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Implicit attitudes toward dieting and thinness distinguish fat-phobic and non-fat-phobic anorexia nervosa from avoidant/restrictive food intake disorder in adolescents

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Abstract

Objective: The majority of individuals with anorexia nervosa (AN) have a fat-phobic (FP-AN) presentation in which they explicitly endorse fear of weight gain, but a minority present as non-fat-phobic (NFP-AN). Diagnostic criteria for avoidant/restrictive food intake disorder (ARFID) specifically exclude fear of weight gain. Differential diagnosis between NFP-AN and ARFID can be challenging and explicit endorsements do not necessarily match internal beliefs.

Method: Ninety-four adolescent females (39 FP-AN, 13 NFP-AN, 10 low-weight ARFID, 32 healthy controls [HC]) completed implicit association tests (IATs) categorizing *statements* as pro-dieting or non-dieting and true or false (Questionnaire-based IAT), and *images* of female models as underweight or normal-weight and words as positive or negative (Picture-based IAT). We used the Eating Disorder Examination to categorize FP- versus NFP-AN presentations.

Results: Individuals with FP-AN and NFP-AN demonstrated a stronger association between pro-dieting and true statements, whereas those with ARFID and HCs demonstrated a stronger association between pro-dieting and false statements. Furthermore, while all groups demonstrated a negative implicit association with underweight models, HC participants had a significantly stronger association than individuals with FP-AN and NFP-AN.

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Discussion: Individuals with NFP-AN exhibited a mixed pattern in which some of their implicit associations were consistent with their explicit endorsements, whereas others were not, possibly reflecting a minimizing response style on explicit measures. In contrast, individuals with ARFID demonstrated implicit associations consistent with explicit endorsements. Replication studies are needed to confirm whether the questionnaire-based IAT is a promising method of differentiating between restrictive eating disorders that share similar clinical characteristics.

Keywords

anorexia nervosa; avoidant/restrictive food intake disorder; ARFID; implicit association test; IAT; drive for thinness; dieting

Introduction

Anorexia nervosa (AN) and avoidant/restrictive food intake disorder (ARFID) share the hallmark diagnostic feature of restrictive eating. A fundamental difference between the two disorders is that, while restrictive eating in AN is driven by fear of weight gain, restrictive eating in ARFID is driven by sensitivity to the sensory characteristics of food, fear of aversive consequences of eating, and/or lack of interest in eating or food (APA, 2013). When individuals explicitly endorse these divergent rationales for restrictive eating, differentiating between AN and ARFID is straightforward. However, in cases where individuals with AN do not report fears of gaining weight or becoming fat, differentiating between AN and ARFID becomes challenging. These individuals with so-called non-fat-phobic AN (NFP-AN), often endorse low appetite or gastrointestinal distress as rationales for food restriction (Lee, Ng, Kwok, Thomas, & Becker, 2012; Becker, Thomas & Pike, 2009), blurring the distinction between ARFID and AN (Thomas, Hartmann, & Killgore, 2013). Thus it is sometimes unclear whether individuals who present with NFP-AN are minimizing or denying underlying shape and weight concerns, have alternate rationales for food restriction, or actually have ARFID (Thomas et al., 2013).

Given that individuals with NFP-AN do not explicitly endorse fear of weight gain, several alternative reasons for insufficient dietary intake have been suggested in the literature, including a need for control in general (Fairburn, 2008) or elevated gastrointestinal symptoms (Lee, 1995). However, empirical studies have instead found that individuals with NFP-AN are less likely to report a need for feeling in control (Murray et al., 2017), or gastrointestinal symptoms such as nausea and bloating (Lee et al., 2012), as reasons for restriction than those with FP-AN. Thus, it may be that individuals with NFP-AN have a minimizing response style that is susceptible to socially desirable responding, highlighting the need for measures that can capture implicit positive biases toward restriction and drive for thinness (Thomas et al., 2013). If implicit biases are present in individuals with NFP-AN, then implicit measures may help differentially diagnose these patients from those with ARFID, who can also present as low weight and may endorse similar rationales for food restriction (Thomas et al., 2013). For example, both individuals with NFP-AN and a subset of those with ARFID may report excessive fullness, stomach pain, or lack of interest in food or eating. While weight gain will be a common treatment target in both scenarios, if weight or shape concerns truly do represent a core maintaining factor in NFP-AN, the treatments for

NFP-AN and low-weight ARFID should differ. Since clinical diagnoses rely heavily on self-report, it is important to explore alternative measures designed to capture implicit attitudes that may differ from explicit endorsements.

