Master thesis

The state of the art of media-based interventions for eating disorders in clinical and non-clinical women aged 12 to 28: A systematic literature review

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Abstract

Background: The ongoing increase in the prevalence of eating disorders is expected to continue further. This is related to a high mortality rate and quality of life decrease. Therefore, media-based interventions have been developed. However, these interventions are relatively new, wherefore multiple approaches, like CBT, cognitive dissonance theory, or approach-avoidance principles, are used to design such an intervention. Further, the research did not agree upon the most suitable delivery platform. Another shortage concerns the targeted participants in these interventions. No review exists focusing on the leading at-risk group of women aged 12 to 28 years old. Although wellbeing has been related to enlarging risk factors, this concept has been seldomly included in interventions for eating disorders nowadays.

Methods: A literature search in Scopus and PsychINFO was executed to overview existing media-based interventions. After applying the NOS quality criteria for non-RCT's and the Cochrane Risk of Bias Assessment Tool for the RCTs, and predefined exclusion and inclusion criteria, 20 articles remained for the review.

Results: The analysis revealed that media-based interventions are effective, independently of the grounding theory. The majority of interventions were web-based and entailed a non-clinical population using selective and indicative prevention to reduce present risk factors. A minority of studies included wellbeing-related measures. Nonetheless, most studies were concerned with high dropout rates and small samples, which decreased the results' statistical power. Although focusing on the leading at-risk group of females aged 12 to 28 years, the overall mean age of included studies was relatively high with 26 years.

Conclusions: Thus, this review might be used to specify research in this area. Since all approaches appear to be equally effective, it would be recommended to focus on one specific intervention to reach conclusive and expressive results regarding usability.

Introduction

In 2020, around 10.2% of the female population in westernized countries had an eating disorder, which implies a gradual increase over the past 30 years (Silén et al., 2020). Eating disorders are related to a high mortality rate of 5 – 8% (Silén et al., 2020). Here, suicides and health-related deaths are included, with the latter being responsible for 80% of this mortality rate (Silén et al., 2020). Common causes for health-related deaths include among other, kidney problems, slow heartbeats, or hypotension (Bulant, Hill, Velíková, Yamamotová, Martásek, & Papežová, 2020; Davey, 2014; Melioli et al., 2018; Smink, 2016). This overall mortality rate and the prevalence rate are different for the distinct types of eating disorders defined within the DSM-5 (American Psychiatric Association, 2013; Davey, 2014; Silén et al., 2020).

The DSM-5 distinguishes seven eating disorders, with Anorexia Nervosa (AN) being the most prevalent and deadly one (Silén et al., 2020). AN is related to a lifetime prevalence of 6.2% in women and is diagnosed when, among other criteria, the individual's BMI is below 18.5 (Davey, 2014). Affected individuals tend to reduce their calorie intake because of feeling too fat. These feelings are regularly accompanied by a low level of self-esteem induced by the supposed fat body, which severely diminishes the individual's quality of life. Besides, affected women tend to be stigmatized as too skinny and unintelligent because of being unable to eat normally (Davey, 2014).

The second highest prevalence rate of 2.4% applies to Bulimia Nervosa (BN), with a relatively low mortality rate in comparison to AN (Davey, 2014). Contrary to AN, the diagnosis of BN is independent of the BMI. Here, the diagnostic criteria are more related to the individuals' attitudes regarding food consumption and body weight. Women with BN want to reduce their body weight but do not abstain from food, as AN-affected individuals. Alternatively, BN leads women to vomit after food intake, accompanied by binge eating episodes. For this type of eating disorder, low levels of self-esteem are triggered by feeling weak after binging. As a result, vomiting is used to relieve, which decreases the quality of life

immensely. Affected individuals tend to be stigmatized as foolish because vomiting is an unhealthy behavior (Davey, 2014).

BN's prevalence is followed by 0.6% for Binge-Eating-Disorder (BED), where the diagnosis is related to the amount of binge eating episodes throughout a week (Davey, 2014). Women having BED tend to be obese with using binging to handle complicated feelings or situations. However, they still feel bad, but not because of their body weight or image. Their quality of life is more centered around having low wellbeing instead of looking fat or skinny. In society, these women tend to be seen as weak and obese (Davey, 2014).

The remaining types of eating disorders, namely Pica, Rumination Disorder, Restrictive Disorder, and unspecified feeding disorder, are related to lower prevalence rates (Silén et al., 2020). Although all these types have a low mortality rate, they are often comorbid with other psychological disorders such as depression or anxiety disorders, leading to more severe problems and eventually to the individual's death (Davey, 2014).

Risk factors of eating disorders

A female's level of self-esteem seems to be a critical risk factor for developing an eating disorder (Bert, Gualano, Camussi, & Siliquini, 2016; Gordon et al., 2020). Women's level of self-esteem changes throughout life, with being at the lowest point at the transition from childhood to adolescence (Gordon et al., 2020). This might explain the first onset of eating disorders (Bert, Gualano, Camussi, & Siliquini, 2016; Silén, 2020). Generally, women develop an eating disorder between 12 and 28 years (Bert, Gualano, Camussi, & Siliquini, 2016; Silén, 2020).

In this age range, feelings of body dissatisfaction increase, leading to a higher tendency for appearance and weight-related anxiety (Davey, 2014; Argyrides, Anastasiades, & Alexiou, 2020; Messer, Anderson, & Linardon, 2021; Leins et al., 2021). Both feelings lead women to reduce their calorie intake, which is further related to weight-related self-monitoring (WRSM) since they perceive their body more negatively (Hahn, Bauer, Kaciroti, Eisenberg, Lipson, &

Sonneville, 2021). It is also connected to lower levels of self-esteem (Davey, 2014; Leins et al., 2021).

Further, it is crucial to consider social media influences in conjunction with eating disorders since time spent on social media is positively related to multiple risk factors for developing an eating disorder (Davey, 2014; Wilksch, O'Shea, Ho, Byrne, & Wade, 2019). Hence, individuals who use social media more frequently tend to have higher levels of body dissatisfaction and weight-related anxiety, perform WRSM regularly, and have lower levels of self-esteem (Davey, 2014; Wilksch, O'Shea, Ho, Byrne, & Wade, 2019). An overview from Davey in 2014 implies that the increased prevalence of eating disorders can be explained by the changes in the ideal female body, which is shown in the media. During the past 20 - 30 years, mass media have used thinner and thinner models for advertising purposes, who often have an average BMI below 18. Thus, females try to imitate this shown ideal body shape (Davey, 2014). Moreover, Santarossa and Woodruff (2017) denote social media as an environment with multiple social comparisons, increasing the risk for the emergence of eating disorders. Besides, social media usage is steadily growing and is hypothesized to increase further in the following years, affecting the prevalence of eating disorders (Wilksch, O'Shea, Ho, Byrne, & Wade, 2019).

