**Metacognitive beliefs across eating disorders and eating behaviors: A systematic review**

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**Abstract**

**Background:** Literature has pointed out a probable association between metacognitive beliefs and eating disorders. To date, no study has synthetized all research exploring the differences or similarities in metacognitive beliefs across different eating disorders diagnoses and eating problems. **Aims:** To review the evidence on metacognitive beliefs across the spectrum of eating disorders and eating behaviors. **Method:** A comprehensive search was conducted on PubMed and PsycInfo. The search terms used were: “eating disorders/anorexia/bulimia/binge eating disorder/binge eating” AND ‘metacognitions/metacognitive beliefs”. A manual search of reference lists was also run. **Results:** Eleven studies were identified. Anorexia Nervosa was broadly characterized by higher levels of metacognitive beliefs compared to the general population, particularly negative beliefs about worry and beliefs about the need to control thoughts. Positive beliefs about worry were higher in Anorexia Nervosa compared to Bulimia Nervosa and Eating Disorder Not Otherwise Specified, and in Bulimia Nervosa compared to Eating Disorder Not Otherwise Specified. Negative beliefs about worry were higher in Anorexia Nervosa compared to Bulimia Nervosa. Cognitive self-consciousness was higher in Anorexia Nervosa compared to Bulimia Nervosa and Eating Disorder Not Otherwise Specified. **Conclusions:** Metacognitive beliefs appear to be implicated in eating disorders and eating behaviors.

**Key practitioner messages**

* Metacognitive beliefs are relevant in eating disorders and eating behaviors.
* The assessment of metacognitive beliefs should not be overlooked in anamnesis.
* Metacognitive Therapy could be considered in supporting individuals with problematic eating behaviors.

**Key words:** anorexia nervosa; bulimia; binge eating; eating disorders; eating behavior; metacognitive beliefs.

1. **Introduction**

Metacognition refers to knowledge and cognitive processes which are involved in the appraisal, monitoring and regulation of cognition (Flavell, 1979). Metacognitive beliefs refer to the information individuals hold about their own cognition (e.g. “I should be in control of my internal states at all times” and “Having thought X means I am weak-willed”) and about coping strategies which impact on it (e.g. “If I worry I will be prepared” and “Ruminating will help me find a solution”).

Wells and Matthews (1994, 1996) have proposed the Self-Regulatory Executive Function (S-REF) model in which metacognitive beliefs activate a combination of maladaptive coping strategies (attentional focusing on threat, perseverative thinking styles and dysfunctional behaviors) termed the ‘Cognitive Attentional Syndrome’ (CAS; Wells, 2000). Once activated, the CAS causes negative thoughts and emotions to persist, leading to failures to modify metacognitive beliefs and stably resolve self-discrepancies (Spada, Caselli, Nikčević, & Wells, 2015a).

Metacognitive beliefs broadly take two forms: positive beliefs about worry (beliefs pertaining to the benefits of perseverative thinking) and negative beliefs about worry (beliefs that thoughts are uncontrollable and dangerous). Metacognitive beliefs have been explored in several psychological disorders including Generalized Anxiety Disorder, Major Depressive Disorder, Obsessive–Compulsive Disorder, Post-Traumatic Stress Disorder, and a wide spectrum of addictive behaviors (Caselli, Martino, Spada, & Wells. 2018; Hamonniere & Varescon, 2018; Rogier, Zobel, Morganti, Ponzoni, & Velotti, 2020; Spada et al., 2015a, Spada, Giustina, Rolandi, Fernie, & Caselli, 2015b).