There is a rich literature from social and cognitive psychology showing that incongruence between implicit and explicit beliefs commonly pertains to sensitive topics, such as weight bias. That is, people may not explicitly endorse weight bias due to social stigma but may still have implicit biases that rest outside of conscious awareness (Juarascio et al., 2011). The Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998; Nosek, Greenwald, & Banaji, 2005) is one widely used measure of implicit attitudes. The IAT is predicated on the assumption that it is easier to make a behavioral response (i.e., pressing a response key) to paired concepts that have stronger associations (e.g., “fat” and “bad”; Teachman, Gapinski, Brownell, Rawlins & Jeyaram, 2003) than paired concepts with weaker associations (e.g., “fat” and “good”). Those who respond faster when the category of “fat people” (Teachman et al., 2003; p. 70) is paired with “bad” than with “good” could be assumed to have higher levels of weight bias. Using the IAT, female high school and undergraduate students showed a strong positive bias toward “thin” women (Ahern & Hetherington, 2006; p. 339). In another study, female undergraduates with a strong explicit drive for thinness also demonstrated a stronger implicit positive bias toward underweight models than did those with a weaker drive for thinness (Ahern, Bennett, & Hetherington, 2008). These studies demonstrate the need for IAT measures that can capture implicit beliefs toward thinness in populations with eating disorders where motivation for restrictive eating is ambiguous: for example, in low-weight restrictive youth who lack insight into their behavior, or in NFP-AN, wherein socially desirable responding may influence individuals’ explicit denial of body image disturbance. Investigators have also developed the questionnaire-based IAT (Q-IAT) that involves pairing self-relevant statements with either true or false statements. The Q-IAT provides an additional measure of implicit beliefs related to concepts captured by items from validated psychological surveys (Yovel & Friedman, 2012).

The purpose of our study was to examine whether implicit attitudes toward dieting and thinness differed between adolescent females with FP-AN, NFP-AN, low-weight ARFID, or no eating disorder (healthy control; HC) using two IATs. First, in a Q-IAT measuring the association between the dieting and true statements, we hypothesized that individuals with FP-AN would have a stronger association between dieting and true statements, whereas individuals with NFP-AN or ARFID, and HCs, would have stronger associations between dieting and false statements. Second, in a picture-based IAT measuring the association between underweight models and positive words, we hypothesized that individuals with FP-AN would have a stronger association between underweight models and positive words whereas individuals with NFP-AN or ARFID, and HCs, would have stronger associations between normal-weight models and positive words. Lastly, we evaluated whether individuals with NFP-AN or ARFID, and HCs, explicitly endorsed lower levels of eating disorder psychopathology compared to those with FP-AN. We hypothesized that, consistent with previous studies, individuals with NFP-AN or ARFID, and HCs, would have lower global Eating Disorder Examination (EDE) and Eating Disorder Inventory Drive for Thinness

(EDI-DFT) scores and engage in fewer binge eating and purging behaviors compared to individuals with FP-AN.

Method

Participants

We recruited participants ($N = 94$) through advertisements, flyers, and health providers at Massachusetts General Hospital (MGH) and the greater Boston area for a longitudinal study of low-weight eating disorders funded by the National Institute of Mental Health (NIMH; R01MH103402: “Homeostatic and Hedonic Food Motivation Underlying Eating Disorder Trajectories,” https://projectreporter.nih.gov/project_info_description.cfm?aid=9450551&icde=39625696&ddparam=&ddvalue=&ddsub=&cr=3&csb=default&cs=ASC&pball=). The study examined neurobiological, hormonal, behavioral, and self-report data among young females with low-weight eating disorders versus HCs. Participants completed all measures at a cross-sectional study visit.

