living.

*Psyflex* (Gloster et al., 2021; Greek version: Paraskeva-Siamata, Spyridou, Gloster, & Karekla, 2018). This 6-item Likert self-report scale (1 = Very Often to 5 = Very Rarely) estimates the individual's state and progression of psychological flexibility across the six core processes of ACT, which all together compose PF (Hayes, Strosahl, & Wilson, 2011; Villanueva et al., 2019) in a brief and context-sensitive manner. The higher the sum of the 6 answers, the

higher the psychological flexibility. The reliability was assessed in a Greek speaking sample (Paraskeva-Siamata, Spyridou, Gloster, & Karekla, 2018) and demonstrated an acceptable Cronbach's alpha ( $\alpha = .74$  at baseline and  $\alpha = .80$ , 4 weeks later). The unique feature of this questionnaire is that it is a short, state measure whereby the presence, rather than absence of a specific skill, is measured - focusing on well-being and quality of life, rather than symptomatology (Gloster et al., 2021). In the current study, PsyFlex was utilized for assessing the levels of general psychological flexibility during the different time frames. Cronbach's alpha in this study was  $\alpha = .79$  (Screening)  $\alpha = .78$  (Post) and  $\alpha = .84$  (Follow-up).

*Body Image-Acceptance and Action Questionnaire (Sandoz et al., 2013; Greek version: Karekla, Mavraki, Nikolaou, & Koushiou, 2020).* BI-AAQ is a 12-item measure ( $\alpha = .93$ ) evaluating cognitively flexible and acceptance-based responding to body-related thoughts and feelings (body image flexibility). On a 7-point Likert Scale, items are rated from 1 (never true) to 7 (always true) and a higher score indicates lower body image acceptance. The Greek version was found to also have good psychometric properties (Karekla, Mavraki, Nikolaou, & Koushiou, 2020) Among two samples, the BI-AAQ showed internal consistency with high Cronbachs' alpha values ( $\alpha = .95$  for both samples) high internal consistency and good item-total correlations. Also, good convergent and divergent validity was demonstrated, similar to the English version (Sandoz, Wilson & Kellum, 2009). BI-AAQ is a context-specific measure of acceptance and action, in contrast with general flexibility measures (e.g., the Acceptance and Action Questionnaire) since it is stated that their application on a specific context has great clinical utility (Wendell, Masuda, & Le, 2012). In this study, BI-AAQ was chosen as a tool to assess the levels of body image flexibility and acceptance as a mediator for participants before and 1 month after the MUVR intervention. It is important to stress that in ACT literature, AAQ



questionnaires are sometimes referred to as a measure of psychological flexibility, while in other cases are considered to measure psychological acceptance (McCracken & Velleman, 2009). For the current study, this questionnaire was used as a measure of body image acceptance, which can be considered a type of psychological flexibility specifically for body image (Sandoz et al., 2009, 2013; Karekla, Mavraki, Nikolaou, & Koushiou, 2020). Cronbach's alpha in this study was  $\alpha = .93$  (Screening) and  $\alpha = .96$  (Follow-up).

### *Materials*

*Multi-User Virtual Reality (MUVR)* (Iosif, 2020; Matsangidou et al., 2020). The VR system was developed using Unity3D 52 and SteamVR to support both Oculus Rift3 and HTC Vive headsets at the same time. The 3D models (human body and the virtual environments) were created in Adobe Fuse CC4 and Maya5 version 2016. Two final versions of MUVR were created: one based on values clarification, and another based on play therapy activities. We also used Oculus Rift controllers to synchronize the movement of the avatar in the virtual space, reflecting the movement of the user in the physical space. The buttons on the Oculus Rift controller were marked in the virtual environment with different colors to improve the identification of each correspondence task (e.g., we associated the red button with object grabbing). Furthermore, Salsa Lip-Sync RandomEyes6 version 1.5.5 and Photon Voice7 version 1.16 were integrated to allow synchronous verbal communication between the therapist and the patient. Audio dialogue files were processed in real time to automate the lip synchronization process and animate the avatar faces. Photon Unity Networking8 version 1.91 was used to implement multi-user capability (up to 20 simultaneous users). Eight design iterations over a six-month period were conducted to design and develop the MUVR system. Each iteration

involved focus groups, interviews and/or pilot evaluations to improve the design, and each pilot evaluation lasted approximately two hours.