A recent review of the literature has indicated a possible link between metacognitive beliefs and eating disorders (Sun, Zhu, & So, 2017). Furthermore, perseverative thinking, in the form of rumination and worry, has been found to be associated with eating disorders. A meta-analysis has highlighted that individuals presenting with eating disorders reported higher levels of rumination than those without this type of presentation (Smith, Mason, & Lavender, 2018); other studies have reported higher levels of worry in patients with eating disorders compared to controls (Sassaroli, et al., 2005; Sternheim et al., 2012). In view of the S-REF model postulating that perseverative thinking is activated and maintained by metacognitive beliefs (Wells & Matthews, 1994; 1996), it could also worthy of interest to explore the presence of metacognitive beliefs in eating disorders. Furthermore, since the publication of the review by Sun and colleagues (2017), additional studies have been published (it also worth noting that a few earlier studies were not been included in Sun and colleagues’ review). Despite the increasing interest in this area of research (Palmieri, Gentile, Da Ros, & Spada, 2020; Robertson & Strodl, 2020), no study, to date, has provided a synthesis of all research that has explored the potential differences or similarities in metacognitive beliefs across different eating disorders diagnoses. It may be worthy to explore these differences or similarities because literature has shown, for example, that Anorexia Nervosa patients report higher levels of positive and negative metacognitive beliefs about worry than bulimic patients (Sapuppo, Ruggiero, Caselli, & Sassaroli, 2018; Vann, Strodl, & Anderson, 2014), while bulimic patients present with higher levels positive beliefs about worry than patients with an Eating Disorder Not Otherwise Specified (Olstad, Solem, Hjemdal, & Hagen, 2015). These findings indicate there may be similarities on metacognitive beliefs between eating disorder diagnoses, but this cannot be ascertained in the absence of a systematic review. Given the recent emergence of research in this area, providing an overarching review of the existing evidence appears warranted. Thus, the aim of this systematic review was to identify and present the current evidence regarding metacognitive beliefs across the spectrum of eating disorders and problems.

1. **Methods**

*2.1 Study selection*

The study selection methodology has been reported following the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines (Moher, Liberati, Tetzlaff, Altman, & Prisma Group, 2009).

*2.2. Eligible studies included*

The following inclusion criteria were applied to the literature search: (a) English-language articles published in peer-reviewed journals; (b) articles related to eating behaviors and eating disorders; (c) articles related to metacognitive beliefs; (d) research using a case-control design, prospective cohort studies, experimental studies, and large population-based cross-sectional and longitudinal studies. We excluded qualitative studies and studies on metacognitive beliefs not specifically referring to the S-REF model (Wells & Matthews, 1996).

*2.3. Information sources and search*

A comprehensive search was conducted on PubMed from March 2007 to June 2020 as well as on PyscInfo from October 2010 to June 2020. Moreover, a manual search of reference lists was run. The search terms used were: “eating disorders / anorexia / bulimia / binge eating disorder / binge eating / eating behaviors” AND “metacognitions / metacognitive beliefs”.

*2.4. Study selection, data collection process, and data items*

The eligibility of studies was assessed through the following procedure: title screening, abstract screening, full papers screening. Titles and abstracts were screened by S.P. Articles appearing potentially relevant were retrieved by S.P. and independently assessed by S.P. and G.M. Disagreements on eligibility were resolved by consensus among authors (intercoder reliability: Cohen’s Kappa coefficient = 0.85). When information about the methods or results was omitted, the authors were contacted to obtain missing information.

*2.5. Assessment of risk of bias in individual studies*

To ascertain the validity of eligible studies, two investigators (S.P. and G.M.) independently rated each study according to the following markers: homogeneity of the sample regarding the diagnosis if present, appropriate random allocation if necessary, the presence of a comparison group if appropriate. Disagreements were resolved by consensus (intercoder reliability: Cohen's Kappa coefficient=0.80).