The Partners Human Research Committee approved the study, and we obtained informed consent from participants aged ≥ 18 years and child assent plus parental consent from participants aged < 18 years. We included females ages 10–22 years who either met *DSM-5* diagnostic criteria for a low-weight eating disorder (e.g., AN-restricting type [AN-R], AN-binge-eating/purging type [AN-B/P], Other Specified Feeding or Eating Disorder [OSFED]-atypical AN, or ARFID) or as an age-matched HC. We operationalized low weight as an inclusion criterion for this study of low-weight eating disorders $< 90\%$ of expected body mass index (eBMI). We defined eBMI as percent expected body weight based on height and 50th percentile of Centers for Disease Control female BMI-for-age growth charts (Kuczmarski, Ogden, Guo, et al., 2002). HC participants had a BMI within the 25th–85th percentile, regular menses after the first two years post-menarche, and no lifetime history of psychiatric illness. Additionally, we excluded HCs who had a vegetarian/vegan diet, wherein certain dietary rules may overlap with endorsements by those with eating disorders, and/or engaged in excessive exercise within the past three months (> 10 hours in any one week). Exclusion criteria for all participants included a history of psychosis, active substance or alcohol use disorder within the past month, and active suicidal ideation. Demographics are shown in Table 1.

Assessments

Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime 2013 Working Draft.—The KSADS-PL is a semi-structured interview used to assess both current and lifetime history of psychiatric diagnoses in children and young adults. The KSADS-PL 2013 Working Draft (Kaufman et al., 2013) is an updated version that reflects *DSM-5* diagnostic criteria and symptom severity scores. Our study team developed supplemental questions to capture *DSM-5* diagnostic criteria for ARFID. The KSADS-PL is a well-established measure that has shown good to excellent test-retest reliability (Ambrosini, 2000; Kaufman et al., 1997). In this study, we used the KSADS-PL to diagnose individuals with *DSM-5* eating disorders, including ARFID, and to categorize HCs.

Eating Disorder Examination.—The EDE 17.0D is an investigator-based interview that is used to capture the frequency of ED behaviors, the severity of ED psychopathology, and diagnose *DSM-5* EDs (Fairburn, Cooper, & O'Connor, 2014). We used the EDE to categorize individuals with AN as either FP-AN or NFP-AN, to ascertain the frequency of binge eating and purging episodes in the past month, and to calculate a global EDE score. Consistent with Dalle Grave, Calugi, and Marchesini (2008), we classified participants as FP-AN if they scored ≥ 4 on one or more of the following EDE items or NFP-AN if they scored <4 on all three of the following EDE items: (1) “Importance of Weight”; (2) “Importance of Shape”; and (3) “Fear of Weight Gain.” However, we included ratings in only the past month, as opposed to the last three months, to capture a more recent picture of explicit endorsements. Five participants were excluded from all statistical analyses, yielding an analytic sample of 94: one participant with an EDE diagnosis of bulimia nervosa, two participants with an EDE diagnosis of OSFED-Other, one biological female participant with FP-AN who identified as agender and one participant with ARFID who did not complete the IATs at her baseline visit and withdrew from the study post-baseline. We excluded our participant who identified as agender, since they endorsed body image concerns related to gender non-conforming traits rather than socially influenced beauty ideals such as thinness, which the Picture-based IAT was designed to capture. Participants with FP-AN received EDE diagnoses of AN-R ($n = 18$), AN-B/P ($n = 9$), and OSFED-atypical AN ($n = 12$). Participants with NFP-AN received diagnoses of AN-R ($n = 6$), AN-B/P ($n = 2$), and OSFED-atypical AN ($n = 5$). In addition, as conferred by the KSADS, we diagnosed 10 participants with ARFID and categorized 32 participants as HCs.

Eating Disorder Inventory-3 Drive for Thinness Subscale.—The EDI-3 is a self-report questionnaire that assesses symptoms and psychological features of EDs, such as drive for thinness (Garner, 2004). In this study, we used the EDI-DFT subscale to compare explicit endorsement of psychopathology across groups. EDI-DFT internal consistency reliability was excellent (Cronbach's $\alpha = .96$).