### *Procedure*

Participants were recruited via convenience sampling from classes at universities in Cyprus, and they had the option to receive course credit if offered by their professors. During the completion of the Screening questionnaire, the participants were given instructions about the next parts of the study along with an informed consent to complete. For each participant who met participation criteria, the lab sessions took place at the ACT*healthy* lab at the University of Cyprus, where both the therapist and the participant were located in two different rooms. The therapist and the participant did not meet in person, but only within the virtual environment. Upon arrival at the lab, participants were welcomed by a researcher and they entered a room for the completion of the pre-intervention questionnaires, prior to being fitted with the VR Head-Mounted Display (HMD).

Participants were then introduced to the VR system via a tutorial (approximate duration of 25 minutes) with the help of the researcher, in order to become familiar with the whole VR system and buttons. After the tutorial, the therapist and the participant appeared in the first, neutral Virtual Environment (VE) to create the participant's avatar. In this VE, the therapist guided the participant to customize her avatar according to the way she looks (body shape and size, hair style and color, skin color etc.). After creating her avatar, the participant and the therapist entered a new VR environment for continuing the intervention. At this point, the participants were randomly assigned into either the Values group or the Play therapy group. The whole procedure was screen recorded in both the separate rooms of the therapist and the participant. The MUVR therapeutic session (either for the values group or the play therapy

group) lasted around 1 hour. After that, each participant was asked to complete the post-interventions questionnaires. One month after the completion of the experimental part, each participant completed the online follow-up questionnaire (Google Forms) sent via email.

*Description of MUVR remote psychotherapy environment.* Participants were represented by an anthropomorphic avatar adjusted by the participant to resemble them, whereas the therapists were represented in VE as a cartoon figure (a talking box) (see Matsangidou et al, 2020 for details on the creation of this MUVR and preliminary testing). According to previous findings (Rehm et al., 2016) using animated cartoons could promote anonymity and security for individuals. Two versions of the MUVR were developed for purposes of this study, according to the intervention aims for the two experimental groups. The ACT values MUVR group (Experimental) included first a values clarification game based on Acceptance and Commitment Therapy (ACT) and then a game leading to the exploration and creation of a values-based map for living a values-driven life. The play therapy MUVR group included two games: a virtual painting task and a virtual basketball-type ball-throwing task. Both experimental and control VEs were designed so that participant movements related to the tasks included would be similar in both. Both conditions also included a final common exercise of a virtual mirror exposure task.

*ACT values MUVR intervention condition.* The values games were adapted and digitized from the AcceptME program (Karekla, Nikolaou & Merwin, 2022; Nikolaou, Merwin & Karekla, pre-print) and based on Hayes and Ciarrochi (2015). In these games, individuals have to explore and define the values that really represent them and give meaning to their lives. Firstly, a board with 63 values is provided, in order to help the individual clarify her own values and to demonstrate the importance of actively choosing our own set of values. In the second game, the therapist helps the participants to develop a life map based on their values, by having them

choose the 6 most important values in their life. The goal of this game is to connect living and goals in one's life path to their chosen values and to be able to have a representation of how the person wants their life to evolve, even if concerns and unpleasant emotions show up, especially ones related to their body shape and weight.

*Play Therapy MUVR intervention control condition.* In this condition, participants played two different games. First, there was a painting game where the participants had the opportunity to paint different characters, while they were discussing their paintings with the therapist. Activity time, conversation and movements were matched between this and the values condition. The second task involved a basketball game where the participant was throwing balls into hoops and during the task participants were discussing sports and exercising with the therapist. The idea of games is based on Play Therapy (PT) which has been found to reduce impulsivity and enhance emotion regulation (Claes et al., 2012; Fagundo et al., 2013) and this is why it was chosen as an active intervention comparison group.