1. **Results**

The search of the PubMed and PsycInfo databases and the manual search provided a total of 82 citations. Adjusting for duplicates and reviewing the papers to exclude those that did not meet the criteria, led to 11 studies remaining eligible for inclusion (see Figure 1). Eight out of 11 studies were on eating disorders patients (Cooper, Grocutt, Deepak, & Bailey, 2007; Davenport, Rushford, Soon, & McDermott , 2015; McDermott & Rushford, 2011; Olstad et al., 2015; Palomba et al., 2017; Sapuppo et al., 2018; Sternheim, Startup, & Schmidt, 2015; Vann et al., 2014), 3 out of 11 studies were on the general population (Konstantellou & Reynolds, 2010; Laghi, Bianchi, Pompili, Lonigro, & Baiocco, 2018; Quattropani et al., 2016). In the selected studies sample sizes ranged from 26 to 804 (total N=1850); eight out eleven studies were conducted in Europe (four in Italy, three in the UK, one in Norway) while three out eleven were conducted in Australia. Patients in clinical samples were inpatients, outpatients, day hospital patients from services specialized in the treatment of eating disorders as well as patients recruited through psychotherapy clinics; only one study specified the approach of psychotherapeutic treatment administered which was cognitive psychotherapy. In some studies, patients with a comorbidity of anxiety, depression, alcohol, and substance abuse were excluded. Other studies did not undertake a screening for other mental disorders. Participants in control samples were university students, high school students, university staff or individuals from the community.

None of the studies fulfilled all the Newcastle-Ottawa quality criteria. Of the 8 case-control studies, one study scored 6/9, three studies scored5/9, three studies scored 4/9, and one study scored 3/9. Of the 3 cross-sectional studies, one study scored 8/10, one study scored 7/10, and one study scored 6/10. Further details regarding study quality for the studies selected can be found in Tables 1 and 2.

Eating disorders were evaluated using, predominantly, DSM criteria (American Psychiatric Association 2000, 2013) and self-report measures such as the Eating Disorders Inventory (higher scores represent higher levels of eating disorder pathology) (EDI-2, Garner, 1991; EDI-3, Garner, 2004), the Eating Attitude Test (higher scores suggest the possibility of an eating disorder) (EAT, Garner & Garfinkel, 1979; Garner, Olmsted, Bohr, & Garfinkel, 1982), the Binge Eating Scale (higher scores represent more severe binge eating symptoms) (BES, Gormally, Black, Daston, & Rardin, 1982), and the Eating Disorder Examination Questionnaire (higher scores imply more severe levels of eating disorder symptoms) (EDE-Q, Fairburn & Beglin, 1994; 2008). Studies were mostly in samples with Anorexia Nervosa (AN) (Cooper et al., 2007; Davenport et al., 2015; McDermott & Rushford, 2011; Olstad et al., 2015; Palomba et al., 2017; Sapuppo et al., 2018; Sternheim et al., 2015; Vann et al., 2014), few studies were in Bulimia Nervosa (BN) samples (Olstad et al., 2015; Sapuppo et al., 2018; Vann et al., 2014) and Eating Disorder Not Otherwise Specified (EDNOS) (Olstad et al., 2015; Vann et al., 2014) while no studies evaluated Binge Eating Disorder (BED).

Metacognitive beliefs were assessed by the Metacognitions Questionnaire (MCQ, Cartwright-Hatton & Wells, 1997; MCQ-30, Wells & Cartwright-Hatton, 2004) which assesses metacognitive beliefs through five factors: (i) positive beliefs about worry (beliefs that perseverative thinking is useful); (ii) negative beliefs about worry (beliefs that thoughts are uncontrollable and dangerous); (iii) cognitive confidence (beliefs in one’s own attention and memory); (iv) beliefs about the need to control thoughts; and (v) cognitive self-consciousness (beliefs about the tendency to self-focus attention and monitor thoughts). Higher scores indicate higher levels of maladaptive metacognitive beliefs. Only one study (Sternheim et al., 2015) considered metacognitive beliefs as whole using the MCQ total score whilst all other studies evaluated the different types of metacognitive beliefs.

*Studies in clinical samples*

Two studies (Olstad et al., 2015; Sapuppo et al., 2018) (see Table 3) comparing patients with eating disorders and healthy controls from the general population found higher levels of metacognitive beliefs in patients than controls. In particular, both positive and negative beliefs about worry, as well as cognitive self-consciousness, appeared to be significantly higher in the clinical sample while no significant differences were found on cognitive confidence (Sapuppo et al., 2018). Moreover, patients with eating disorders reported significantly higher scores on positive beliefs about worry, negative beliefs about worry, and on the total MCQ-30 score compared to patients with eating and psychiatric problems as well as those with only psychiatric problems (Olstad et al., 2015).

