A Set of Meta-Analytic Studies on the Factors Associated with Disordered Eating
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Citation

Abstract

Objective: To consolidate knowledge from research on associates of disordered eating to guide future research efforts, asking “which factors are associated with the presence of disturbed eating/ anorexia/ bulimia?”

Method: We reviewed 232 studies, comprising 87,878 participants, through 74 individual meta-analyses under 12 associative factor category headings.

Results: Race had no association (r = .02), whilst anxiety (r = .47) and depression (r = .39) were modestly associated with disordered eating. Women with eating disorders were more likely than controls to have experienced abuse (r = .19), personality disorders (r = .26), an increased tendency to self-harm (r = .37), various personality traits such as perfectionism (r = .30) and hostility (r = .40), and engage in more exercise (r = .13). A higher incidence of stressful life events were reported by women with bulimia (r = .23) but not by women with other eating disorders.

Conclusions: Although disturbed eating, anorexia and bulimia show similar associations with various factors, they also show some disorder-specific relationships, highlighting overlapping and unique aspects of the disorders. Suggestions to benefit further research are proposed based on these differences.

The work was conducted at the Department of Psychology, University of Bath, UK

INTRODUCTION

In the quest to understand the causes and development of eating disorders, many risk factors and associates have been proposed and investigated, and the research corpus has become incredibly large. A small proportion of this research has been longitudinal/prospective in design and so has firmly established certain factors (e.g., perfectionism, as contributory causes of eating disorders). These longitudinal studies have recently been subjected to a comprehensive meta-analysis (1) which provided perspective on current knowledge about eating disorder causal factors. A limitation to this meta-analysis, however, was the exclusion of studies with correlational and retrospective data. These data still have the potential to inform the field if treated appropriately. Specifically, although research on associates cannot reliably establish causes and effects, it can still inform us about factors associated with eating behaviours, and so remains of value to the researcher interested in eating disorders, especially given the large number of participants who have taken part in this research.

To dismiss these studies because their methodology does not allow conclusive statements about the aetiology of eating disorders, is premature and unnecessary. However, at the same time we feel a point has been reached where correlational research is in such abundance that there is a need to consolidate it to reveal the state of our knowledge about associates of eating disorders as a way of guiding future research efforts. This is particularly pressing given that the meta-analysis by Stice (1) did not cover a range of potential associate factors suggesting they have not yet been investigated via longitudinal methods (e.g., autonomy, exercise, and obsessive compulsive disorder (OCD)). Factors that seem most promising from this objective integration of the literature might then be studied using other and more powerful methods to investigate more accurately the issue of cause and effect.

METHOD

There are various ways to synthesize the data provided by reviewing a body of literature, and perhaps the most heralded is to use meta-analytic methods. To provide the broadest possible review of how eating behaviours and attitudes are related to the various associate factors under
investigation, the primary research question was “which factors are associated with the presence of disturbed eating (defined as any disturbance, clinical or sub-clinical, measured with a clinical diagnosis or, in non-clinical populations, with a scale such as the Eating Disorder Inventory)?” Secondary research questions focused the review on more specific diagnoses: “which factors are associated with anorexia nervosa?” and “which factors are associated with bulimia nervosa?” where studies were only included if participants had received a clinical diagnosis. We maintained this classic diagnostic line of distinguishing between anorexia nervosa and bulimia nervosa as there is little data, especially from the older studies, on factors associated with the sub-types of these disorders, or the presence of specific behaviours such as purging.

Several a priori decisions were made regarding the type of data and studies that would be included in the review. First, since so many measures of eating disorders have been employed in the research, it was decided that data collected from a wide range of measures would be used in the meta-analysis to gain the broadest picture of which aspects may be associated with disordered eating. For example, indices of weight concern, eating psychopathology, body image distortion, and body dissatisfaction, were considered eligible outcome measures, as well as popular instruments like the Eating Disorders Inventory (EDI (1)) and the Eating Attitudes Test (EAT (3)). Second, it was decided to only use studies written in English, published between 1987 and 2003 (there is a marked drop in the number of published studies before 1987, showing that it was the beginning of the rapid growth of eating disorder research) and that were non-longitudinal in nature (i.e., correlational, case-control, cross-sectional). Third, only data from female participants aged 13 or over were included. Finally, studies were only included if they contained at least one of the following comparisons: (a) levels of assessed factors in an eating-disordered group and a non-eating-disordered group; (b) a group with a putative associate factor compared to a group without that factor, assessing eating disorder prevalence in each group; and (c) correlations between measures of disordered eating and the putative associate factor. Excluded comparisons were: (a) an eating-disordered group compared to another eating-disordered group (e.g., a bulimic group with the putative associate factor compared to a bulimic group without it); and (b) correlations within an all-eating-disordered group. Such comparisons were inappropriate for this review as they did not allow us to assess the extent to which a factor is associated with the prevalence of disordered eating. All studies relating to eating disorder prevention, treatment, or measurement development were excluded, as were any studies that did not report statistics suitable for meta-analysis.

SEARCH STRATEGY

Articles that met the inclusion criteria outlined above were identified as follows: 1) a computer search of PsycINFO, BIDS, Ingenta, ScienceDirect (medicine, psychology, and social science categories), and Web of Science electronic publication databases was conducted for the relevant years, using the search terms “eating disorders” “anorexia nervosa”, “bulimia nervosa” “risk factors” and where appropriate excluding “prospective” and “longitudinal” with the resultant studies assessed for relevance by the researcher and categorised under 12 headings (e.g., “abuse”, “exercise”, and “race”); 2) each category of factor was then subjected to a further search utilising category-specific search terms (e.g., search terms relating to the abuse category included “abuse”, “sex abuse”, “physical abuse”, “emotional abuse”, and “childhood sexual abuse”); 3) the References sections of all the articles were examined; 4) all articles in the authors’ possession were checked for relevance and their References sections also examined; 5) in attempting to locate articles, papers were requested from authors, which often led them to send other articles that they had written.