*Mirror exposure task (common for both groups).* The participants in both groups (experimental and control) continued to the exposure part of the intervention (adapted from Pearson et al., 2010). They found themselves in a bedroom, where they could see their avatar being reflected in a mirror. In this part, they had the option to re-adjust their avatar's looks (figure shape etc.) in order to ensure that the avatar resembles their own appearance, while they could also choose the kind of clothes they would like their avatar to wear. These modification activities aimed to enhance the engagement and the realistic feel of the situation. The therapist guided the participant through the mirror exposure exercise by referring separately to each body-part and asked the participant to focus on it for a few seconds. The exposure continued by gradually changing the avatars' clothes to be tighter and then taking off pieces of clothing, until

the avatar was left with their underwear so as to increase the exposure to one's body shape and size, or until the participant chose to discontinue the process. At each step of the hierarchy, the participants were reminded of the previous activities (either values or games, based on the condition) as a means to motivate them through the exposure. For the ACT values MUVR condition, examples included the participant's value map for guiding them, people and experiences indicative of their perceived most important values, how those were related to their thoughts about their body etc. For the play control condition, examples included remembering the fun games they played, their favorite art or sports hobbies, how would these hobbies help them relax etc. All participants were asked to carefully observe their thoughts and emotions showing up during the procedure and they were encouraged, but not obliged to share them with the therapist. After completing the last step of the hierarchy, the participant was allowed to exit the VR. None of our participants refused to complete the exposure part.

*After the intervention (common for both groups)* After the end of the session, the participants completed the post-intervention questionnaires and they were reminded that in about one month they would have to complete another questionnaire. The follow-up questionnaire was sent via email to every participant, indicating a specific deadline.

#### *Data Analysis*

All statistical tests were carried out using the Statistical Package for the Social Sciences (SPSS) version 27.

Firstly, a bivariate correlation analysis (two-tailed) was run for the variables of interest at the different time points for each group: risk of presenting an ED, values-based behavior, psychological flexibility and body image acceptance. After that, a series of repeated measures (independent variable: experimental vs. control group x repeated factor: time) ANOVAs were

conducted for each dependent variable of interest (risk of presenting EDs, values-based behavior, psychological flexibility, body image acceptance) in order to compare the two treatment groups over time on the outcomes. Finally, PROCESS (a free expansion tool of SPSS) was utilized (Hayes, 2012) for each group separately, in order to examine the potential mediating effects (Model 4) of psychological flexibility on the relation between values clarification and body image acceptance, as well as values clarification and risk of presenting EDs. The potential mediating effects of body image acceptance (assessed as body image psychological flexibility) were also investigated on the relation between values clarification and risk of presenting EDs. Finally, the changed score (subtraction of the screening time point score, from the follow-up time point score) for each variable of interest respectively (values-based behavior, psychological flexibility and body image acceptance) was examined as a mediator between the risk of presenting an ED assessed at the pre-intervention time point, and the risk of presenting an ED assessed at the follow-up time point.

### *Results*

In terms of bivariate correlation analysis, the potential correlations for all the variables of interest were examined for each group separately. Table 2 (control group) and 3 (experimental group) present the bivariate correlations between the risk of presenting ED, values-based living, psychological flexibility and body image acceptance, for all time frames that were assessed and along with their descriptive statistics (*M* and *SD*). The red-spotted numbers represent the correlations which are present only at the indicated group, while the underlined items represent correlations in both groups, but with the underlined being the strongest one. The correlation analysis yielded mixed results, but the most notable one was the strong correlation between

higher psychological flexibility and lower EDs risk level for the experimental group, while there was no statistically significant similar correlation in the control group.