Five studies compared eating disorder diagnoses and general population on metacognitive beliefs (Cooper et al., 2007; Davenport et al., 2015; McDermott & Rushford, 2011; Palomba et al., 2017; Sternheim et al., 2015) (see Table 3). One study (McDermott & Rushford, 2011) found significantly higher levels on all metacognitive beliefs in patients with AN when compared to the general population Differences, except for positive beliefs about worry, remained significant after controlling for BMI. Similarly, another study (Cooper et al., 2007) showed that AN patients had significantly higher scores on negative beliefs about worry, cognitive confidence, beliefs about the need to control thoughts, and cognitive self-consciousness, but not on positive beliefs about worry, than dieting and non-dieting participants form the general population. Moreover, dieting and non-dieting groups did not differ on MCQ-30 subscales (Cooper et al., 2007). Another study (Palomba et al., 2017) found significantly higher levels only on negative beliefs about worry and beliefs about the need to control thoughts in patients with AN compared to healthy controls. Moreover, in a study by Sternheim and colleagues (2015) patients with AN reported significant higher scoring on the MCQ-total compared to healthy controls. In another study (Davenport et al., 2015) metacognitive beliefs did not significantly differ between typical and atypical AN groups, while patients had significantly higher levels of metacognitive beliefs than community participants. In the same study (Davenport et al., 2015) beliefs about the need to control thoughts were related with the duration of the disorder in typical AN patients. Finally, drive for thinness was significantly predicted by positive beliefs about worry and beliefs about the need to control thoughts in typical AN patients, by negative beliefs about worry and, inversely, cognitive self-consciousness in atypical AN patients, and by cognitive self-consciousness in the community control group (Davenport et al., 2015).

Three studies (Olstadt et al., 2015; Sapuppo et al., 2018; Vann et al., 2014) (see Table 3) comparing eating disorder diagnoses each other on metacognitive beliefs showed that: AN patients had significantly higher levels of negative beliefs about worry than bulimic patients (Sapuppo et al., 2018); BN patients had significantly higher levels of positive beliefs about worry than EDNOS patients (Olstadt et al., 2015); and AN patients had significantly higher levels on positive beliefs about worry and cognitive confidence compared to both BN and EDNOS patients (Vann et al., 2014).

*Studies in general population*

One study (Konstantellou & Reynolds, 2010) (see Table 4) found significantly higher levels of positive beliefs about worry, negative beliefs about worry, and beliefs about the need to control thoughts (as well as total metacognitive beliefs scores) in participants with problematic eating attitudes compared to those with normal eating attitudes. Another study (Quattropani et al., 2016) (Table 2) did not find a significant association between drive for thinness, bulimia, body dissatisfaction and metacognitive beliefs as well as between eating disorder risk and metacognitive beliefs. On the other hand, the authors (Quattropani et al., 2016) reported a significant correlation among MCQ-30 subscales and several EDI-III subscales; in particular, all but one scales of MCQ-30 were associated with EDI-III General Psychological Maladjustment. Moreover, another piece of research (Laghi et al., 2018) (see Table 2) found a significant positive correlation between binge eating and all metacognitive beliefs except for the cognitive self-consciousness.

1. **Discussion**

The present systematic review highlights the positive association between metacognitive beliefs and the spectrum of eating disorders and problems. The results showed that both people with eating disorders and people with problematic eating behaviors hold in dysfunctional metacognitive beliefs.