Of the several thousand articles retrieved through this strategy, 700 were deemed appropriate for further scrutiny, of which 232 were included in the review. This demonstrates just how large the field of eating disorder research has become, and in particular, how much correlational data has been generated. We feel this amply justifies this review, as synthesizing this large body of research is likely the most appropriate way to derive concrete conclusions from such a vast volume of data.

PROCEDURE

Data were extracted by the principal author (EV), in line with the coding sheet developed for this review. In the event of uncertainty regarding the data, the second author independently extracted the data and results were compared. Any inconsistencies were discussed until an agreement was reached. As long as the data met the criteria outlined above, the study was included.

The meta-analyses were conducted using Schwarzer’s (4) freely available software Meta, which utilises the procedures of Hunter, Schmidt and Jackson (5) and Hedges and Olkin (4).
All analyses used a random-effects model with effect sizes weighted for sample size and corrected with Fisher’s z-transformation \((z)\). The analyses all followed a similar format. Each began with an analysis investigating whether the category in question (e.g., substance use) was related to a general eating disturbance, by including all measures of substance use and all levels of eating disturbance (specific and general forms, sub-clinical, and non-clinical). In calculating the overall relationship, three tests of effect-size homogeneity were conducted: residual standard deviation is smaller than a quarter of the sampling error variance \((\text{Sp, SD}<\frac{1}{4})\), observed variance is accounted for by at least 75% of the sampling error \((\text{Se})\), and a non-significant chi-square for systematic variation. If the results of at least two of these tests showed that the effect sizes were homogeneous then the overall meta-analysis effect size could simply be interpreted as a measure of association. However, when the effect sizes showed heterogeneity, an inductive moderator search \((z)\) was conducted to search for study characteristics that could explain the variance in effect sizes. This involved a hierarchical cluster analysis to identify clusters of studies with similar effect sizes, then, using the coding sheet, identifying various study features to explain cluster membership. Additionally we distinguish between mixed heterogeneity and varied heterogeneity. The former is when the effect sizes differ in direction as well as magnitude and so show fundamental disagreement in the literature, whilst the latter agree on the direction of the association and differ only in magnitude.

When the data allowed, further analyses were conducted to look at the relationships between each associate factor and the two clinical forms of eating disorder, anorexia nervosa (AN) and bulimia nervosa (BN). In some cases it was also appropriate to sub-divide the overall factor – for example, in the substance use analysis, separate analyses for the different types of substance use were conducted, first with general eating disturbance, and then with anorexia and bulimia where possible, providing a more detailed picture of any associations.

**EFFECT SIZES**

As the emphasis of this paper is the co-occurrence of associate factors and eating disorders, \(r\), with its connotations of association, is the natural choice of effect size measure. It also has the advantage that it is by far the most widely understood measure of effect size \((\rho)\), and can be readily converted to other effect-size measures such as \(d\). Cohen’s \((10)\) rough guide to what constitute small, medium and large effect sizes for \(r\) \((r > 0.10, r > 0.30\) and \(r > 0.50\)

respectively) are applied throughout the analyses to provide a loose, but useful scale of magnitude to guide interpretation.

**RESULTS**

For each meta-analysis, number of studies \((k)\) and number of participants \((N)\) are reported alongside the effect size, and its corresponding \(z\) and \(p\) measures to assess statistical significance. For each of the meta-analyses the “fail-safe N” statistic, \(N_{fs}\), is also reported to address the “file drawer problem” \((11)\), in which it is assumed that owing to submission and publication biases, for every published study showing a relationship between two variables, there is an unknown number of unpublished studies showing no relationship between the same two variables. Usually, the value of \(N_{fs}\) reported in a meta-analysis is the number of unpublished studies that would need to exist to turn a significant effect size into a non-significant one. Here we take a more conservative approach and present instead \(N_{fs.10}\), which is the number of unpublished studies that would have to exist to reduce the obtained effect size to an effect size of \(r = .10\), which, is the smallest effect size generally held to be of interest. We interpreted \(N_{fs.10}\) such that if \(N_{fs.10}\) for a given significant effect was equal to or higher than \(k\), the result was assumed almost certainly to indicate a robust effect, if \(N_{fs.10}\) was less than \(k\) then the result was classed as not robust. This rule-of-thumb was chosen as it was unlikely that the same number of studies again for any given analysis existed due to the comprehensive literature search. This approach was used rather than using funnel plots as it provides an actual value (rather than a visual display) that can easily be compared across studies as to whether the effect found is robust or not in terms of the effect of potential unpublished studies.

Due to the retrospective nature of the factors in this series of meta-analyses, we have been carefully neutral about using the term “associate factors” rather than “risk factors”. Although it is the assumption of much work to date that many of the factors are probably causes of the eating disorders, many of these risk factors are also plausibly consequences of the eating disorder rather than antecedents. With this meta-analysis providing clear evidence of which factors have definite relationships with eating disorders, it is for future research to further explore which are causes and which are consequences of the eating problems.

The meta-statistics for each analysis can be found in Table 1 below, whereas the details of the studies included in the
A Set of Meta-Analytic Studies on the Factors Associated with Disordered Eating

analysis can be found in Appendix 1.