As for the repeated-measures ANOVA, each variable was examined for statistically significant changes between groups (values-ACT vs. play games) across the different time points. For the eating disorder risk (independent variable: experimental vs. control group x repeated factor: screening, pre-intervention and follow-up time point) Mauchly's Test indicated a violation of sphericity,  $\chi^2(2) = 31.85$ ,  $p = <.001$ . Since sphericity was violated, ( $\epsilon = .638$ ) Greenhouse-Geisser corrected results are reported. The interaction of group by time was not statistically significant:  $F(1.27, 49.76) = .900$ ,  $p = .371$ ,  $\eta^2 = 0.23$ . In terms of values-based living (independent variable: experimental vs. control group x repeated factor: screening, post-intervention and follow-up time point) Mauchly's test did not indicate any violation of sphericity,  $\chi^2(2) = 5.81$ ,  $p = .055$ . However, the interaction effect of group by time was not statistically significant:  $F(2, 78) = 1.65$ ,  $p = .19$ ,  $\eta^2 = 0.41$ . As for the psychological flexibility (independent variable: experimental vs. control group x repeated factor: screening, post-intervention and follow-up time point) Mauchly's test did not indicate any violation of sphericity,  $\chi^2(2) = 4.87$ ,  $p = .088$ . Again there was no statistically significant interaction effects of group by time:  $F(2, 78) = 1.48$ ,  $p = .233$ ,  $\eta^2 = 0.37$ . Finally, for body image acceptance (independent variable: experimental vs. control group x repeated factor: screening and follow-up time point) Mauchly's Test indicated a violation of sphericity,  $\chi^2(0) = .000$ ,  $p = <.001$ . Since sphericity was violated, ( $\epsilon = 1.00$ ) Huynh-Feldt corrected results ( $\epsilon > 0.75$ ) are reported. The group by time interaction was not statistically significant:  $F(1.00, 39.00) = .681$ ,  $p = .414$ ,  $\eta^2 = 0.17$ . Therefore, no statistically significant differences between groups across time points examined were indicated for any of the dependent variables of interest.

Even though no statistically significant changes were observed among the two groups in terms of the variables of interest, an attempt to run mediation analysis was made either way to examine if any of the measured traits could act as predictors of others, and whether these relationships were mediated by psychological flexibility. Rather, as first recommended by Baron & Kenny (1986), a series of regression models should be estimated in order to progress towards a mediation analysis. Despite the existing correlations, it was not possible to establish a three-way series for regression and, consequently, to examine if psychological flexibility (either generally or in terms of body image) could serve as a mediator. Therefore, no statistically significant mediation effect was able to be detected. However, it is important to note that during the setting of regression models, both higher levels of psychological flexibility ( $\beta = -5.63$ ,  $p = .004$ ) and body image acceptance ( $\beta = -1.45$ ,  $p < .001$ ) were associated with lower level of EDs risk for the values-ACT group, and this was not found for the control group.

Table 2

*Means, Standard Deviations and Bivariate Correlations between all study variables for the Control group (n = 14).*

	1	2	3	4	5	6	7	8	9	10	11
1.WCS-S	-	<b>.85**</b>	.33	-.16	-.13	-.20	-.21	-.16	-.16	<b>.59*</b>	.31
2.WCS-Pr		-	.39	-.38	-.33	-.31	-.25	-.25	-.13	<b>.68**</b>	.49
3.WCS-F			-	-.30	-.30	-.39	-.34	-.24	-.48	.34	<b>.61*</b>
4.VQ-S				-	<b>.96**</b>	<b>.89**</b>	<b>.84**</b>	<b>.85**</b>	<b>.60*</b>	<b>-.74**</b>	<b>-.65*</b>
5.VQ-Ps					-	<b>.91**</b>	<b>.85**</b>	<b>.85**</b>	<b>.69**</b>	<b>-.71**</b>	<b>-.73**</b>
6.VQ-F						-	<b>.87**</b>	<b>.84**</b>	<b>.79**</b>	<b>-.68**</b>	<b>-.66**</b>
7.PF-S							-	<b>.89**</b>	<b>.83**</b>	<b>-.60*</b>	<b>-.67**</b>



8.PF-Ps									-	<b>.74**</b>	<b>-.66*</b>	<b>-.63*</b>
9.PF-F										-	-0.36	<b>-.73**</b>
10.BIAAQ-S											-	<b>.58*</b>
11.BIAAQ-F												-
<i>M</i>	88.49	79.76	90.27	36.21	36.64	38.07	22.85	21.78	22.57	47.78	39.92	
<i>SD</i>	29.91	22.64	28.63	13.33	10.80	11.46	4.58	4.54	4.60	13.93	21.23	