Some studies explored the presence of metacognitive beliefs in eating disorders comparing patients to the general population. In more detail, the reviewed studies showed that AN patients generally present with higher levels of negative beliefs about worry compared to healthy controls and the general population in four out five studies (Cooper et al., 2007; Davenport et al., 2015; McDermott & Rushford, 2011; Palomba et al., 2017). Beliefs about the need to control thoughts, cognitive confidence, and cognitive self-consciousness were also found to be higher in three out five studies (Cooper et al., 2007; Davenport et al., 2015; McDermott & Rushford, 2011); only two studies found higher positive beliefs about worry in AN patients when compared to the general population (Davenport et al., 2015; McDermott & Rushford, 2011). The differences between AN patients and general population on the metacognitive beliefs identified may indicate that AN patients, relative to the general population, are more likely to be engaging in maladaptive attempts to control cognitive-affective states as well as have heightened self-focused attention. This appears to be in line with the S-REF model proposed by Wells (2000) and with other findings in associated areas, such as addictive behaviors, where negative beliefs about worry, beliefs about the need to control thoughts and cognitive confidence have been observed to differentiate severity of presentations (e.g., Spada et al., 2015; Hamonniere & Varescon, 2018). Other studies have evaluated metacognitive beliefs comparing eating disorder diagnoses. In more detail, positive beliefs about worry were found to be higher in bulimic patients than in patients with EDNOS in one out three studies (Olstadt et al., 2015) and in AN patients compared to those with BN or EDNOS (Vann et al., 2014). Only one out three studies reported higher negative beliefs about worry in AN than BN (Sapuppo et al., 2018). One out three studies (Vann et al., 2014) found lower levels of cognitive confidence in AN than BN and EDNOS. No differences among diagnoses were found on both beliefs about the need for control thoughts and cognitive self-consciousness. Finally, some studies explored metacognitive beliefs in the general population finding that, except for cognitive self-consciousness, all dysfunctional metacognitive beliefs are present (Konstantellou & Reynolds, 2010; Laghi et al., 2018; Quattropani et al., 2016).

Taken together these results confirm the notion that metacognitive beliefs could be implicated in eating disorders and eating behaviors. Our results are consistent with a previous study (Sun et al., 2017) which pointed out that, as in other psychopathological presentations, negative beliefs about worry, beliefs about the need to control thoughts, cognitive confidence and cognitive self-consciousness are most strongly associated with eating disorders (Hamonniere & Varescon, 2018; Rogier et al., 2020; Palmieri et al., 2020; Spada et al., 2012; Wells & Matthews, 1994, 1996). On the other hand, we also found that patients differ among each other on positive and negative beliefs about worry as well as in levels of cognitive confidence. It would appear AN patients score higher on the combination of positive and negative beliefs about worry compared to BN patients. The combined presence of these two dimensions of metacognitive beliefs tends to indicate that perseverative thinking (e.g., worry and rumination) has escalated to pathological levels. In other words, tackling worry and rumination in AN may be crucial in overcoming this eating disorder (Sassaroli, et al., 2005; Sternheim et al., 2012). Low cognitive confidence in both AN than BN compared to EDNOS may indicate that difficulties in problem-solving/decision-making (which have been found to be associated with low cognitive confidence) play a role in these two eating disorders. Focusing on potentiating cognitive confidence, therefore, may be helpful for both AN and BN patients. The lack of a differences among patients on beliefs about the need to control thoughts and on cognitive self-consciousness (i.e., monitoring of thinking processes) might suggest a transdiagnostic nature of these processes.

The present review highlights several limitations. Firstly, all studies are cross-sectional preventing concluding, with confidence, about the nature of the relationship between metacognitive beliefs and eating disorders spectrum; hence longitudinal or experimental studies are needed to confirm the findings reviewed. Secondly, the instruments used in the reviewed searches to assess eating disorders are not homogeneous. Thirdly, sample sizes were frequently small and composed, predominantly, by female participants. Finally, the reviewed studies are mainly focused on AN; indeed, no studies compared BN or BED with the general population on possible difference in metacognitive beliefs. Therefore, the generalizability of the results is limited suggesting the need for further studies comparing the aforementioned diagnostic categories with the general population on metacognitive beliefs.

Despite these limitations, our findings support the clear role of metacognitive beliefs in the spectrum of eating disorders and eating behaviors suggesting the possible benefits of employing the techniques and principles of Metacognitive Therapy (Wells, 2011) in order to support individuals in discontinuing dysfunctional eating behaviors. As put forward in standard MCT protocols, Socratic metacognitive interventions could be used to re-appraise metacognitive beliefs (Wells 2011) while attention training and detached mindfulness could be used to try to interrupt maladaptive eating patterns (Wells 2013).