All of these previously mentioned risk factors seem to be related to the individual's wellbeing. Low levels of self-esteem, feelings of body dissatisfaction, appearance and weight-related anxiety, WRSM, and social media usage might be higher in females with low wellbeing (Davey, 2014; Wilksch, O'Shea, Ho, Byrne, & Wade, 2019). However, the relationship between wellbeing and eating disorder-specific risk factors appears as interacting with each other. Thus, on the one hand, the presence of risk factors decreases the females' wellbeing. On the other hand, low levels of wellbeing increase the emergence of risk factors (Davey, 2014; Wilksch, O'Shea, Ho, Byrne, & Wade, 2019). Hence, focusing on increasing the individual's wellbeing might decrease the prevalence of eating disorders as well.

Prevention and treatment for eating disorders

There is a distinction between treatment and preventive interventions (Levine & Smolak, 2008). Both are further divided into specific subcategories. Treatment is distinguished in early treatment, treatment, and aftercare (Mowszowski, Batchelor, & Naismith, 2010). Interventions with a preventive focus might target participants universally, selectively, or indicatively (Levine & Smolak, 2008). Selective and indicative prevention refers to recruiting participants who are more at risk of developing an eating disorder or have engaged in disordered eating already. A particular population might be scanned for risk factors, like asking university students to fulfill a questionnaire regarding body dissatisfaction to compile a suitable target group. Universal prevention implies including a population in general without scanning for known risk factors (Levine & Smolak, 2008). The early treatment phase might overlap with selective and indicative prevention since both target groups might be exposed to risk factors or have minor symptoms already (Mowszowski, Batchelor, & Naismith, 2010). Distinguishing between early treatment and indicative/ selective prevention is not organized according to clear guidelines. Thus, the focus of different types of interventions is sometimes overlapping (Mowszowski, Batchelor, & Naismith, 2010). This review will be primarily focused on selective/ indicative prevention, with some studies being universally oriented. However, included studies also entail early treatment and treatment-focused interventions.

Interventions for eating disorders

Already existing reviews and meta-analyses in the field of eating disorders tend to focus on several distinct aspects. Some studies aimed at improving the end-user engagement (Linardon et al., 2020), while others included mainly young girls and their parents (Zeiller et al., 2020) or entailed risk factor specific tasks to improve childrens' body image and self-esteem (Chua et al., 2020). This variety needs to be analyzed more thoroughly to overview the individual effectiveness of specific interventions in this field.

Most interventions for preventing/ treating eating disorders are focused on cognitive behavioral therapy (CBT) principles and have become steadily more media-based (Stice et al.,

2017; Linardon, Hindle, & Brennan, 2018). Nevertheless, other approaches such as the cognitive dissonance theory and the approach-avoidance theory might be effective in symptom reduction, too (Levine & Smolak, 2020). Media-based interventions might include face-to-face interactions or self-help interventions blended with websites or apps. Thus, counselor-driven interventions might also be media-based when having some media elements. Non-media-based interventions are defined as interventions based on face-to-face interactions only or printed interventions. Media-based CBT programs are regularly divided into distinct modules, focusing on CBT's cognitive or behavioral part of CBT. Lately, these are published through social media to reach individuals at risk and are placed on websites or within mobile applications to address more women (Stice et al., 2017). Since females between 12 to 28 years spent on average three to four hours a day on media, including social media, media-based CBT approaches have developed (Statista, 2020; Jones et al., 2020). However, digital media and related possibilities are relatively new, a reason why some studies are not yet finished (Jones et al., 2020). Thus, research is limited, and some effects of media-based interventions are still unclear, for example, the mere influence of the medium's nature, independently of the delivered intervention. However, a clear advantage of implementing media-based interventions in health care is related to reducing the treatment gap and the potential of decreasing feelings of shame in affected individuals because they do not need to see a therapeutic place (Jones et al., 2020).

eHealth interventions for eating disorders are delivered via different platforms, like websites or mobile apps, and have been shown to yield significant reductions in the prevalence of eating disorders. The most popular delivery platform is a website, followed by app-based/ mobile interventions. Websites have been proven effective and easily accessible (Wilksch, O'Shea, Ho, Byrne, & Wade, 2019). However, research concerning apps is not yet conclusive, wherefore this modality might be seldomly used (Birkhoff & Moriarty, 2016). Although they seem to be effective, the sample size is often relatively small, which decreases the expressive power. Since different studies about the same intervention tend to yield different results, a

literature review might be helpful to get a better overview of the current state of the art of media-baed interventions for eating disorders. Another shortage concerns the lack of comparisons between different modalities of media-based interventions for eating disorders. There are only a few articles comparing various interventions, which often yield inconclusive results. Hence, some studies suggest websites as more effective, and others point out apps as most suitable to reach the target audience (Stice, Durant, Rohde, & Shaw, 2014).

It became clear that these reviews tend to distinguish between children aged up to 17 years or adult women. No review focused on the eating disorder-specific at-risk group of women, aged 12 to 28 years old, including adults and children. Target groups tend to be built homogeneously to reach precise results regarding influencing variables (Kruglanski, Shah, Pierro, & Mannetti, 2002). A target group consisting of adults and children is more heterogeneous, making it more complicated to isolate the critical variable (Kruglanski, Shah, Pierro, & Mannetti, 2002). However, such a heterogenous group would also have the advantage of entailing the whole at-risk group for eating disorders.

This review

The above-explained variety within the focus of existing interventions, the diversity of delivery platforms, and the distinct grounding theories and principles led to inconclusive results regarding the effectiveness of specific interventions targeting eating disorders or related risk factors. Further, existing interventions only include children or adults without creating a heterogeneous group. Therefore, the current literature review examines the state of the art of media-based interventions for eating disorders in clinical and non-clinical women aged 12 to 28 years old. Further, the interventions' effect on the individual's wellbeing and the eating disorder symptomatology is analyzed.

Method

Search Strategy

For this literature review, the scientific databases Scopus and PsychINFO were used. The search terms were based on two main concepts. First, words related to eating disorders were defined. Second, words about media-based interventions were formulated (Figure 1). Each construct entailed multiple keywords to ensure a comprehensive overview of already conducted and assessed interventions in this area.