Implicit Association Tests.—We conceptually adapted our Q-IAT from Yovel and Friedman's (2012) Q-IAT task. In our study, we designed a Q-IAT to measure the association between pro-dieting/non-dieting statements and true/false statements (Table 2). Since individuals with NFP-AN have previously been differentiated from FP-AN by their lower explicit drive for thinness scores (Dalle Grave et al., 2008), to construct this IAT, we included five dieting items from the EDI-DFT subscale of the EDI-3. The item “I am preoccupied with the desire to be thinner” was shortened to “I think a lot about being thinner” to be of similar length and readability of the reverse statements and the true and false statements. Additional items included “I think about dieting,” “I am terrified of gaining weight,” “I feel extremely guilty after overeating,” and “If I gain a pound, I worry that I'll keep gaining.” We designed five non-dieting items to be conceptual opposites of the EDI-DFT items. They included, “I feel comfortable eating sweets,” “My weight rarely enters my mind,” “I feel OK if I overeat sometimes,” “I dislike feeling hungry,” and “If I gain a pound, it's not a big deal.” We adapted five true statements from Yovel and Friedman (2012) to be relevant to our study setting at MGH. Items included “I'm in a building at Mass General,” “I'm in a small room with a computer,” “I'm participating in an experiment,” “I'm pressing

buttons on a keyboard,” and “I’m sitting in a chair.” Lastly, we took four of the five false statements directly from Yovel and Friedman (2012). They included “I’m climbing a steep mountain,” “I’m sitting on the sand at the beach,” “I’m playing my electric guitar,” and “I’m playing soccer outside.” We changed the fifth statement “I’m shopping at the local grocery store” (Yovel & Friedman, 2012) to “I’m shopping at the mall” to avoid prompting food-related thoughts that could be potentially stressful to our participants with eating disorders. The Q-IAT follows the well-established seven-block IAT structure (Greenwald, Nosek, & Banaji, 2003; Table 2).

We adapted the Picture-based IAT from a previous version that measures the implicit association between underweight or normal-weight models paired with positive or negative attributes (Ahern et al., 2008) by reducing the number of pictures to include five total pictures in each group of models and using the category labels of “Underweight models” and “Normal-weight models” instead of letters A and B. The four categories included pictures of underweight models, pictures of normal-weight models, positive words (e.g., “glorious”, “happy”, “joy”), and negative words (e.g., “agony”, “awful”, “failure”). The Picture-based IAT followed the same seven-block structure described above (Greenwald et al., 2003; Table 3).

We developed the IATs using Presentation® (Neurobehavioral Systems, Inc., Berkeley, CA, USA) and ran them on a HP ProBook 650 PC laptop with a 15.6” HD SVA eDP screen (Resolution 1366 × 768). Participants responded by pressing the “Z” (left key) and “/” (right key) keys on the in-built keyboard with their left and right index finger, respectively. In both tasks, respondents were asked to categorize individual items into groups as quickly and accurately as possible. We scored both IATs based on the improved scoring algorithm that uses correct response latencies from blocks with combined practice (blocks 3 and 6) and test (blocks 4 and 7) categories (Greenwald et al., 2003). Based on algorithm criteria, we deleted trials with reaction times >10,000 ms and added 600 ms to the reaction times for trials with incorrect responses. Subjects who met exclusion criteria due to error latencies <300 ms for more than 10% of trials per block for both IATs were excluded from all cross-sectional analyses ($n = 3$).

For the Q-IAT, we calculated two IAT scores per participant as the difference between the “Pro-dieting + false statement” and “Pro-dieting + true statement” practice trials divided by the pooled standard deviation (SD), and the difference between “Pro-dieting + false statement” and “Pro-dieting + true statement” test trials divided by the pooled SD. Thus, greater difference scores suggested that participants responded faster when dieting statements were paired with true statements than with false statements, indicating a stronger implicit association between pro-dieting and true statements.

For the Picture-based IAT, we calculated two IAT scores per participant as the difference between “Underweight model + negative word” and “Underweight model + positive word” practice trials divided by the pooled SD, and the difference between “Underweight model + negative word” and “Underweight model + positive word” test trials divided by the pooled SD. Thus greater difference scores suggested that participants responded faster when the

category “Underweight model” was paired with “Positive word” than with “Negative word”, indicating a stronger association between underweight models and positive words.