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**Table 1. Quality Assessment for Case-control Studies using the Newcastle-Ottawa Scale**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Selection** | **Comparability** | **Exposure** |  |
| **Study** | **Adequate case definition** | **Representativeness of the cases** | **Selection of controls** | **Definition of controls** | **Based on the study design and analysis** | **Ascertainment of exposure** | **Same method of ascertainment for cases and controls** | **Non-response rate** | **Total score****(9)** |
| Cooper et al., 2007 |  |  | + | + |  |  | **+** | + | 4/9 |
| McDermott & Rushford, 2011 | + | + | + | + | + |  | + |  | 6/9 |
| Vann et al, 2014 | + |  |  |  |  |  | + | + | 3/9 |
| Olstad et al., 2015 |  | + | + | + |  |  | + | + | 5/9 |
| Sternheim et al., 2015 | + |  | + | + |  |  |  | + | 4/9 |
| Davenport et al., 2015 |  | + | + | + |  |  | + | + | 5/9 |
| Palomba et al., 2017 | + | + | + | + |  |  |  | + | 5/9 |
| Sapuppo et al., 2018 |  | + | + | + |  |  |  | + | 4/9 |

**Table 2. Quality Assessment for Cross sectional Studies using the Newcastle-Ottawa Scale**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Selection** | **Comparability** | **Outcome** | **Total score****(10)** |
| **Study** | **Representativeness of the sample** | **Sample size** | **Non-respondents****(satisfactory response rate is)** | **Ascertainment of the exposure** | **Based on the study design and analysis** | **Assessment of the outcome** | **Statistical test** |
| **Validated measurement tool** | **Non-validated tool but it is described** | **Independent blind assessment** | **Record linkage** | **Self- report** |
| Konstantellou & Reynolds, 2010  | + | + |  | ++ |  |  |  |  | + | + | 6/10 |
| Quattropani et al., 2016 | + | + | + | ++ |  |  |  |  | + | + | 7/10 |
| Laghi et al., 2018 | + | + | + | ++ |  | + |  |  | + | + | 8/10 |