Figure 1
Table 1: Statistical information for the series of meta-analyses.

<table>
<thead>
<tr>
<th>Disordered eating</th>
<th>A</th>
<th>N</th>
<th>r</th>
<th>SE</th>
<th>z</th>
<th>p</th>
<th>Sig.</th>
<th>B</th>
<th>Std. Err.</th>
<th>Sig.</th>
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<td>No</td>
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<td>9.50</td>
<td>0.000</td>
</tr>
<tr>
<td>- Gender</td>
<td>6</td>
<td>634</td>
<td>24</td>
<td>75</td>
<td>8.53</td>
<td>Yes</td>
<td>100</td>
<td>No</td>
<td>0.000</td>
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</tr>
<tr>
<td>Social anxiety</td>
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<td>2128</td>
<td>9.12</td>
<td>14</td>
<td>Yes</td>
<td>89.27</td>
<td>No</td>
<td>0.000</td>
<td>9.50</td>
<td>0.000</td>
</tr>
<tr>
<td>Physical abuse</td>
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<td>837</td>
<td>12</td>
<td>3.58</td>
<td>1</td>
<td>Yes</td>
<td>91.86</td>
<td>No</td>
<td>0.000</td>
<td>9.50</td>
</tr>
<tr>
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<td>0.6</td>
<td>No</td>
<td>12.4</td>
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<td>0.000</td>
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<td>3</td>
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<td>35.76</td>
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<td>39.34</td>
<td>Yes</td>
<td>0.000</td>
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<td>5.8</td>
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<td>12</td>
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<td>No</td>
<td>100</td>
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<td>11.32</td>
<td>30</td>
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<td>Yes</td>
<td>0.000</td>
<td>9.50</td>
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<td>Meta influence</td>
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<td>30</td>
<td>No</td>
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<td>0.000</td>
<td>9.50</td>
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<tr>
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<td>68</td>
<td>11.32</td>
<td>30</td>
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<td>61.84</td>
<td>Yes</td>
<td>0.000</td>
<td>9.50</td>
</tr>
</tbody>
</table>

**Note:**
- A: number of studies.
- N: number of participants.
- r: correlation coefficient.
- SE: standard error.
- z: z-score.
- p: p-value.
- Sig.: significance.
- B: beta-weight.
- Std. Err.: standard error of beta-weight.
- - Gender: gender differences.

2. Observed variance accounted for by at least 75% of the sampling error (2%) demonstrates homogeneity.

3. A non-significant chi-square test for cross-tabulation analysis demonstrates homogeneity.
ABUSE
Based on our analysis, women who have suffered abuse are more likely to display eating disturbances. Abuse, in general, was related to eating disturbance with a small effect size ($r = .19$), as was sexual abuse ($r = .20$). While physical abuse was associated with eating disturbance ($r = .12$), the result was not robust in terms of the fail safe N. More research would remedy this issue and would also determine whether the mechanisms and links to eating disturbance for physical abuse differ from those of sexual abuse. A disorder-specific analysis demonstrated a small-medium association ($r = .26$) between BN and general abuse.

SEXUALITY
While there was a small association ($r = .10$) between sexuality and disturbed eating, the result was not robust in terms of the fail safe N value and showed mixed effect sizes. The inductive moderator search showed that culture and age may explain the variance in effect sizes. However, due to the unstable meta-analytical result, the evidence on the relationship between sexuality and eating disturbance is inconclusive, and further work is needed to explore the potential moderators further.

SELF-HARM
Based on our analyses, women with disturbed eating behaviour exhibited a higher level of self-harm behaviours than do non-eating disturbed women. To highlight, disturbed eating showed a modest relationship ($r = .37$) with self-harm behaviours. Although effect sizes were all positive, variation was seen between them, which may be a result of the assessment measures used: the first cluster of studies ($k = 2$, weighted mean $r = .32$), used self-harm-specific assessment measures, whereas a unique study ($r = .61$) used only selected sub-scales from a personality assessment measure.

RELATIONSHIP WITH PRIMARY CARE GIVER
Two main concepts were combined and investigated, both assessing the quality of the fundamental relationship with the primary caregiver: attachment style and perceived parental bonding. The overall analysis found a moderate association ($r = .30$) between general eating disturbance and poor caregiver relationship, but the effect sizes varied. Analyses of AN and BN both demonstrated that eating-disordered women reported more maladaptive relationships with their caregivers ($r = .26$, $r = .40$ respectively). However, both analyses again showed heterogeneity in effect sizes; the moderator search revealed no meaningful suggestions in the AN analysis, while in the BN analysis, much larger effect sizes were found in the cluster containing the most recent studies (mean publication year of 2001, mean weighted $r = .54$, versus 1992, mean weighted $r = .23$). This finding may reflect either a true higher level of dysfunction, or changes in reporting behaviour. Overall, these analyses indicate that women displaying eating disordered behaviours, especially the clinical variants of AN and BN, are more likely than control women to report dysfunctional relationships with their caregivers.

FAMILY ENVIRONMENT
Analyses of family environment were mixed in result, but overall indicate that women displaying disordered eating, especially AN and BN, report more family dysfunction than control groups. There was a small association ($r = .13$) between eating disturbance and family environment, but this was not robust and mixed effect sizes were seen. A cluster analysis indicated that this mixed effect may be explained by age: the Waller et al. study found a unique negative effect (N = 78, $r = – .24$, mean age 26) using a sample that was significantly older than in the other studies (N = 26, $r = .19$, mean age 20). However, we recommend further research on the influences of participant age on this factor. Specific analyses for AN and BN found small effects of family environment ($r = .09$, $r = .20$ respectively). Although the BN analysis was robust and the effect sizes were all similar, the AN analysis was non-robust with mixed effect sizes. Again age was identified as a probable moderator, with removal of the Waller et al's older sample strengthening the association.