Construct 1: Eating disorders

‘Eating disorder*’ OR ‘anorexia’ OR ‘bulimia’ OR ‘binge-eating’ OR ‘(disordered eating)’ OR ‘WRSM’

AND

Construct 2: Media-based interventions

‘(social media)’ OR ‘cognitive-behaviour*’ OR ‘computer’ OR ‘WRSM’ OR ‘media’ OR ‘(thin ideal)’ OR ‘(body image)’ OR ‘internet’ OR ‘mindfulness’ OR ‘self-compassion’ OR ‘positive psycholog*’
AND
‘intervention’ OR ‘prevent*’ OR ‘campaign*’ OR ‘strategy’ OR ‘program’

Figure 1.

Search strategy and related search terms

After applying the search mentioned above in Scopus and PsychINFO, 890'962 results were found (Figure 2). In the following, multiple rounds of selection took place. First, articles published before the 21st century were deleted since this review focuses on recently developed media-based interventions (Lamberton & Stephen, 2016). Parallelly, reports were limited to the English language and psychology since eating disorders should be targeted as psychological disorders rather than eating disorders with a physical origin. Next, search results were limited

to females aged 12 to 28 years since this is the previously defined at-risk group for this literature review.

In the following, titles and abstracts of the remaining 1575 articles were screened. Here, one exclusion criterion was focused on the type of intervention. If the title or the abstract showed a non-media-based intervention, the article was removed. After these screening rounds, 54 articles were analyzed more in-depth for checking the remaining inclusion and exclusion criteria. Articles that were not focused on some form of media, like for example, websites, apps, or other media devices (n = 25), articles without experimental research (n = 4), articles without having the full text available (n = 2), interventions with a different age group (n = 2) and unfinished study protocols (n = 1) were excluded (Figure 2). Finally, 20 articles remained for the current review.

Data analysis

The included 20 articles were screened for required data on the overall study design, the sample composition, the type of intervention, the used theory, resulting dropout rates, the utilized media platform, and the assessed quality measurements. This review's primary outcome measures are disordered eating symptoms, present risk factors, intensity after completing the intervention, and the individual's quality of life measurements.

Methodological Quality Criteria

The overall quality of the screened studies was assessed with two different quality instruments. For the randomized controlled trials (n = 11), the Cochrane Risk of bias assessment tool was administered (Higgins et al., 2016). The Newcastle-Ottawa Quality Assessment Scale (NOS) was used (Stang, 2010). The Cochrane Risk of bias assessment tool consists of six quality criteria: strength of sample size, blinding, randomization, similar baseline scores, complete follow-up data, and a full representation of received results (Higgins et al., 2016). Each criterion can be rated with a 0 or 1. In the end, the individual measures are summed up to

a general score. Here, five to six points stand for high quality, three to four points for a moderate grade, and a score below three for low quality (Higgins et al., 2016).

The NOS is divided into three subscales: selection, comparability, and outcome (Stang, 2010). For the 'selection' scale, a maximum of 4 points is possible. The second scale can be rated with 2 points at the most. Lastly, the 'comparability' scale can reach not more than 3 points. Therefore, a maximum score of 9 points is possible and indicates the overall good quality of the assessed study (Stang, 2010).