For each IAT task, we calculated the D score for each participant as the mean of their two IAT scores. The strength of the association as measured through the IAT D score can be interpreted in the same way as the well-known Cohen’s d effect size (i.e., 0.2 is small, 0.5 is medium, and 0.8 is large; Cohen, 1977). For the Q-IAT, faster response times when “pro-dieting” and “true statement” categories were paired led to higher D scores, indicating a stronger association between pro-dieting and true statements. For the Picture-based IAT, faster response times when “underweight model” and “positive words” were paired led to higher D scores, indicating a stronger association between underweight models and positive words.

Procedures

All participants completed the measures individually. They first completed the self-report questionnaires and then two IATs at a computer. The EDE was performed at the end of their visit. Participants completed several other procedures throughout the day, including standardized meals, questionnaires, blood draws, and functional magnetic resonance imaging scans as part of the parent study. The randomization order of the IATs was counterbalanced across participants.

Statistical Methods

We conducted all statistical analyses in SPSS version 25.0 (SPSS, 2012, Chicago, IL). To characterize the sample, we conducted one-way analyses of variance (ANOVAs) to compare continuous demographic variables between groups and followed up significant omnibus tests with post-hoc pairwise comparisons using Fisher’s Least Significant Difference (LSD) test. We ran an internal consistency reliability analysis using Cronbach’s alpha for the EDI-DFT measure. In addition, we performed Chi-square tests to compare categorical variables between groups, which included race, ethnicity, and the presence or absence of binge eating and purging behaviors in the past month.

To test the hypothesis that individuals with FP-AN would have stronger associations between dieting and true statements, whereas individuals with NFP-AN, ARFID, and HC would have stronger associations between dieting and false statements, we conducted a one-way ANOVA to compare Q-IAT D scores between groups. To test the hypothesis that individuals with FP-AN would have positive biases toward underweight models, whereas individuals with NFP-AN, ARFID, and HC would have positive biases toward normal-weight models, we conducted a one-way ANOVA to compare Picture-based IAT D scores between groups. Because our initial group comparisons revealed that the groups differed significantly by age, we also conducted ANCOVAs to compare Q-IAT and Picture-based IAT D scores between groups, using age as a covariate. To test the hypothesis that the groups would differ on explicit measures of psychopathology, we conducted ANOVAs for EDI-3-DFT and EDE global scores and Chi-square tests for the presence of objective binge episodes and purging behaviors (coded categorically as present or absent) in the past month.

We conducted post-hoc analyses for both IAT tasks and psychopathology measures using Fisher's LSD test. A p -value of <0.05 was used to indicate significance on all analyses.

Results

Of our analytic sample of 94 participants, one HC participant met the error latency exclusion criterion (Greenwald et al., 2003) for the Picture-based IAT and was thus excluded from the Picture-based IAT analyses only. There were no differences in race and ethnicity across the four groups.

Questionnaire-based IAT

Consistent with our first hypothesis, individuals with FP-AN exhibited a positive association between dieting and true statements. Contrary to our first hypothesis, individuals with NFP-AN exhibited a positive association between dieting and true statements. Both AN groups did not differ from one another and demonstrated associations with a small-to-medium effect size, and the strength and direction of their association differed significantly from those with ARFID and HCs (Figure 1). Indeed, consistent with our first hypothesis, individuals with ARFID and HCs exhibited significant associations between non-dieting statements and true statements with a medium effect size, and did not differ from one another. These between-group differences remained when controlling for age ($F(3, 91) = 20.06, p < .001$).

Picture-based IAT

Inconsistent with our second hypothesis, all groups exhibited a stronger association between underweight models and negative words than with underweight models and positive words (Figure 2). Specifically, HCs had a stronger negative association between underweight models and negative words (with a large effect size) compared to individuals with NFP-AN and FP-AN (who exhibited the same association with a small effect size). Individuals with ARFID exhibited a medium effect size for their association between underweight models and negative words, and did not significantly differ from any of the other groups. These between-group differences remained when controlling for age ($F(3, 90) = 5.620, p = .001$).