STRESS
Stress was not associated with disturbed eating ($r = .03$), albeit with heterogeneous effect sizes. Exploration of this heterogeneity showed that negative effect sizes were found in studies using only non-clinical samples and no association was found in studies simply assessing number of life events as opposed to the perceived severity of the stress. A disorder-specific analysis found a small association between BN and stress, but again with varied heterogeneity in the effect sizes.

IRRATIONAL COGNITIONS
An overall analysis found an association ($r = .40$) between general eating disturbance and irrational cognitions (a commonly used term to encompass negative self-beliefs/core beliefs or dysfunctional cognitions and underlying assumptions regarding eating, weight and body shape seen in people with eating disorders). Effect sizes ranged from a
trivial $r = .05$ ($14$) to an impressive $r = .89$ ($15$), with 14 out of the 17 studies reporting an effect size of $.28$ or greater. Exploration of the heterogeneity found that studies using eating-specific measures of irrational cognitions found the strongest associations. A stratification analysis based on measurement scale was conducted to explore this further. Although all the eating-specific measures (Dysfunctional Attitudes Scale [DAS]; Irrational Beliefs Scale [IBS]; Young's Schema Questionnaire [YSQ]; Eating Disorder Belief Questionnaire [EDBQ]) found associations between irrational cognitions and disturbed eating, only the DAS resulted in homogeneous effect sizes. Although the DAS's conceptualisation of dysfunctional attitudes may differ from that of the beliefs assessed in the other three measures, our finding does imply that measurement scale was not solely responsible for the initial effect size heterogeneity. The analyses for the specific eating disorders of AN and BN produced results both similar to each other and to the overall analysis ($r = .62$, $r = .61$ respectively) with varied effect sizes which were not readily explicable.

Overall, the analyses demonstrated that women with disturbed eating, and AN and BN specifically, show higher levels of irrational cognitions than do women with no eating problems, although there is substantial variance in the strength of this finding. When cognitions are assessed by the DAS, the relationship appears more stable and robust than when measured with other relevant measures. However, we suggest more work is needed to further explore possible reasons for the range of effect sizes.

**EXERCISE**

Exercise level showed a small association with disturbed eating ($r = .13$). However, this result was not robust and showed mixed effect sizes, with 14 studies suggesting higher levels of exercise are found in those who have disturbed eating, and 12 studies suggesting exercise levels are marginally higher in control women. Exploration of the heterogeneity found that the underlying research questions posed may explain this: studies with a negative effect size predominately assessed eating-disorder prevalence in athletes versus non-athletes, whereas the studies with positive effect sizes assessed exercise in eating disordered versus non-disordered women. The relationships between exercise and AN and BN could not be explored due to insufficient studies including data obtained from a clinically defined sample compared directly to a healthy group in each diagnostic case.

**SUBSTANCE USE**

Disturbed eating was associated with overall substance use level ($r = .17$), but the result was not robust and showed various effect sizes. This may be explained by the assessment measure utilised: Granner et al. ($16$), who used only the EDI behavioural sub-scales, found a much stronger association than researchers who used the entire scale ($r = .43$ versus mean weighted $r = .14$) suggesting that non-eating-disorder-specific behaviours may be contributing to the relationship more than the specific psychopathological aspects and that there are non-specific links between substance use and disturbed eating. Substance-specific analyses demonstrated that alcohol and smoking were loosely related to disturbed eating ($r = .13$ and $r = .20$ respectively). However, the illicit drug use analysis was homogeneous ($r = .19$), showing that such substance use is more common in women with disordered eating than in control women. While women with BN showed elevated use of all three types of substance use compared to control women, the relationships were not robust in the analysis and caution should be exercised when interpreting these results.

**SOCIO-CULTURAL PRESSURES**

As socio-cultural pressure is a multi-faceted concept, it was broken down into three areas: internalisation of the thin-ideal, the influence of media, and peer and family teasing/pressure. No association was found between internalisation and disturbed eating ($r = .11$), although cluster analysis revealed that two studies ($17$, $r = - .06$, $18$, $r = - .29$) masked the medium association found in the remaining six studies (mean $r = .37$). These two negative effect sizes may be caused firstly by age – Share and Mintz ($17$) used a sample with a higher average age than those used in all the other studies – and secondly by assessment measure: Miotto et al. ($18$) were the only group to use the Marlow-Crown social desirability scale, which may exert a unique effect on the association. Media influence showed a small association with disturbed eating ($r = .14$) but with varying heterogeneity. However, the varied effect sizes disappeared when the Lin and Kulik ($19$) study was removed, which assessed dissatisfaction with body-parts rather than overall body dissatisfaction. Finally, a strong, robust association ($r = .60$) was found between disordered eating and teasing about weight and shape by family and friends, with varied effect sizes noted. The Irving study ($20$), one of two studies which found much smaller effect sizes ($r = .16$) compared women with high BULIT scale scores to those with low scores, potentially resulting in the control group having a
higher degree of disturbed eating than the control groups of all the other studies which included only women from the general population.