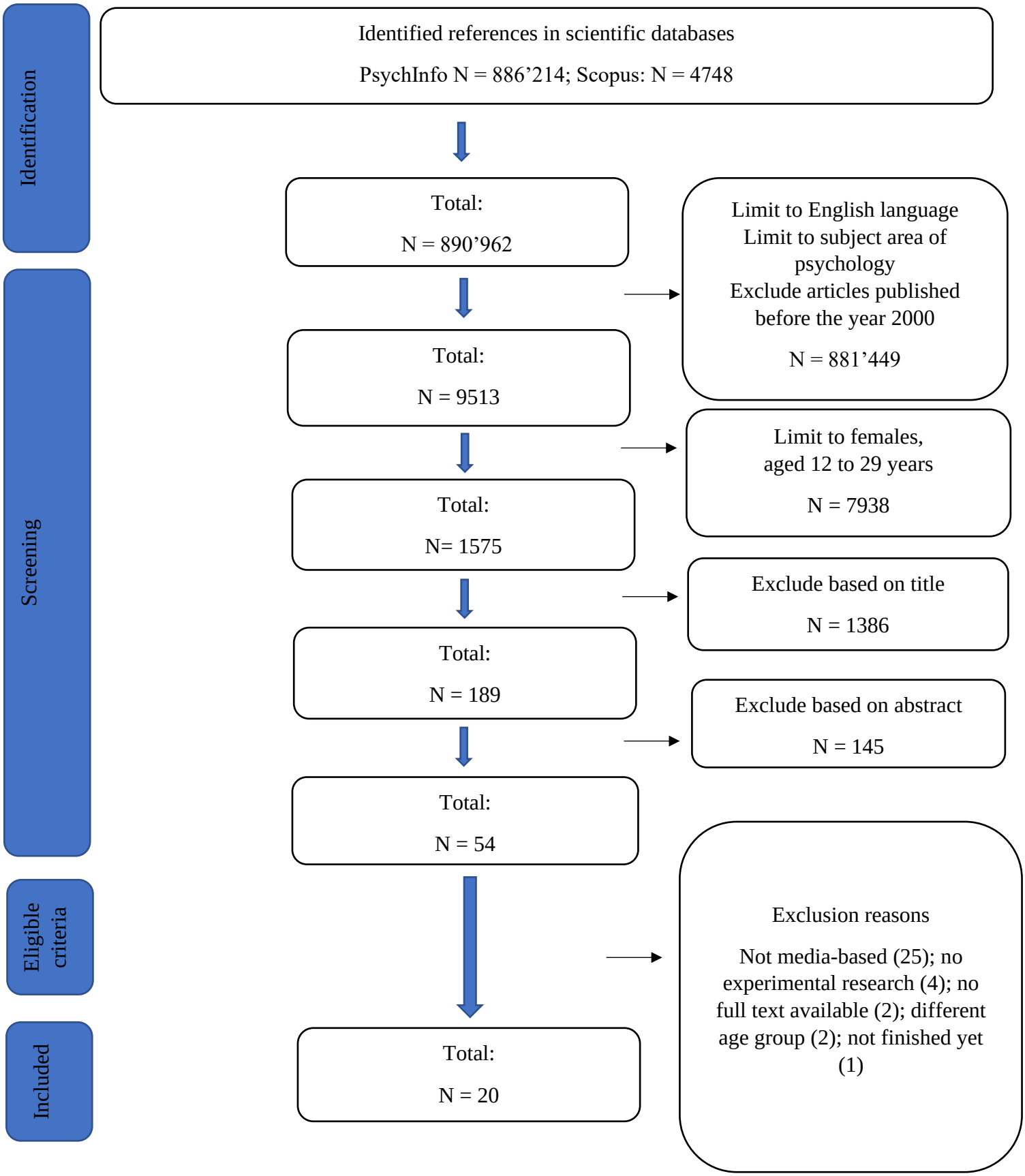

Figure 2.
Flow chart of the selection procedure

Results

General study characteristics

Design

This literature review is based on 20 studies evaluating and comparing distinct media-based interventions for decreasing eating disorder symptomatology and increasing the wellbeing of females. A summary of the used studies can be found in Table 3. In total, eleven RCTs are included and nine non-randomized controlled trials. Most studies compared an intervention group with an active control group (n = 7) or a waitlist control group (n = 10). The remaining three studies did not include a control group. In some studies, the control group was an information-based module, and in other instances, the group received other modules independent of the eating disorder intervention.

Samples

The majority of the included studies are based on a complete female sample (n = 15). The remaining studies entailed at least 83% females, with males forming a minority. This suits the prevalence rates for eating disorders since women tend to be seven times more likely to develop this disorder than men (Davey, 2014; Silén et al., 2020).

Furthermore, most researchers focused on a non-clinical sample with a selective/ indicative preventive focus (n = 14) with a participant's mean age of 24.03 years. Usually, these samples have high scores on risk-factor-specific scales. The remaining six studies entailed a clinical sample, averagely aged 31.4 years. Thus, interventions were evaluated with participants diagnosed with an eating disorder. In total, included studies have participants with a mean age of 26.25 years, which resembles the leading at-risk group for eating disorders.

Intervention characteristics

Regarding the delivery platform, interventions were published on a website, delivered through a smartphone app, or via online telephone calls. Most interventions consisted of modules, presented on a website, created for the specific intervention. These websites were

password-protected and only shared with the intervention participants, which made personal data more secure. Sometimes, this website was combined with regular email reminders, face-to-face conversations, or a concluding meeting with a clinician or counselor to round up the intervention. Two interventions entailed an app for smartphones to be more convenient with the current smartphone generation (Kollei et al., 2017; Cerea et al., 2021). Another one used telephone calls as the delivery platform to have more personal contact with participants (Cassin et al., 2016).

The majority was focused on cognitive behavioral therapy (CBT). CBT is a standard therapeutic option concerning interventions for eating disorders (Stice et al., 2017). This review entailed 13 studies in which the intervention was based on CBT. Four interventions were based on the theory of cognitive dissonance and one intervention each for either the motivational enhancement therapy (Hötzel et al., 2014), the approach-avoidance principles (Kollei, Lukas, Loeber, & Berking, 2017), or the theory of categorical perception (Irvine et al., 2020). These therapeutic principles have also been studied and proven to decrease eating disorder-related symptoms using offline effectively or face-to-face interventions (Hötzel et al., 2014; Kollei, Lukas, Loeber, & Berking, 2017; Irvine et al., 2020).

Type of intervention

CBT-based interventions. In 1999, Springer and colleagues introduced "StudentBodies" as a CBT-based intervention to prevent the onset of eating disorders in young females selectively recruited. Since then, multiple trials and comparisons have been published to evaluate this intervention's effectiveness, of which three studies were included in the current review. Graff-Low and colleagues (2006) investigated the long-term efficacy after eight months. They found significantly lower scores for the drive for thinness and weight and shape concerns in the intervention group compared to an active control group ($p = .026$). Parallelly, the individual's wellbeing had increased (Graff-Low, Charanasomboon, Lesser, Reinhalter, & Martin, 2006). Another study found further evidence for "StudentBodies" being effective in

reducing the number of binge episodes and purging by 67% to 86% in individuals after a 6-month follow-up compared with a waitlist control group (Jacobi, Völker, Trockel, & Taylor, 2012). This positive outlook was verified by Dev and Taylor (2000). They compared "StudentBodies" with a classroom intervention and found no differences for the effectiveness regarding decreasing eating disorder symptomatology and increasing self-esteem.

Other intervening approaches were focused on one specific factor, like "overcoming perfectionism" (Kothari et al., 2019; Shu et al., 2019), "overcoming binge eating" (Wagner et al., 2016), or the "GGBI: Positive Body Image app" (Cerea et al., 2021). All these programs are based on CBT principles. They have been proven to effectively reduce the targeted factor compared to a waitlist control group, with effect sizes being moderate to large *(d = 0.60 -0.88)*. "Overcoming perfectionism" and "Overcoming binge eating" were delivered via websites and are focused on topic-related psychoeducational strategies (Wagner et al., 2016; Kothari et al., 2019; Shu et al., 2019). The "GGBI: Positive Body Image app" was focused on the prevention of eating disorders by recruiting women at risk (Cerea et al., 2021). This app yielded significant results for decreasing negative thoughts and behaviors, like thinking about being ugly or checking the mirror steadily compared to a waitlist control group ($p = .01$; $p = .05$). A second outcome was increasing the female's wellbeing because of the decreased symptoms and more positive behaviors (Cerea et al., 2021).

Self-help interventions were also part of the spectrum for preventing or treating eating disorders. Here, Carrard and colleagues (2011) developed an internet-based "self-help intervention for binge eating disorder", which significantly reduced feelings of body dissatisfaction and drive for thinness while increasing the individual's interoceptive awareness compared to a waitlist control group ($p = .044$). However, six-month follow-up data showed no significant reductions of the targeted factors anymore ($p = .197$), suggesting decreased eating disorder symptomatology only in the first instance, but not in the follow-up (Carrard et al., 2011). In this area, the CBT-based "SALUT project" from Carrard and colleagues (2011)

has also been proven to significantly lower the risk for bulimia nervosa in European countries after the six-month self-help intervention *(p = .005).*

Multiple interventions focused on promoting a positive body image by using CBT principles, including for example, "every Body Fit" (Beintner et al., 2019), "VR training" (Irvine et al., 2020), and "Set Your Body Free" (Gollings, & Paxton, 2006). Since social media usage is steadily increasing, females tend to be more and more confronted with the thin ideal. The interventions try to reshape participants' awareness of a healthy body. Results showed that women with a more positive body image at baseline were less at risk for developing an eating disorder. They were also more prone to overcome an eating disorder faster. Moreover, the results showed that females stayed healthy for the long term (Gollings, & Paxton, 2006; Beintner et al., 2019; Irvine et al., 2020).