Explicit measures of eating-disorder psychopathology

Consistent with our third hypothesis, individuals with NFP-AN scored significantly lower on explicit measures of eating-disorder psychopathology, including global EDE and EDI-DFT compared to individuals with FP-AN (Table 1). Individuals with NFP-AN and FP-AN scored higher on global EDE and EDI-DFT compared to individuals with ARFID and HCs, with FP-AN having the highest scores. Individuals with ARFID did not significantly differ from HCs on global EDE and EDI-DFT. Contrary to our third hypothesis, there were no significant differences among groups on the presence of objective binge episodes and purging behaviors in the past month, which were rare across the entire sample.

Discussion

To our knowledge, this is the first study to compare implicit associations between individuals with low-weight eating disorders—including FP-AN, NFP-AN, and ARFID—

and healthy controls. In our study, a Q-IAT measuring the association between dieting and true statements more strongly differentiated groups than did a picture-based IAT measuring the association between underweight models and positive words. Specifically, we found that individuals with NFP-AN and FP-AN shared implicit associations towards dieting and true statements on the Q-IAT, in contrast to those with ARFID and HCs, who shared implicit associations toward dieting and false statements. Although all groups more strongly associated underweight models with negative (versus positive) words, HCs had significantly stronger negative associations compared to those with NFP-AN and FP-AN, with the ARFID group scoring intermediately between the other groups.

Consistent with previous literature (Becker et al., 2009), individuals with NFP-AN in our study had significantly lower explicit EDI-DFT scores than those with FP-AN. Although the mean EDI-DFT score in the NFP-AN group was just over 14, which some groups have used to differentiate FP- versus NFP-AN (Murray et al., 2017), it was still within $\pm 1SD$ of the mean EDI-DFT score in a non-clinical community sample (Belon et al., 2015). Thus, it was surprising that the NFP-AN and FP-AN groups shared similar implicit biases toward dieting and true statements. This is inconsistent with studies in which patients with NFP-AN had lower explicit drive for thinness scores compared to those with FP-AN (Becker et al., 2009; Dalle Grave et al., 2008). In contrast, individuals with ARFID and HCs had implicit associations between non-dieting and true statements, suggesting that their implicit beliefs matched their explicit endorsements of the absence of fear of weight gain and body image disturbance.

In our study, we found that all groups showed negative associations between underweight models and positive words. The negative association was strongest in HCs, which was consistent with a previous study that found that individuals had stronger implicit associations between pictures of normal-weight (versus underweight) people and positive words (Marini, 2017). Surprisingly, in the current study, individuals with FP-AN had negative associations between underweight models and positive words, which was inconsistent with a previous study that found that women with a stronger drive for thinness had positive implicit biases toward underweight models (Ahern et al., 2008). In our study, the Picture-based IAT included pictures of underweight and normal-weight models that had been categorized by participants in a previous study (Ahern et al., 2008). Thus, it is possible that the pictures of underweight models did not align with our participants' socially defined ideals of thinness. In a previous study, women with AN had implicit associations between emaciation and both beauty and ugliness words compared to healthy controls, wherein they responded faster when "beauty" and "ugly" words were primed with pictures of emaciated women (Smith, Joiner, & Dodd, 2014; p. 141). These findings suggest that women with AN may have complex implicit attitudes toward thinness. Since individuals with AN in our study demonstrated only negative associations between thinness and positive words, further studies are needed to examine explicit ratings of "underweight" stimuli to compare to their implicit biases.

As predicted, individuals with low-weight ARFID demonstrated negative implicit associations between thinness and positive words. Although individuals with ARFID did not significantly differ from any of the groups, their intermediate effect size indicates that they

responded slower than HCs with a large effect size when underweight models were paired with negative words. As this study is the first to examine implicit biases towards thinness in individuals with ARFID compared to those with AN, further studies can ask participants to categorize images into underweight and normal-weight groups in order to better assess their socially influenced perceptions of thinness.

Individuals with NFP-AN and FP-AN have shown heterogeneous differences in explicit endorsements across studies (Becker et al., 2009; Murray et al., 2017). Our study addresses this limitation by examining implicit measures of thinness and dieting in order to mitigate self-report factors such as minimization and socially desirable responding that are common in the NFP-AN population (Becker et al., 2009; Lee et al., 2012; Thomas et al., 2013). A criticism of the IAT is that it is a purely associational test in which individuals may not be responding in accordance with their own beliefs, but rather their own knowledge of societal norms and values (Juarascio et al., 2011). Thus, the Q-IAT, in particular, may be more informative for measuring implicit assessments of psychopathology since it pairs statements described as applying to oneself with either true or false statements. As shown in our Q-IAT with EDI-DFT items, self-relevant statements from validated psychological surveys that measure fear of weight gain can offer a stronger assessment of psychopathology than picture-based stimuli, and can be compared to explicit survey responses in future studies (Yovel & Friedman, 2012).