**Table 3. Studies in Clinical Samples**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study** | **Design** | **Sample size** | **Population** | **Measures** | **Findings** |
| Cooper et al., 2007 | Cross-sectional | AN n=16Controls: Dieters n=15Non-dieters n=17 | AN: mean age 29.6 years, SD=11.4 yearsDieters: mean age 34 years, SD=12.8 yearsNon-dieters: mean age 26.2 years, SD=9.5 yearsFemale: 100% | DSM-IV criteria MCQ-30 | AN patients had significantly higher scores on negative beliefs about worry, cognitive confidence, beliefs about the need to control thoughts, and cognitive self-consciousness than dieters and non-dieters participants. No significant differences on positive beliefs about worry were observed. No significant differences between dieting and non-dieting control groups on metacognitive beliefs subscales were observed.  |
| McDermott & Rushford, 2011 | Cross-sectional | AN n=74General population n=93 | AN: mean age 24.3 years, SD=6.5 yearsGeneral population: mean age 27.3 years, SD=7.1 yearsFemale 100% | DSM-IV-TR criteriaMCQ-30 | AN patients had significantly higher scores on all metacognitive subscales compared to the general population. Effect sizes indicated a moderate difference on positive belief about worry (η2=0.6), cognitive self-consciousness (η2=0.12) and cognitive confidence (η2=0.12), and large differences on beliefs about the need to control thoughts (η2=0.30) and negative beliefs about worry (η2=0.35). Except for positive beliefs about worry, differences were significant after controlling for BMI.  |
| Vann et al, 2014 | Cross-sectional | AN n=9BN n=9EDNOS n=9 | Age range 18-55 years; Mean age 26.3 years, SD=8.1 yearsFemale: 100% | DSM-IV-TR criteriaMINI 6.0 MCQ-30 | AN patients reported significantly higher scores on positive beliefs about worry and cognitive confidence that BN and EDNOS patients. |
| Olstad et al., 2015 | Cross-sectional | Clinical sample n=53 (AN=17, BN=14, EDNOS=22)Control groupsEating and psychiatric problems n=47Other psychiatric problems n=37Healthy controls n=66 | Clinical sample: Mean age 28.4 years, SD=9.3 yearsFemale: 100% | Self-reported type of EDsEDE-Q 6.0MCQ-30 | EDs sample had significantly higher scores on the MCQ-30 than healthy controls, participant with self-reported history of eating and psychiatric problems, or other psychiatric problems. EDs sample had significantly higher means on all MCQ-30 subscales than healthy controls.In the clinical sample, the global EDE-Q score significantly correlated with MCQ-30 total score and all MCQ-30 subscales. Effect sizes indicated medium to large differences (r range: 0.31-0.71). BN patients had significantly higher scores on positive beliefs about worry than the EDNOS group.  |
| Sternheim et al., 2015 | Cross-sectional | AN n=36Healthy controls n=38 | AN: mean age 25.8 years, SD=7.9 yearsHealthy controls: mean age 27.4 years, SD=10.3 years Female: 100% | DSM-IV criteriaEDE-QMCQ-30 | AN patients had significantly higher scores on MCQ-total than healthy controls. Effect size indicated a large difference (Cohen's *d*=2.8).  |
| Davenport et al., 2015 | Cross-sectional | Clinical samples:AN-t n=75AN-at n=44General population n=100  | AN-t: mean age 24.5 years, SD =6.9 yearsAN-at: mean age 25.4 years, SD=6.9 yearsGeneral population: mean age 25.7 years, SD=7.1 yearsFemale: 100% | EDI-3 (DT subscale) MCQ-30 | No significant differences in MCQ-30 between typical and atypical AN groups but not between clinical and non-clinical samples. Effect sizes indicated medium to large differences (η2 range: 0.06-0.60).Beliefs about the need to control thoughts was significantly related with the duration of the disorder in typical anorexic patients. Positive beliefs about worry and beliefs about the need to control thoughts significantly predicted drive for thinness in AN-t (R2=0.21 indicating a large effect size); negative beliefs about worry and, inversely, cognitive self-consciousness significantly predicted drive for thinness in AN-at (R2=0.29 indicating a large effect size); cognitive self-consciousness significantly predicted drive for thinness in general population (R2=0.069 indicating a medium effect size). |
| Palomba et al., 2017 | Cross-sectional | AN n=13Healthy controls n=13 | AN: mean age 22.3 years, SD=7.7 yearsHealthy controls: mean age 23.9 years, SD=3.4 years | DSM-IV criteriaSCID-IEDI-2EAT-40MCQ | Negative beliefs about the uncontrollability of thoughts and corresponding danger, and negative beliefs about thoughts in general were significantly higher in the AN group than healthy controls. No significant differences on the others metacognitive beliefs subscales.  |
| Sapuppo et al., 2018 | Cross-sectional | AN n=36BN n=48Healthy controls n=38 | Clinical sample: mean age 23.4 years, SD=4.8 yearsHealthy controls: mean age 25.3 years, SD=5.4 years Female: 100% | SCID-IMCQ | Positive and negative beliefs about worry, and cognitive self-consciousness were significantly higher in EDs patients than controls. Negative beliefs about worry were significantly higher in AN than BN patients. No significant differences on cognitive competence. |

Note: AN: Anorexia Nervosa; SD: Standard Deviation; DSM: Diagnostic and Statistical Manual of Mental Disorders; MCQ-30: Metacognitions Questionnaire 30; MCQ: Metacognitions Questionnaire; BMI: Body Mass Index; BN: Bulimia Nervosa; EDNOS: Eating Disorders Not Otherwise Specified; EDE-Q: Eating Disorder Examination Questionnaire; AN-t: Anorexia Nervosa typical; AN-at: Anorexia Nervosa atypical; EDI-2: Eating Disorder Inventory 2; EDI-3: Eating Disorders Inventory-3; DT: Drive for Thinness; SCID-I: Structured Clinical Interview for DSM IV; EAT-40: Eating Attitude Test.