Cognitive dissonance theory-based interventions. The intervention program "Body Project", which is based on the theory of cognitive dissonance, was established in 2000 by Stice et al. Articles in this review showed the effectiveness of "Body Project" in comparison to active control groups as well other interventions (n = 4). Initially, "Body Project" was supported by clinicians who delivered the program online and via face-to-face interactions. However, in 2017, Stice and colleagues changed the delivery to peer-led groups. They found no significant differences concerning the effectiveness of groups led by professionals ($p = .478$), which increased the potential of Body Project to be used by more non-professional instructors (Stice, Rohde, Shaw, & Gau, 2017). These results were further substantiated by Luo and colleagues (2021). They found a significant decrease in eating disorder-related risk factors ($p = < .001$) and an increase in protecting aspects, like self-esteem, wellbeing, and body appreciation in individuals participating in the "Body Project" with an education brochure control group. Based on these promising results, Ghaderi and colleagues (2020) changed the original internet-based intervention to a full virtual reality version. This "VR-Body Project" decreased the incidence

of eating disorders onset over a 2-year follow-up by 77% in comparison to a waitlist control condition (Ghaderi, Stice, Andersson, & Persson, 2020).

Motivational enhancement therapy-based intervention. The internet-based program "ESS-KIMO" was established to enhance motivation to change in females having symptoms of eating disorders (Hötzel et al., 2014). The "ESS-KIMO" group was compared with a waitlist control group. Both groups were built up of females being diagnosed with an eating disorder according to the DSM-5. The intervention group attended six weekly online sessions, focusing on contrasting their eating disorder's positive and negative aspects. The intervention's primary goal of increasing motivational factors was reached ($p < .001$) by parallelly decreasing symptoms and increasing their level of self-esteem (Hötzel et al., 2014).

Approach-avoidance technique-based intervention. Furthermore, two interventions were delivered through smartphone apps and led to significant reductions of risk factors for eating disorders. First, the "Mindtastic Body Dissatisfaction app" (MT-BD) used the approach-avoidance task (AAT) as a groundwork (Kollei, Lukas, Loeber, & Berking, 2017). In this case, AAT aims to retrain automatic behavioral responses in individuals with eating disorders or present risk factors. Thus, participants should approach images displaying healthy body weight and avoid an unhealthy thin ideal. For this, the app consisted of suitable pictures for these groups. Hence, AAT focuses on changing the females' cognitive bias regarding the ideal body shape (Kollei, Lukas, Loeber, & Berking, 2017). The MT-BD app yielded significant results for decreasing body dissatisfaction, weight and shape concerns, and increased participant's quality of life compared to a waitlist control group ($p = .001$; $p = .007$). Furthermore, these results were also sustained after a 1-month follow-up (e.g., Kollei, Lukas, Loeber, & Berking, 2017; Cerea et al., 2021).

Categorical perception theory-based intervention. In 2020, Irvine and colleagues tested a virtually-delivered training program for modifying the individual's body image to prevent the onset of eating disorders in individuals being at-risk. This 4-day intervention

focused on changing the perceived boundary between a fat and a thin body based on the theory of categorical perception (Irvine et al., 2020). One intervention group was confronted with the 3D stimuli without a time limit, whereas the second intervention group had a time limit. Concerns about their body weight and disordered eating habits decreased in both groups significantly, compared to an active control group who only received psychoeducation without taking part in the perceptual training ($p < .001$). The perceptual training consisted of 15 body images, being underweight or obese. Participants needed to decide for each body about being fat or thin. Nevertheless, unlimited stimulus presentation, where participants could look at the body images without a time limit, yielded a more significant training effect and follow-up after two weeks (Irvine et al., 2020).

Interventions focusing on wellbeing. This review's studies mainly focused on decreasing eating disorder symptomatology and increasing protecting factors like wellbeing. Since females with higher levels of wellbeing seem to be less prone to develop an eating disorder (Davey, 2014), this outcome measure was included in some studies. For example, "StudentBodies" and the "GGBI" app yielded a significant increase in the participant's wellbeing (Graff-Low, Charanasomboon, Lesser, Reinhalter, & Martin, 2006; Cerea et al., 2021). However, these interventions did not aim at improving wellbeing specifically. They tend to measure only facets of wellbeing but do not target it with positive psychological approaches. So, the "MT-BD" app only included the participant's quality of life, partly related to wellbeing (Kollei, Lukas, Loeber, & Berking, 2017). Other studies, like "ESS-KIMO" or "BodyProject", focused on increasing the level of self-esteem, which is also conceptually related to wellbeing (Hötzel et al., 2014; Ghaderi, Stice, Andersson, & Persson, 2020). Generally, the intervention's content is aimed at symptom and risk factor reduction. None of the included studies focused on wellbeing as a multifacet construct. They only measured constructs, like self-esteem, or quality of life, which might be partly related to the individual's overall level of wellbeing.

Dropout rates

The studies' overall quality was decreased by a relatively high dropout rate with a mean of 28% (range 1.2% to 66%) for the included articles. Irvine and colleagues (2020) tested virtual reality to prevent eating disorders and organized a 20£ gift voucher to motivate participants to keep on track. This approach effectively decreased the dropout rates since this study has the lowest rate at 1.2% (Irvine et al., 2020). Generally, it is noticeable that studies with extensive follow-up questionnaires or a considerable period between the intervention and the follow-up have higher dropout rates up to 66% (Beintner et al., 2019).

Efficacy

Overall, this review compromised 15 different interventions targeting eating disorder symptomatology or risk factor reduction. The majority of them yielded significant improvements regarding decreasing risk factors, like feelings of body dissatisfaction, low self-esteem or appearance, and weight-related anxiety. In contrast, others significantly decreased the symptomatology in clinical participants. Follow-up data intensified this positive outlook since most interventions kept their effectiveness. Only the "self-help intervention for binge eating disorder" from Carrard and colleagues (2011) did not remain its significant improvements after the 6-month follow-up period.

Besides these promising results, the efficacy needs to be analyzed concerning the different control group designs. Thus, Linardon and colleagues (2020) showed that effect sizes were more significant when a media-based intervention was compared to a waitlist control group design than an active control group. This might suggest the effectiveness of the intervention being partly a result of the media's nature and not based on the therapeutic constructs behind the program (Linardon, 2020; Torous & Firth, 2016).