Taken together, our findings suggest that individuals with NFP-AN may be particularly susceptible to socially desirable responding, as their implicit associations did not differ from those with FP-AN on either IAT. However, we did not directly assess socially desirable responding, and thus a future direction could be to include measures such as the Paulhus Deception Scales (Paulhus, 1991). For individuals with ARFID, their implicit association between non-dieting and true statements is consistent with explicit endorsements of the absence of weight and shape concerns, which supports *DSM-5* criteria for ARFID (APA, 2013). Furthermore, the dieting Q-IAT may help differentially diagnose NFP-AN and ARFID, who may endorse similar reasons for restricting such as gastrointestinal symptoms like nausea or low appetite (Zimmerman & Fisher, 2017). The Q-IAT can help elucidate whether weight and shape concerns are present in those with NFP-AN that could partially explain these symptoms, whereas those with ARFID who have negative biases toward thinness and dieting may be experiencing these symptoms in the context of fear of aversive consequences of eating. Future studies are required to further investigate the thinness and dieting IATs as tools that could help clinicians identify whether there is a presence of fear of weight gain or body disturbance in individuals with NFP-AN who may not endorse such concerns in interviews and/or self-report measures. In doing so, clinicians who deliver evidence-based therapies for eating disorders can be better equipped to address these concerns.

In summary, we found that adolescents and young women with NFP-AN and FP-AN had implicit associations with dieting and true statements, compared to those with ARFID and HCs, who did not. For individuals with NFP-AN, this finding indicates that their implicit beliefs may not match their explicitly expressed beliefs towards dieting. In addition, we found that all groups had negative associations towards underweight models, with HCs

showing the strongest association, and individuals with AN showing the weakest. Taken together, future studies are needed to confirm whether the Q-IAT can play an important role in distinguishing NFP-AN presentations from FP-AN and ARFID presentations.

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Figure 1.

Questionnaire-based Implicit Association Test *D* scores among groups. Identical letter headings indicate a non-significant post-hoc pairwise comparison by Fisher's Least Significance Difference test. Error bars represent standard error. FP-AN, Fat-phobic anorexia nervosa; NFP-AN, Non-fat-phobic anorexia nervosa; ARFID, avoidant/restrictive food intake disorder; HC, healthy controls.

Figure 2.

Picture-based Implicit Association Test *D* scores among groups. Identical letter headings indicate a non-significant post-hoc pairwise comparison by Fisher's Least Significance Difference test. Error bars represent standard error. FP-AN, Fat-phobic anorexia nervosa; NFP-AN, Non-fat-phobic anorexia nervosa; ARFID, avoidant/restrictive food intake disorder; HC, healthy controls.

Table 1.

Demographic characteristics and eating disorder psychopathology for FP-AN, NFP-AN, ARFID, and HC