*Note: PF-S=PsyFlex-Screening, PF-Ps=PsyFlex-PostIntervention, PF-F=PsyFlex--1-month Follow Up, WCS-S=Weight Concern Scale-Screening, WCS-Pr=Weight Concern Scale-PreIntervention, WCS-F=Weight Concern Scale--1-month Follow Up, VQ-S=Values Questionnaire-Screening, VQ-Ps=Values Questionnaire-PostIntervention, VQ-F=Values Questionnaire--1-month FollowUp, BIAAQ-S=Body Image Acceptance and Action Questionnaire-Screening, BIAAQ-F=Body Image Acceptance and Action Questionnaire--1-month Follow Up*

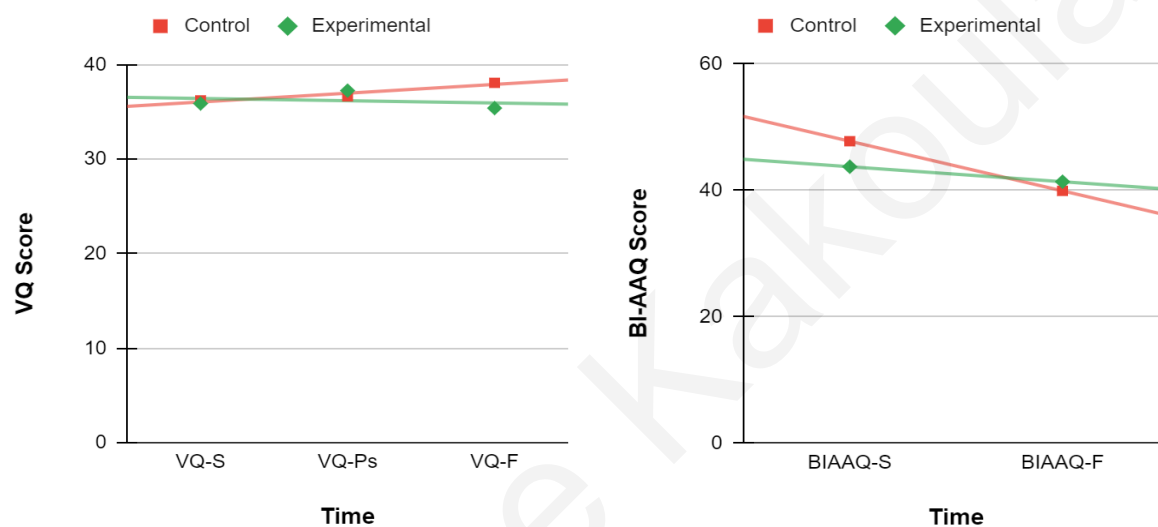
*Note: \*p < .05, \*\*p < .01*

Table 3

*Means, Standard Deviations and Bivariate Correlations between all study variables for the Experimental group (n = 27).*

	1	2	3	4	5	6	7	8	9	10	11
1.WCS-S	-	<b>.84**</b>	.14	<b>-.42*</b>	-.28	-.15	-.36	-.19	-.07	<b>.65**</b>	.08
2.WCS-Pr		-	.09	<b>-.40*</b>	-.24	-.20	<b>-.39*</b>	<b>-.39*</b>	-.09	<b>.76**</b>	-.00
3.WCS-F			-	-.32	<b>-.54**</b>	-.32	-.14	-.13	<b>-.60**</b>	.21	<b>.71**</b>
4.VQ-S				-	<b>.84**</b>	<b>.78**</b>	<b>.74**</b>	<b>.59**</b>	<b>.55**</b>	<b>-.59**</b>	-.35
5.VQ-Ps					-	<b>.81**</b>	<b>.61**</b>	<b>.58**</b>	<b>.59**</b>	<b>-.40*</b>	<b>-.49**</b>





*Note: PF-S=PsyFlex-Screening, PF-Ps=PsyFlex-PostIntervention, PF-F=PsyFlex--1-month Follow Up, WCS-S=Weight Concern Scale-Screening, WCS-Pr=Weight Concern Scale-PreIntervention, WCS-F=Weight Concern Scale--1-month Follow Up, VQ-S=Values Questionnaire-Screening, VQ-Ps=Values Questionnaire-PostIntervention, VQ-F=Values Questionnaire--1-month FollowUp, BIAAQ-S=Body Image Acceptance and Action Questionnaire-Screening, BIAAQ-F=Body Image Acceptance and Action Questionnaire--1-month Follow Up*