**RACE**

There was no association between race and the presence of disturbed eating behaviours or attitudes in this very large analysis (r = .02). However, to make the analysis more meaningful, the specific question of whether disturbed eating is associated more with Caucasian women than women from other ethnic groups was explored. A series of five analyses were conducted which found that disturbed eating was not associated more with being a female Caucasian than being a female from an African (African-American and African-British are being referred to as African), Asian (overall), South Asian (based on the British usage of “Asian”, referring to populations from countries such as India, Pakistan, Bangladesh), North Asian (based on the American usage, referring to populations coming from countries such as China, Japan, Taiwan), or Hispanic ethnicity (r = .05, r = -.02, r = -.09, r = .07, r = -.01 respectively). Based on the large sample in this review (N = 30,926), we conclude that race has no association with the presence of disturbed eating behaviours or attitudes.

**INDIVIDUAL DIFFERENCES**

As such a large number of individual difference factors have been linked to eating disorders in the literature, we divided our analyses into 12 sub-studies.

**Defence style:** Although an association between an immature defence style and disturbed eating was found within the reviewed studies (r = .30), significant heterogeneity was found among the effect sizes. More research is recommended to strengthen an understanding of this relationship.

**Autonomy:** Problems surrounding autonomy (subjective feelings of choice and freedom) were associated with disturbed eating, but there only appears to be an association between autonomy deficits and disordered eating in specific clinical cases. Effect sizes were mixed between studies and likely due to the specificity of eating disorder diagnosis. While BN showed a robust association with autonomy deficits (r = .42), there was not enough study data to permit an analysis for AN.

**Shame and guilt:** Our analysis found a moderate association between disturbed eating and feelings of shame and guilt (r = .29), with heterogeneous effect sizes. The cluster analysis showed that a much stronger effect size was seen in the study that included participants with specific clinical diagnoses (r = .29), whereas a smaller effect size was found in the one study (r = .21) that used the shame and guilt section from a generalised personality measure rather than the specifically developed shame and guilt measures used by the other five studies. Associations with clinical diagnoses were not possible due to a lack of studies.

**Perfectionism:** There was a moderate association between perfectionism and disturbed eating (r = .30), with mixed effect sizes. Composition of the sample in terms of clinical specificity appeared to be affecting the heterogeneity, but as associations between AN and perfectionism could not be conducted, this was not possible to confirm.

**Anger and hostility:** Disturbed eating was related to anger and hostility (r = .29), but individual study effect sizes varied. For example, there was a larger effect size in the Williams et al. (r = .13, r = .36), the calculated effect sizes were again elevated by the Williams et al. (r = .13) study. This suggests it cannot be specificity of diagnosis alone that is causing the heterogeneity in the effect sizes. Further exploration showed that Williams et al. (r = .21) had utilised a measure of hostility (the Hostility and Direction of Hostility Questionnaire (r = .21)) whereas the other studies had used the State-Trait Anger Expression Inventory (STAXI (r = .21)) which measures anger. Our initial decision to combine these two concepts may have, therefore, been misguided. The analyses were re-run, resulting in anger showing a clear association with disturbed eating, but the association with hostility remaining heterogeneous indicating that it may be moderated by disorder specificity. However, as all the studies found positive relationships, varying only in magnitude, additional research is needed to describe more precisely the nature of this relationship.

**Coping:** Maladaptive coping style showed a small association with disturbed eating (r = .18), with varied effect sizes between individual studies; a similar association was found between BN and maladaptive coping (r = .17). As both analyses were not robust in terms of the fail safe N number and given the heterogeneous effect sizes, we suggest further research is conducted to help clarify the emerging association between maladaptive coping and disordered eating.
eating.

Temperament: There was a small association between temperament and disturbed eating \((r = .17)\). However, this result was not robust and showed heterogeneous effect sizes possibly moderated by clinical diagnosis. There was a large association between AN and temperament, albeit with varied effect sizes between studies \((r = .46)\), suggesting that a clinical diagnosis is not solely responsible for the heterogeneity found in the initial overall analysis. Additionally, there was no association between BN and temperament, although this was not robust. We therefore suggest more research would be useful to gain insights into the characteristics that may be responsible for the heterogeneity of effect sizes found in these analyses.

Anxiety: Overall, there was strong evidence for an association \((r = .47)\) between disturbed eating and anxiety (the definition of which was not restricted to clinical diagnosis), although the effect sizes varied, again potentially due to whether studies had used clinically diagnosed samples. The largest effect sizes were found in studies that had used only clinically diagnosed patients, whereas those with smaller effect sizes had also used sub-clinical women. However, although both AN and BN were strongly linked with anxiety \((r = .56, r = .57\) respectively), effect sizes still varied significantly, suggesting clinical diagnosis may not be the sole moderator. We recommend additional research to explore the potential moderators affecting effect sizes between the studies to date.

Depression: This substantial analysis revealed a large and robust association between depression and disturbed eating \((r = .39)\). However, although effect sizes ranged from \(r = .01\) to \(r = .91\), potential moderators could not be identified. The specific analyses with AN and BN were similar: large associations \((r = .75, r = .67\) respectively), but also substantial inexplicable heterogeneity. Therefore, it can be concluded that despite some variation in association strength between studies, speculatively caused by methodological and definition differences, research suggests that those with disordered eating show higher levels of depression than control women.

Personality traits: Sufficient data were only available to focus on the associations that extroversion/introversion and neuroticism have with disturbed eating. No association between extraversion \((r = .04)\) or neuroticism \((r = -.04)\) and disturbed eating was found. Although the effect sizes in the former were homogeneous, those in the latter showed mixed effect sizes, with the Davis, Claridge and Cerullo \((25)\) study responsible for lowering the overall effect size to one of no association. Underlying reasons, however, could not be identified from Davis et al.’s paper.