**Table 4. Studies in the General Population**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study** | **Design** | **Sample size** | **Population** | **Measures** | **Main findings** |
| Konstantellou & Reynolds, 2010 | Cross-sectional | University students n=116 | Mean age 22.6 years, SD=4.7 yearsFemale: 80%  | EAT-26MCQ-30 | Significantly higher levels of positive beliefs about worry, negative beliefs about worry, beliefs about the need to control thoughts and on the total score of MCQ-30 in participants with problematic eating attitudes than those with normal eating attitudes. Effect sizes indicated large effects (η2 range: 0.15-0.27).  |
| Quattropani et al., 2016 | Cross-sectional | n=44 | Mean age 42.8 years, SD=4.6 yearsFemale: 82% | EDI-3 MCQ-30 | No significant association between DT, B, BD and the MCQ-30 scales. Significant correlation between:- EDI “General Psychological Maladjustment” and total score of MCQ-30, negative beliefs about worry, and beliefs about the need to control thoughts. Effect sizes indicated large effects (r range: 0.53-0.70).- EDI “Overcontrol” and MCQ total score, beliefs about the need to control thoughts. Effect sizes indicated large effects (r range: 0.50-0.60).- EDI “Asceticism” and negative beliefs about worry, and beliefs about the need to control thoughts. Effect sizes indicated large effects (r range: 0.51-0.55).- EDI “Affective problem” and MCQ total score. Specifically, “Emotional Dysregulation” correlated with negative beliefs about worry, and cognitive confidence. The “Interoceptive Deficits” subscale correlated with negative beliefs worry and with beliefs about the need to control thoughts. Effect sizes indicated medium to large effects (r range: 0.47-0.59). - “Interpersonal Problems” and the “Maturity Fears” correlated with MCQ total score. Effect size indicated a medium effect (r=0.39).- “Ineffectiveness” and negative beliefs about worry; in particular negative beliefs about worry correlated with “Personal Alienation” and “Low Self Esteem”. Effect sizes indicated medium to large effects (r range: 0.46-0.57)There was not a significant correlation between “Eating Disorder Risk” and MCQ-30 sub-scales.  |
| Laghi et al., 2018 | Cross-sectional | Adolescent from general populationn=804 | Mean age 17.5 years, SD=1.0 yearFemale: 49.7%  | BES MCQ-30 | A significant positive correlation between binge eating and all metacognitive beliefs except for the cognitive self-consciousness. Effect sizes indicated small to medium effects (r range: 0.12-0.32) Binge eating was significantly predicted by cognitive confidence and beliefs about the need to control thoughts. |

Note: SD: Standard Deviation; EAT-26: Eating Attitude Test; EDI-3: Eating Disorders Inventory-3; DT: Drive for Thinness; B: Bulimia; BD: Body Dissatisfaction; BES: Binge Eating Scale; MCQ-30: Metacognitions Questionnaire 30.

**Appendix: Search strategy**

Limits: English, Humans

(eating disorders) AND (metacognition)

(eating disorders) AND (metacognitive beliefs)

(anorexia) AND (metacognition)

(anorexia) AND (metacognitive beliefs)

(bulimia) AND (metacognition)

(bulimia) AND (metacognitive beliefs)

(binge eating disorder) AND (metacognition)

(binge eating disorder) AND (metacognitive beliefs)

(binge eating) AND (metacognition)

(binge eating) AND (metacognitive beliefs)

**Figure 1. Identification of studies selection**

Title/abstracts from

from manual search

(n=1)

Title/abstracts from

PubMed, PsycINFO

(n=117)

**Identification**

**Included**

**Eligibility**

**Screening**

Abstracts/papers after duplicates removed

 (n=75)

Abstracts/papers screened

(n=75)

Full-text papers assessed for eligibility

(n=21)

Studies included in qualitative synthesis

(n=11)

Records excluded (n=54)

- not appropriate for our research question

Full-text papers excluded

 (n=10)

- no match the inclusion criteria