## Discussion

Although the study of psychological flexibility is still considered to be in its early stages (Kashdan et al., 2020) there is considerable evidence of its fundamental role in mental health, including eating-related conditions (Wendell, 2011). Body image acceptance (Bluett et al., 2016) and values-driven behavior (Nicolaou, Merwin & Karekla, 2021) are shown to be crucial aspects of psychological flexibility with an essential role in preventing the onset of eating disorders (Wendell, Masuda & Le, 2012). The present study aimed to investigate the mediating role of psychological flexibility for body image acceptance and the lower risk of presenting an ED, in relation to a multi-user virtual reality intervention based on Acceptance and Commitment Therapy (values clarification), resulting in a lower eating disorder risk. This is the first study to utilize Multi-User Virtual Reality (MUVR) technology as an early-intervention tool and to examine the mediating role of the purported mechanism of action of the ACT intervention.

First of all, the traced correlations yielded mixed results, but with some noteworthy results standing out: Higher levels of psychological flexibility, values-driven behavior and body image acceptance before the intervention seemed to be associated with their respective levels afterwards, as well as with each other, regardless of the participant's group. In terms of the experimental group only, lower ED risk during the follow-up was associated with higher psychological flexibility and, interestingly, to higher levels of values based behavior of the post-intervention time frame, but not the follow-up one. There was also a relationship between lower EDs risk and higher body image acceptance in both groups, but considerably stronger in the experimental one. Indeed, it also seems that higher levels of both psychological flexibility and body image acceptance have a predictive effect at lower EDs risk levels exclusively for the experimental group. However, no significant differences were traced between the ACT-based and play therapy intervention group, nor a significant change in any variable before and after the

intervention. Also, it was not possible to detect a possible mediation effect between a values-based behavior and body image acceptance. As a result, it seems that there were important predictive relationships across a number of variables, but without indicating any notable difference between the two types of interventions nor mediating mechanisms of action.

In general, the current results did not confirm the initial hypotheses. Nevertheless, it can be inferred that they exhibit a trend towards the importance of psychological flexibility, along with values-based behavior and body image acceptance in contributing to a lower risk of presenting an ED based on the correlation findings, as shown in previous studies (e.g., Kashdan & Rottenberg, 2010; Nicolaou, 2017; Wendell, Masuda & Ke, 2012). Previous research indicated the importance of variables related to psychological flexibility, like acceptance (Lillis et al., 2009) and values-based behavior (Juarascio et al., 2017). More specifically, the present findings support the idea that psychological flexibility is inversely correlated to disordered eating cognitions as well as to overall mental health (Masuda, Le & Cohen, 2014). An example is the partial mediation for negatively impacted individuals between childhood traumas and various psychopathological conditions (Richardson and Josh, 2019) as well as between eating-related cognitions and eating pathology (Wendell, Masuda & Ke, 2012). Along with previous literature, the current findings indicate the important role of psychological flexibility in prevention, and therefore its potential as a protective factor for individuals at risk.

In addition, the results of this study come to an agreement with literature on body image acceptance, which also seems to be a potentially protective factor from developing and maintaining an ED (Brechan & Kvalem, 2015; Linardon, Gleeson, Yap, Murphy & Brennan, 2019; Striegel-Moore and Bulik, 2007). Specifically, it seems that cultivating a more accepting

and flexible approach on body image may be a new route towards the prevention of EDs (Piran, 2015).