Table 3.
Overview of study and intervention characteristics (N=20)

Study	Intervention name	Participant's age (% females)	Sample (diagnosis)	Theory	Media platform	Drop-Out rates	Outcome measures	Study design
Beintner et al. (2019)	Every Body fit	42.6 years (100%)	Non-clinical sample	CBT	Website	66%	weight and shape concerns, eating disorder pathology, self-esteem	Nonrandomized controlled trial
Carrard et al. (2011)	CBT for BED disorder	36 years (-)	Clinical sample (BED)	CBT	Website	17.6%	eating disorder pathology, body dissatisfaction, symptom checklist, self-esteem	Randomized controlled trial
Carrard et al. (2011)	SALUT project	24.7 years (100%)	Clinical sample (BN)	CBT	Website	25.2%	eating disorder pathology, symptom checklist	Pilot study
Cassin et al. (2016)	Tele-CBT	45.5 years (83%)	Clinical sample (BED)	CBT	Telephone	15.5%	body dissatisfaction, eating disorder pathology, patient health	Randomized controlled trial
Cerea et al. (2021)	GGBI**	21.7 years (100%)	Non-clinical sample	CBT	Mobile-App	-	eating disorder pathology	Randomized controlled trial
Ghaderi et al. (2020)	VR-Body Project	15-20 years (100%)	Non-clinical sample	Cognitive dissonance	Website + Mails	-	eating disorder pathology, positive/ negative affect, body dissatisfaction, clinical impairment	Randomized controlled trial
Gollings et al. (2006)	Set Your Body Free	18-30 years (100%)	Non-clinical sample	CBT	Website face to face	21%	body dissatisfaction	Pilot study
Graff-Low et al. (2006)	Student Bodies	- (100%)	Non-clinical sample	CBT	Website	16%	eating disorder pathology, weight and shape concerns	Long term Follow-Up
Hötzel et al. (2014)	ESS-KIMO	18-50 years (100%)	Non-clinical sample	MET*	Closed website	41%	self-esteem, eating disorder pathology	Randomized controlled trial

Irvine et al. (2020)	VR-training	18-35 years (100%)	Non-clinical sample	Categorical perception	Website	1.24%	eating disorder pathology, depression, self-esteem	Pilot study
Jacobi et al. (2012)	Student Bodies	22.3 years (100%)	Non-clinical sample	CBT	Website	-	eating disorder pathology, body dissatisfaction, depression	Randomized controlled trial
Kollei et al. (2017)	MT-BD App	- (92.3%)	Non-clinical sample	Approach-Avoidance	Mobile App	-	eating disorder pathology	Randomized controlled trial
Kothari et al. (2019)	Overcoming Perfectionism	28.9 years (82%)	Clinical sample	CBT	Website	46%	obsessive-compulsive, intolerance of uncertainty, eating disorder pathology, self-esteem, fear of compassion	Randomized controlled trial
Luo et al. (2021)	eBody Project	14-22 years (100%)	Clinical sample (ED)	Cognitive dissonance	Website	34%	body dissatisfaction, self-esteem, eating disorder pathology	Pilot study
Shu et al. (2019)	ICBT for Perfectionism	16.2 years (100%)	Non-clinical sample	CBT	Website + Mails	33%	eating disorder pathology, self-esteem, perfectionism	Randomized controlled trial
Stice et al. (2014)	Body Project	21. 6 years (100%)	Non-clinical sample	Cognitive dissonance	Website	11%	body dissatisfaction, depression	Follow-Up study
Stice et al. (2017)	Body Project	22.2 years (100%)	Non-clinical sample	Cognitive dissonance	Website + Clinicians	11%	positive/ negative affect, body dissatisfaction	Pilot study
Wagner et al. (2016)	Overcoming Binge Eating	35,1 years (96.4%)	Clinical sample (BED)	CBT	Website	27.5%	eating disorder pathology, depression, symptom checklist	Randomized controlled trial
Wilksch et al. (2017)	Media-Smart Targeted	20.7 years (100%)	Non-clinical sample	CBT	Website	58.8%	eating disorder pathology	Randomized controlled trial
Winzelberg et al. (2000)	Student Bodies	19.6 years (100%)	Non-clinical sample	CBT	Website	24%	eating disorder pathology, body dissatisfaction	Controlled trial

* Motivational Enhancement Therapy (MET),

** Positive Body Image App (GGBI)

Quality of studies

Reliability and Validity

The included studies in this literature review have evident reliability and validity criteria. For assessing the quality of a particular intervention, different questionnaires or schemes were used. Included studies only yield valid and reliable scales in determining the focused intervention. So, symptoms were measured by different eating disorder scales, which were proven to be reliable and valid (Carrard et al., 2011; Jacobi, Völker, Trockel, & Taylor, 2012; Wilksch et al., 2017). For this, the Eating Disorder Examination-Questionnaire (EDE-Q), the Eating Disorder Inventory-2 (EDI-2), and the Three-Factor Eating Questionnaire (TFEQ) were used regularly. These scales were also used to assess the intensity of present risk factors (Carrard et al., 2011; Jacobi, Völker, Trockel, & Taylor, 2012; Wilksch et al., 2017). Nevertheless, some studies added risk factor-specific subscales, like 'The Ideal-Body Stereotype Scale' or 'The Satisfaction and Dissatisfaction with Body Parts Scale' (Stice, Durant, Rhode, & Shaw, 2014). The individual's quality of life was also measured in most studies to assess the intervention's importance (Carrard et al., 2011; Jacobi, Völker, Trockel, & Taylor, 2012; Stice, Durant, Rhode, & Shaw, 2014; Wilksch et al., 2017). Therefore, scales that measure depression symptoms and psychopathology symptoms were added for the pre-and post-test. For this, the Beck Depression Inventory-II (BDI-II), the Symptom Checklist-90-Revised (SCL-90R), and the Impact of Weight on Quality of Life Questionnaire (IWQOL-Lite) were included (Carrard et al., 2011).

Methodological quality

For the non-randomized controlled trials (N=9), the Newcastle-Ottawa Quality Assessment Scale (NOS) was used (Table 1). For this review's studies, the NOS indicated a mean score of 3.2 for the selection criterion, where a maximum of 4 would have been possible. For the second criterion, comparability, a mean of 1.3 out of 2 points was reached. The outcome criterion was rated with a mean of 1.9, where 3 points could have been given. Concluding the

three aspects of the NOS, the overall mean of 6.4 indicates a fair quality for the assessed studies (Stang, 2010).