Personality disorders: The presence of a personality disorder was more likely in women displaying disturbed eating than in control women \((r = .26)\). However, effect sizes varied, with one out of the 27 differing in direction, and the analysis suggesting that personality disorders may only be related to the clinical forms of eating disorders. Indeed, co-morbidity does seem more likely when the specific clinical disorders of AN and BN are considered \((r = .32, r = .34\) respectively), although effect sizes still varied between studies. Three specific personality disorders were sufficiently investigated to allow separate meta-analyses: narcissism, obsessive-compulsiveness, and borderline personality. Although there was a degree of variation between the studies' findings, there is a tendency for personality disorders to be seen more in women with both general disturbed eating and the specific eating disorders. A clear, robust association showed that women with disturbed eating are more likely to suffer from borderline personality than control women \((r = .30)\). Narcissism also showed an association with disturbed eating \((r = .30)\), but the effect sizes displayed heterogeneity with two studies finding no notable association and appearing responsible for variation, as when removed a significant association remained. Finally, there appears to be a tendency for eating disordered women to show more obsessive-compulsiveness than healthy women \((r = .27)\), with this relationship being stronger in women with AN \((r = .33)\) than in women with BN \((r = .28)\). Effect sizes varied, however, with moderators not readily identifiable.

Self-esteem: Analyses revealed no association between low self-esteem and disturbed eating \((r = .03)\) or BN \((r = -.01)\). However, there was a large association between low self-esteem and AN \((r = .47)\), although the effect sizes were mixed, with one study \((31)\) showing a large negative association and all the others large positive associations. Reasons for Williams’s study standing out could not be identified. Overall, data suggested women with AN, but not with general disturbances or BN, are more likely to have lowered self-esteem compared to healthy women. We suggest more research is conducted in this area to help explain the mixed findings.

**DISCUSSION**

The purpose of this review was to consolidate, using meta-
analyses, the vast body of retrospective eating disorder associate-factor literature published between 1987 and 2003 to identify which of the many factors linked with eating disorders show a true association with general problematic eating and the clinical forms of AN and BN.

In total, 74 meta-analyses (47 main analyses and 27 follow-ups) were conducted on 12 main areas, comprising 232 published studies involving 87,878 participants. Only 14 of all the analyses (19%) resulted in clear associations (see Table 2 for a descriptive summary of the results), highlighting the range of study and participant features that vary across the research. A further 38 analyses (51%) found agreement on the direction of effects, differing only on the magnitude of the association.

In keeping with a continuity perspective (e.g., 26, 27), it was expected that the analyses investigating the specific clinical eating disorders would show larger associations with each factor than general disturbed eating. This was found to be true in many cases: in seven analyses at least one of the clinical diagnoses showed higher associations and in six analyses both diagnoses had stronger associations than did general disturbed eating. These findings support those of Stice (1), who reported that studies predicting general disordered eating had smaller effect sizes than studies focused on specific eating disorders. Using the results in combination, it can be speculated that these levels would be higher if analyses comparing clinical AN and BN with controls had been possible for each analysis.

As expected from the literature, the results also showed that although the diagnoses of AN and BN do share common relationships with factors, they also demonstrated disorder-specific relationships with associates. For example, both AN and BN had strong links with cognitions, anxiety and depression, but BN additionally showed a strong relationship with poor caregiver relationships, and AN with temperament and low self-esteem. Clinically this is important as it highlights both the overlapping and unique aspects of the disorders allowing a profile of each disorder to be constructed which in turn can lead to disorder specific strategies to be developed in terms of both treatment and prevention. Additionally, it can inform further research on the interplay of the specific factors to determine the weight each individual factor contributes to the specific diagnosis when in combination with all the other factors. Again this would be valuable to both treatment and prevention efforts.

The results from this series of meta-analytic studies justify the decision to extend the meta-analysis of Stice (1) demonstrating that the vast amount of research on eating disorder associates can make a very useful contribution to the body of knowledge on this topic. The available literature resulted in the two studies covering, to a degree, different factors; some of the factors investigated in this series of studies simply were not covered by the Stice analyses, presumably due to the lack of prospective research available. Therefore although this review consolidates some of the findings from the Stice review (1), reviewing the retrospective research also adds information to the general discussion and highlights areas where further longitudinal

<table>
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<tr>
<th>Overall Strength of Association</th>
<th>Factors and Outcomes</th>
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<td>No Association</td>
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<tr>
<td>Disordered eating and:</td>
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<td>Stress</td>
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| Small Association               |                      |
| Disordered eating and:          |                      |
| Abuse, Sexual abuse, Physical   |                      |
| abuse                          |                      |
| Sensitivity                     |                      |
| Family environment              |                      |
| Enuresis                       |                      |
| Substance use, Alcohol use,     |                      |
| Smoking, Drug use               |                      |
| Somato-Cultural pressure, Media|                      |
| Influence                       |                      |
| Autocopy                        |                      |
| Anger                           |                      |
| Coping                          |                      |
| Sensitivity                     |                      |
| Temperament                     |                      |

| Medium Association             |                      |
| Disordered eating and:         |                      |
| Substance use, Alcohol use,    |                      |
| Smoking, Drug use              |                      |
| Somato-Cultural pressure, Media|                      |
| Influence                       |                      |
| Autocopy                        |                      |
| Anger and hostility, Hostility  |                      |
| Depression                      |                      |
| Feasibility disorder, Dissocial|                      |
| Personality disorder, OCD       |                      |
| BN and                          |                      |
| Abuse                          |                      |
| Family environment              |                      |
| Stress                          |                      |
| Substance use, Alcohol use,     |                      |
| Smoking, Drug use               |                      |
| Somato-Cultural pressure, Media|                      |
| Influence                       |                      |
| Autocopy                        |                      |
| Anger and hostility, Hostility  |                      |
| Depression                      |                      |
| Feasibility disorder, OCD       |                      |