This study needs to be interpreted in light of several limitations, with the relatively small sample size as the most prominent one which led to lack of adequate power to detect any differences. Since this study was conducted during the COVID-19 pandemic and given its experimental nature which demanded the participants to be present in the lab, it was not possible to collect the minimum required number of participants based on the initial power analysis. Furthermore, the sample of the current study was a convenience one, recruited from two universities in Cyprus and with a uniform sample of almost exclusively Greek/Cypriots included. This may affect the external validity of the current results and limits their generalizability. Another important limitation of this study is its self-report nature, since the final analysis was based on the scores in the self-completed questionnaires. Moreover, a 1-session intervention is may not be enough to make changes in long-standing patterns of behaving, and probably more sessions are needed before actually starting to see changes. In a study about ACT for reducing EDs symptoms and body image problems in patients from Fogelkvist et al. (2020) the intervention consisted of 12 sessions, with a minimum of 6 sessions. Also, a collection of case studies examined the efficiency of ACT sessions for EDs in 17–19 sessions (Berman et al. 2009). Thus, one would expect that significant changes among different groups would not have occurred after one session. This can also partially explain the strong correlation of a lower ED risk during the follow-up with the reported values-based behavior during the post intervention phase: people may need more than one session to really incorporate and keep the mentality of a values-based living in the long-term. Either way, the first sessions in ACT-interventions are often

used to introduce the patients in the 6 main dimensions of the therapy, including values-based behavior (Manlick, Cochran & Koon, 2013).

However, this study is not without some noteworthy strengths. First of all, this paper was presented with considerable novelties and innovations for the VR approach to targeted prevention, paving the way for next similar studies to occur. Also, it included a short follow-up of one month post intervention to examine any effects longitudinally. Another strength of the study was the strict exclusion criteria. In order to increase internal validity, participants who failed to provide data for each examined variable in every time point were excluded from the data analysis, e.g. the participants who didn't complete the follow-up questionnaires.

The present findings could also imply some clinical implications. For example, we could speculate that the interrelated concepts of psychological flexibility, body image acceptance and values-based behavior can serve as a form of resilience against the onset of an ED. Those concepts have an essential role in Acceptance and Commitment therapy (Hayes et al., 2012; Hayes, Strosahl & Wilson, 1999, 2011) which is based on the notion that an individual's psychologically flexible response to negative events is fundamental in the process of understanding and dealing with mental struggles, extending beyond the scope of mere symptomatology (Segal et al., 2004). Promising results in terms of the utility of ACT as a viable treatment for a range of mental health problems, including eating-related pathology (Juarascio et al., 2017; Manlick et al., 2013) are thoroughly illustrated in previous research (Gloster et al., 2020; Masuda et al., 2010). Consequently, we can assume that psychological flexibility and body image acceptance can potentially be enhanced through the cultivation of values-based living, for a lower risk of presenting an ED. Therefore, the current findings suggest that it is worthwhile continuing to investigate the role of psychological flexibility, body image acceptance and

values-based behavior and to attempt incorporating those findings in acceptance- and mindfulness- based interventions for eating-related problems, like the ones based on ACT.

Future relevant research should concentrate on getting a larger sample size, in order to have a fully powered study and therefore to be able to detect any mediation effects between the examined factors. The proposed MUVR ACT intervention utilized in this study may have not yielded significant effects, however it still seems to be an innovating, promising contribution in the field of virtual therapy for eating disorders, since its fundamental therapeutic components are backed up from extensive scientific research. Additionally, most of the studies about ACT in eating disorders were mainly oriented towards the therapeutic outcome without focusing adequately on the underlying processes (Wendell, 2011). In fact, this was exactly the main attempt in the present study, and future research should also focus more extensively on this route ([see Hayes et al., 2021](#)). Finally, future studies should probably consider the possibility of longer followup periods in the MUVR environment so as to increase the potency of the intervention, as it is shown before that follow-ups for a longer period of time are beneficial for people in traditional face-to-face treatment for EDs (Fogelkvist et al, 2020; Manlick, Cochran & Koon, 2013) but also in virtual therapy (Riva, Malighetti & Serino, 2021) where there is still a lot more to find, especially in MUVR. (Matsangidou et al., 2020).

Summing up, this study demonstrated some intercorrelated and promising processes of psychological flexibility, values-based behavior, body image acceptance and the risk of presenting an ED in the future. Although mostly tentative, the present investigation adds to the existing evidence that in order to fully understand how to help people who are vulnerable in presenting eating-related problems, it is essential to further explore the way that those underlying, interrelated mechanisms of psychological flexibility, values-based behavior, and



body image acceptance relate to intervention outcomes and impact upon body image concerns, one of the central aspects placing individuals at risk for ED development.

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