For the randomized controlled trials (RCTs) (N=11), the Cochrane Risk of bias assessment tool was used. Here, eight RCTs scored with 5 out of 6 possible points, and three studies scored with 4 out of 6 points (Table 2). This indicates a moderate to high quality and, therefore, a generally low probability of bias regarding the used randomized controlled trials for this literature review (Higgins et al., 2016).

Table 1.

Quality criteria according to the Newcastle-Ottawa Quality Assessment Scale (NOS) per non-RCT (N=9)

Study	Selection	Comparability	Outcome	Total score	Overall quality
Beintner et al. (2019)	3.5	2	2.5	8	High quality
Carrard et al. (2011)	3	2	1	6	Fair quality
Gollings et al. (2006)	2.5	1	1	4.5	Low quality
Graff Low et al. (2006)	3	1	2.5	6.5	Fair quality
Irvine et al. (2020)	3.5	1	2.5	7	Fair quality
Luo et al. (2021)	3.5	2	2	7.5	High quality
Stice et al. (2014)	3.5	1	2.5	7	Fair quality
Stice et al. (2017)	3.5	1	2.5	7	Fair quality
Winzelberg et al. (2000)	2.5	1	1	4.5	Low quality

Table 2.
Quality criteria according to the Cochrane Risk of bias assessment tool per RCT (N=11)

Study	Strength of sample size	Blinding	Randomization	Similar baseline scores	Follow-up data	Full representation	Total score	Overall quality
Carrard et al. (2011)	1	1	1	0	0	1	4	Moderate quality
Cassin et al. (2016)	0	1	1	1	0	1	4	Moderate quality
Cerea et al. (2021)	0	1	1	1	1	1	5	High quality
Ghaderi et al. (2020)	0	1	1	1	1	1	5	High quality
Hötzel et al. (2014)	1	1	1	1	0	1	5	High quality
Jacobi et al. (2012)	1	1	1	1	0	1	5	High quality
Kollei et al. (2017)	0	1	1	1	1	1	5	High quality
Kothari et al. (2019)	1	1	1	1	0	1	5	High quality
Shu et al. (2019)	0	1	1	1	0	1	4	Moderate quality
Wagner et al. (2016)	0	1	1	1	0	1	4	Moderate quality
Wilksch et al. (2017)	0	1	1	1	1	1	5	High quality

Discussion

Main findings

This review compared 20 studies based on distinct media-based interventions for eating disorders in females aged 12 to 28. Included interventions were centered on CBT, the cognitive dissonance theory, motivational enhancement therapy, approach-avoidance theory (AAT), and the theory of categorical perception. Although CBT is the most acknowledged therapeutic approach in eating disorders, research of Murratore and Attia (2021), alongside this review, proved other theories as similarly effective in symptom reduction. Studies included in this review yielded significant decreases in eating disorder symptomatology and significant increases in the individual's level of wellbeing, independently of the initial approach (e.g., Graff-Low et al., 2006; Stice et al., 2017; Ghaderi et al., 2020).

The diversity of the disease pattern for eating disorders might explain this variety of grounding theories behind effective interventions. For example, individuals with AN are more focused on the thin ideal than individuals with BED (Davey, 2014). Parallelly, the risk factors for the distinct subtypes differ as AN and BN are more related to social media influences, and BED correlates most with emotional problems, like depression or anxiety disorders (Grucza, Przybeck, & Cloninger, 2007). Therefore, CBT might be most suitable to target problematic cognitions leading to emotional problems, as in BED. In contrast, AAT might decrease the misleading thin idealization in AN or BN-affected females (Murratore, & Attia, 2021).

Most of the included studies were web-based, presented on a website, two interventions were app-based, and one intervention was applied via telephone. The above-analyzed effectiveness in decreasing eating disorder symptomatology and risk factors proved web-based interventions as effective. Alongside, the apps were equally effective without having clear advantages or disadvantages to websites. This shows websites as being a suitable medium to spread online interventions within the target group. Women aged 12 to 28 years old tend to increase their media usage steadily, making online interventions more attractive (Wilksch,

O'Shea, Ho, Byrne, & Wade, 2019). However, time spent on smartphones tends to increase even more, making app-based interventions more likable (Santarossa & Woodruff, 2017). The study of Birkhoff and Moriarty (2016) focused on the inconclusiveness of research regarding the effectiveness of eHealth apps which is in line with this review since only two apps have been found relating to eating disorders. Accordingly, more research is needed to investigate the applicability of eHealth apps more in-depth (Birkhoff, & Moriarty, 2016). Moreover, the design phase of an app is more complex than implementing a website (Topham, Caleb-Solly, Matthews, Farmer, & Mash, 2015). This complexity and the lack of research might explain the designer's decision to implement their intervention on a website instead of creating an app.

Another finding of this literature review concerns the high dropout rates with small sample sizes for the included studies. More time between the intervention and the follow-up increased the dropout rates up to 66%. In general, online interventions have been shown to have higher dropout rates than face-to-face interventions (Stice et al., 2017; Irvine et al., 2021). To circumvent this non-adherence, an incentive approach combined with selective/ indicative prevention, used by Irvine and colleagues (2021), led to a successful decrease in dropouts. This finding could be helpful for future study designs. In combination with the discovery that most studies have high dropout rates, the results seemed to be based on small sample sizes. Indeed, the quality assessment of the included RCTs showed low scores for the intervention's sample size. Although researchers performed power analyses in most studies beforehand, the dropout rates decreased the sample's absolute power. Low statistical power reduces the likelihood of detecting an actual effect, which, in turn, implies that the found result needs to be considered carefully (Hall, Marron, & Neeman, 2005). For future research, the non-adherence might already be considered when calculating the power analysis to ensure that the results have high power in the end. For this, a larger sample would be needed or strategies to decrease dropout significantly.

Lastly, most included studies for women aged 12 to 50 years old ($Mean_{age}$ = 24.03 years) tend to have a preventive focus by centering on the non-clinical population (*n=14*). These interventions mainly dealt with selective and indicated prevention. Preventing the onset of eating disorders in young females seems crucial as the healing process and the journey to overcome the eating disorder is regularly emphasized by emotional disturbances and long-lasting disordered eating patterns (Pettersen et al., 2011). Interventions focusing on the clinical population are routinely characterized by higher costs and more effort to put in from the affected individuals (Gordon et al., 2020). Additionally, evidence for the effectiveness of eHealth interventions for eating disorders is limited, which might lead clinicians to avoid implementing these interventions for clinical women (Ahmadiankalati, Steins-Loeber, & Paslakis, 2020). This can be explained by clinicians being afraid to disadvantage severely affected women with these interventions (Ahmadiankalati, Steins-Loeber, & Paslakis, 2020). This might explain non-clinical samples are forming the majority within the area of interventions for eating disorders. Parallelly, the prevalence of eating disorders increased during the last years, which increased the necessity of preventive interventions even more (Gordon et al., 2020).