| Large Association              |                      |
| Disordered eating and:         |                      |
| Weight and shape teasing       |                      |
| Anxiety                        |                      |
| BN and                          |                      |
| Internalization of the Unified |                      |
| Family                         |                      |
| Sexual                          |                      |
| Hemorrhage                      |                      |
| Substance use, Alcohol use,     |                      |
| Smoking, Drug use               |                      |
| Somato-Cultural pressure, Media|                      |
| Influence                       |                      |
| Autocopy                        |                      |
| Anger and hostility, Hostility  |                      |
| Depression                      |                      |
work would be very useful.

This series of meta-analytic studies resulted in a number of important findings. The first is that race has no association with disordered eating, that is being Caucasian carries no more risk of problematic eating than being of any other ethnic origin. As this analysis included data from over 31,000 women, our conclusion adds substantial weight to the long-standing debate in this area, and suggests that in detecting eating disorders, clinicians should not assume Caucasians are more at risk. It must be noted, however, that the analyses presented were intentionally concerned only with race: that is, colour of skin, with no account being made of culture or country of origin, which could be addressed in future work. A further two striking findings were the substantial relationships between all forms of eating disorder with anxiety and depression. One can give extra weight and confidence for these findings as they included exceptionally large sample sizes. However, the results still do not answer the question of whether the eating disorders are variants of these two co-morbid disorders, or are separate entities that share commonalties.

A surprising finding was the mixed results of the self-esteem analyses, which showed a wholly inconclusive relationship with general disordered eating, no relationship with BN, but a strong varied association with AN. An obvious link between low self-esteem and disturbed eating in general has been presumed based on the assumption that the individual must feel their body is inadequate in order to desire to change it so desperately (29), and feeling inadequate goes hand-in-hand with low self-esteem. However, based on our analyses, this relationship may only apply in the case of AN. It is likely the surprising result is due to methodological differences between the studies investigating this concept – for example, whether self-esteem was treated as a uni- or multi-dimensional concept. It is plausible that self-esteem is related to general eating disturbance and BN, but there needs to be more methodological rigour to detect the associations with these outcomes, which may be weaker than that found with AN.

The socio-cultural pressure analyses also provided interesting results. Despite the stressed importance of media influence and internalisation of the thin-ideal in the literature and in popular media, they surprisingly showed little association with disordered eating. However, this could be due to desensitisation caused by overexposure to the thin-ideal and/or a clearer understanding that many magazine pictures are altered. Additionally, when assessment measure was taken into account, it appeared that assessing dissatisfaction with body-parts (30) rather than overall body dissatisfaction lowered the overall effect. The media tend to promote an overall desirable body shape, rather than focusing on separate parts of the body, and so it appears that studies focusing on the latter may be missing the important aspects of this concept.

Our analyses demonstrated a strong association between disordered eating and weight- and shape-related teasing. This is an interesting finding as it suggests that weight/shape teasing, which in varying levels may feature commonly in the everyday lives of some adolescent girls, may have lasting implications and lead to a general level of disturbed eating.

The inductive moderator searches conducted when effect sizes showed heterogeneity revealed some interesting insights. In the family environment analysis it was suggested that as one gets older, family dysfunction no longer places one at an increased risk of eating disturbance. This may be due to no longer living with the family unit, or that memory of poor family environment diminishes with age. Similarly, in the sexuality analysis it was shown that age and culture may explain the variance in effect sizes. The data suggested that Australian lesbian women may perceive less weight and shape pressures in comparison to American lesbian women, and additionally, lesbian women overall may become less concerned with weight and shape as they get older to a greater extent than do heterosexual women overall.

The medium-strength relationship between disturbed eating and self-harm behaviours was found to be affected by the assessment measures used. It appears that when a measure specific for self harm is used the resultant effect is smaller, suggesting that non-specific measures may be tapping into other phenomena associated with disturbed eating, and therefore to gain the true effect, a measure specifically designed for the purpose should be used. In the substance use analysis, associations were detected between disturbed eating and smoking and illegal drug use, but not between disturbed eating and alcohol use. This could be due to a perception that alcohol is a weight-gaining substance, whereas cigarettes and some illegal drugs are perceived to have a weight-reducing effect. Finally, in the exercise analysis it was found that studies reporting a negative effect size predominately assessed eating-disorder prevalence in athletes versus non-athletes, whereas the studies with positive effect sizes assessed exercise in eating disordered versus non-disordered women. Although not wholly clear-cut due to some remaining heterogeneity in the analysis, this
suggestions that women with disordered eating appear to exercise more than other women, but athletes are no more likely to have an eating disorder than non-athlete controls.

Meta-analysis has its limitations. We are sensitive that the findings reported in this paper are dependent on the methods and decisions we applied (i.e., our decisions to use Fishers z-transformation, a random-effects model, to consider only published studies). Had alternative methodological decisions been made (using a fixed-effects model for example), it is possible our results may have differed. We would like to emphasize that the methods and criteria applied are consistent with the standard practices of meta-analysis, and that in most cases the decisions provided the most conservative estimates of effects, and so if our results are skewed in any way it is likely that we have made Type II errors rather than Type I.