Strengths and limitations

The studies for this review have been checked with reliable quality criteria, namely the Newcastle-Ottawa Quality Assessment Scale and the Cochrane Risk of Bias assessment tool. These tools showed most studies being of high quality (*n* = 9) or moderate quality (*n* = 9). Just two studies were of low quality. Based on the reliability of the used assessment tools and the qualitative outcomes, this review's overall results might have high reliability, too.

A further strength of this review is the focus on women aged 12 to 28. This target group is the primary at-risk group for eating disorders and, parallelly, the group that regularly uses media. Besides, other reviews tend to focus on underaged or on females above 18 years only. Therefore, this review enables a more complex and novel overview of interventions for eating disorders in the whole at-risk group: women between 12 and 28 years.

Nevertheless, this literature review also has some limitations, with the studies' small sample sizes being the first one. Universal prevention approaches especially require larger sample sizes since, in this design, women are also included who do not belong to the at-risk group (Linardon et al., 2020; Zeiller et al., 2020). Small samples might decrease the expressive power, which would minimize the reliability of the results at the end (Linardon et al., 2020). For that reason, this review's overall finding of media-based interventions being effective must be considered carefully. Based on these small sample sizes, a meta-analysis focusing on sub-group analyses was not possible.

Another limitation concerns the interrater reliability of this review. This literature review is only based on the literature search from one researcher. Unfortunately, no second researcher has conducted the same examination to evaluate interrater reliability. Past research shows the construct of interrater reliability as essential to improve the review's overall expressive power (Bornmann, Mutz, & Daniel, 2010). Therefore, it would be recommended to conduct the literature search, screening, and quality assessment by at least two researchers to fulfill interrater reliability criteria in the future.

Furthermore, this review did not specifically focus on the distinction between universal prevention and selective/ indicative prevention. All studies were screened for the prevention type. Still, due to the limited number of included articles, no meta-analysis regarding the distinct effects of the prevention types could be executed. Previous research showed universal prevention is more critical in reducing known risk factors for eating disorders than indicative or selective prevention. This is because the increased social media usage tends to pertain to most females without them seeing this as problematic behavior. Accepting high social media usage as normal might lead women to miss this as a significant risk factor. Therefore, universal prevention is essential also to target those who do not see themselves as part of an at-risk group (Schwartz et al., 2019). This could be related to the steadily increasing time spent on social media, a real risk factor (Davey, 2014; Santarossa & Woodruff, 2017; Wilksch, O'Shea, Ho,

Byrne, & Wade, 2019). However, Schwartz and colleagues' (2019) research showed that until now, most interventions still target their participants selectively. This goes along with this review, with most studies being focused on selective and indicative prevention (n = 13). Based on Schwartz and colleagues' (2019) promising results and the increasing social media usage, a review focusing on the differences between universal and selective/ indicative prevention would be recommended. Future study designs could be improved to decrease the presence of risk factors for eating disorders in females.

Recommendations

Future research should focus on increasing the sample size by decreasing the dropout rates of media-based interventions. By this, the sample's power and the final expressive power of the individual study can be enhanced. Irvine and colleagues (2021) study yielded promising results with decreasing the dropouts successfully by adding incentives. However, it must be stated that they did not compare it directly to a group or study without incentives (Irvine et al., 2021). Hence, future research recommends comparing an incentive group with a non-incentive group in one study to reach more insights into the effectiveness of using incentives. Past research confirmed that the individual's motivation to complete a study thoroughly could be increased by adding payments (Eisenberger, Rhoades, & Cameron, 1999). Although the participants' starting motivation might be based on decreasing symptoms, this motivation seems to reduce before the intervention's end or before the follow-up procedure. Here, payments or rewards can increase motivation until effects might be present, too (Eisenberger, Rhoades, & Cameron, 1999). Another possibility to increase the sample size might be to enlarge the time frame and the ways of recruiting to reach more people.

Further, it is essential to develop studies that evaluate the control design more in-depth to ensure that effect sizes are due to the intervention's design and not the used control condition. Otherwise, the placebo effect of the active control group might intervene with the expressiveness of the group participating in the psychological intervention (Linardon et al.,

2020). In this case, the placebo effect implies changes due to thinking partaking in an intervention condition. Based on these thoughts, eating disorder symptomatology might decrease without being an actual participant within a psychologically designed intervention to tackle the disorder. That might be triggered by the intervention being media-based. However, this finding implies that the actual effectiveness of a designed intervention cannot be acknowledged (Linardon et al., 2020). One possible next step could be a literature review focusing only on a specific control group design, namely a waitlist control group or an active control group.

The studies for this review are heterogeneous regarding the program as well as regarding the therapeutic constructs. The most significant reductions of eating disorder symptomatology and increases of the individual's wellbeing imply media-based as effective, independently of their exact design. However, based on this heterogeneity, less research has been conducted for the distinct interventions. Therefore, it is recommended to investigate the individual interventions more in-depth, like "Set Your Body Free" or the different apps. Currently, much research is conducted with a complex and heterogeneous focus instead of creating a thorough picture of one intervention by replicating approaches or improving existing ones.

Conclusion

The current literature review suggests that online interventions for preventing and treating eating disorders in women aged 12 to 28 years effectively reduce symptoms and the presence of known risk factors. This effectiveness is primarily independent of the applied theory since CBT seemed similarly effective as the cognitive dissonance theory or the motivation enhancement theory. The majority of the interventions were web-based, but app-based interventions seem to be effective, too. This might be a basis for future research since app usage is steadily increasing in the at-risk group. Expanding the usage potential and applicability of interventions for eating disorders might decrease the treatment gap even further, which might, in turn, reduce the prevalence of fully diagnosed eating disorders, according to the DSM-5.

Besides these promising results, the small sample sizes and high dropout rates should be considered to possibly increase the implementation of interventions with higher expressiveness concerning the results. Exemplary, this might be tackled with the incentive approach or by including estimated dropouts already in the power analysis.

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