A second limitation of the analyses is connected with the multi-dimensional nature of many of the measures used in the aggregated studies: for example, the restraint scale (29) measures dieting behaviour, binge eating and weight fluctuation. The decision in this analysis to average scores across all sub-scales to produce one effect size for each study means that how the specific dimensions vary in their contribution to the effects found was not considered. Stice (1) suggests that for a clearer interpretation of study findings, measures that assess concepts in a unitary fashion are needed rather than multidimensional measures. Additionally, there are potential problems with assuming a consistent definition for measures such as body dissatisfaction. Studies use and assess this outcome in different ways, and where one study may assess BD as a behavioural measure, another may assess it as an attitude. While this is a limitation of this meta-analysis, it is also a limitation of the research collated, as the majority of the studies did not clearly define such constructs. Further consolidation of how concepts are defined and measured in the eating disorder field is needed to provide analytic clarity to study findings.

A third limitation of the study is that data was abstracted from all relevant studies with no methodological assessment of the studies in which the data came from. This approach was taken as it was felt important to get the broadest summary of the non-longitudinal data as possible. The main study characteristics were coded using the developed coding scheme in the hope that if methodological heterogeneity existed between the studies it would have been detected by the inductive moderator searchers performed for each analysis. However, in a number of the analyses heterogeneity could not be explained by the characteristics coded for. To strengthen our observations of associations, in retrospect it would have been preferable to assess the included studies for methodological quality, especially in terms of control of confounders; the likely cause of the varied effect sizes.

We must mention that the main reason studies were excluded from these analyses was due to a lack of appropriate statistics: 33% of the excluded studies (150 studies) were left out for this reason. There was a surprising lack of inferential statistics in many of the viewed studies, and even commonplace descriptive statistics, such as means and standard deviations, were often not reported; many studies gave only percentages, which were unable to be used for the particular effect size approach used in our meta-analysis. We found the standard of reporting in the literature lacking and hope our experience of examining the whole research corpus serves as a reminder to researchers in this field that quantitative data can be used beyond the particular study, and so should always be reported as fully as possible.

As a final point, the results of this meta-analysis are mainly based on retrospective methods of data collection, which are open to respondent bias, and also highlight associations or relationships between eating disturbance and various factors, and do not give the ability to derive interpretations regarding cause and effect. Many of the factors investigated could just as plausibly be consequences of the disorder, rather than antecedents, and so it cannot be concluded that these relationships are evidence that the factor precedes the onset of the disorder. The very nature of this review in taking retrospective, correlational studies for analysis automatically limits the review findings to the same correlational, retrospective level. To confirm, for example, that people with BN experience more stress than healthy women rather than just report/perceive more, or to allow causality to be implied, further prospective, longitudinal work must be conducted. We hope our analysis will be valuable for guiding such efforts.

CONCLUSIONS

Based on the findings from this series of meta-analytic studies it is possible to sketch a profile of women with disturbed eating, AN and BN. Women with disordered eating are: more likely than controls to have experienced abuse, especially sexual abuse; have a dysfunctional attachment, and a tendency to come from a more dysfunctional family background; to have higher levels of
distorted/irrational cognitions; to have experienced weight- or shape-related teasing; to more likely utilise maladaptive coping strategies and immature defences, to smoke and take illegal drugs, but be no more likely to use alcohol; are perfectionists who show higher levels of anger and hostility, shame and guilt, neuroticism, and have anxious, depressive, borderline, and obsessive-compulsive traits. However, women with disordered eating are not more likely to: be of any given sexuality; self-harm; have higher levels of stress; exercise; or be more, or less, extroverted in their behaviour; be more likely to internalise norms, or differ in temperament. In addition to this overall profile, women with AN and BN are more likely than women with general disordered eating to have dysfunctional attachments, to be depressed and anxious, and to have higher levels of obsessive compulsive disorders; they also show higher levels of irrational cognitions, anger and hostility. Further, women with BN are more likely than women with disturbed eating and AN to come from families with dysfunctional backgrounds, be stressed and show reduced autonomy, whereas women with AN are more likely than women with disturbed eating and BN to have high levels of general personality disorders, and low self-esteem.

With regard to direction for future longitudinal and experimental research, our suggestions fall into three categories. First, the results of the race, and temperament analyses suggest that no more research, either longitudinal or correlational, is needed, as these are simply not associated with eating pathology. Second, certain factors should receive more cross-sectional research, or further investigation of the association moderators, before money and time are invested on large-scale prospective studies. Specifically, self-harm, irrational beliefs, anger and hostility, coping, and self-esteem could potentially benefit from further investigation of the moderators involved in the associations, or further work on the definition/measurement of the concepts, whilst defence style, personality traits, and borderline personality disorder would all benefit from further correlational work due to the small number of studies currently available. Third, there are factors that are deemed important and interesting enough to warrant the investment of time and money in prospective and experimental studies. There are promising associations between abuse and family environment and the different forms of eating pathology. Despite these areas being assumed to have a role in eating pathology development, Stice (1) found few longitudinal studies on these areas and as such it would be highly beneficial to investigate these two areas in an empirical manner. Moreover, autonomy, negative cognitions, shame and guilt, attachment with primary caregiver, exercise and obsession-compulsion were all strongly associated with eating disturbance in this review but were not assessed by Stice (1), so offer further scope for longitudinal investigation. Finally, there were some factors in this review, which although associated with eating pathology and previously assessed by Stice (1), would still merit further prospective investigation due to a lack of studies on specific associations with AN or BN. For example, the various concepts of socio-cultural pressure and substance use have been suggested to be related in different ways to each form of disorder, and determining whether these speculations are correct would enrich the profiles of the two disorders.

[Image:3]

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