	FP-AN (<i>n</i> = 39)	NFP-AN (<i>n</i> = 13)	ARFID (<i>n</i> = 10)	HC (<i>n</i> = 32)	Test statistic (<i>F</i> or χ^2)	<i>p</i>
Demographics						
Age (years)	19.5 (2.5) ^a	18.3 (3.6) ^{ab}	15.2 (3.6) ^c	17.4 (3.1) ^b	6.18	.001
Race, <i>n</i> (%)					2.59	.857
Asian	6 (15.4)	1 (7.7)	1 (10.0)	4 (12.5)		
African-American/White	1 (2.6)	0 (0.0)	1 (10.0)	1 (3.1)		
White	32 (82.0)	12 (92.3)	8 (80.0)	27 (84.4)		
Ethnicity, <i>n</i> (%)					2.66	.447
Hispanic/Latino	2 (5.1)	1 (7.7)	2 (20.0)	2 (6.3)		
Non-Hispanic/Latino	37 (94.9)	12 (92.3)	8 (80.0)	30 (93.7)		
Weight						
BMI (kg/m ²)	17.6 (1.5) ^a	17.4 (1.4) ^{ab}	16.0 (1.4) ^b	21.4 (2.2) ^c	38.55	<.0001
% Median BMI (50 th percentile for age)	82.9 (6.7) ^a	83.1 (6.9) ^a	82.5 (5.1) ^a	101.7 (16.8) ^b	19.95	<.0001
BMI Z-score	-1.7 (0.9) ^a	-1.6 (0.9) ^a	-1.8 (0.7) ^a	0.1 (0.5) ^b	37.45	<.0001
Eating disorder psychopathology						
EDE						
Importance of Weight	4.0 (1.9) ^a	0.7 (0.9) ^b	0.0 (0.0) ^b	0.0 (0.2) ^b	70.82	<.0001
Importance of Shape	4.6 (1.4) ^a	1.2 (1.3) ^b	0.0 (0.0) ^c	0.3 (0.7) ^c	111.43	<.0001
Fear of Weight Gain	4.8 (2.2) ^a	0.5 (0.9) ^b	0.0 (0.0) ^b	0.0 (0.0) ^b	75.63	<.0001
Global Score	3.5 (1.2) ^a	1.3 (1.0) ^b	0.1 (0.2) ^c	0.0 (0.1) ^c	108.31	<.0001
OBE [*] , <i>n</i> (%)	5 (12.8)	2 (15.4)	0 (0.0)	0 (0.0)	6.20	.102
Purging [†] , <i>n</i> (%)	6 (15.4)	1 (7.7)	0 (0.0)	0 (0.0)	6.94	.074
EDI-DFT	23.1 (4.9) ^a	14.6 (7.6) ^b	1.0 (1.5) ^c	1.9 (2.1) ^c	156.86	<.0001

Note. Data are reported as mean (SD) or *n* (%). Identical superscript letters indicate a non-significant post-hoc pairwise comparison by the Fisher's Least Significant Difference test. FP-AN, Fat-phobic anorexia nervosa; NFP-AN, Non-fat-phobic anorexia nervosa; EDE, Eating Disorder Examination; OBE, Objective Binge Episode; EDI-DFT, Eating Disorders Inventory Drive for Thinness subscale; BMI, body mass index.

* Individuals with binge eating episodes present in the past month.

Individuals with purging behaviors present in the past month.

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Table 2.

Block design of the Questionnaire-based Implicit Association Test

Block	No. of trials	Items assigned to left key	Items assigned to right key
Randomization1			
1	20	Pro-dieting statements	Non-dieting statements
2	20	True statements	False statements
3 (Practice)	20	Pro-dieting + true	Non-dieting + false
4 (Test)	40	Pro-dieting + true	Non-dieting + false
5	40	Non-dieting statements	Pro-dieting statements
6 (Practice)	20	Non-dieting + true	Pro-dieting + false
7 (Test)	40	Non-dieting + true	Pro-dieting + false
Randomization 2			
1	20	Non-dieting statements	Pro-dieting statements
2	20	True statements	False statements
3 (Practice)	20	Non-dieting + true	Pro-dieting + false
4 (Test)	40	Non-dieting + true	Pro-dieting + false
5	40	Pro-dieting statements	Non-dieting statements
6 (Practice)	20	Pro-dieting + true	Non-dieting + false
7 (Test)	40	Pro-dieting + true	Non-dieting + false

Table 3.

Block design of the Picture-based Implicit Association Test

Block	No. of trials	Items assigned to left key	Items assigned to right key
Randomization 1			
1	20	Underweight models	Normal weight models
2	20	Positive words	Negative words
3 (Practice)	20	Underweight models + positive words	Normal weight models + negative words
4 (Test)	40	Underweight models + positive words	Normal weight models + negative words
5	40	Normal weight models	Underweight models
6 (Practice)	20	Normal weight models + positive words	Underweight models + negative words
7 (Test)	40	Normal weight models + positive words	Underweight models + negative words
Randomization 2			
1	20	Normal weight models	Underweight models
2	20	Positive words	Negative words
3 (Practice)	20	Normal weight models + positive words	Underweight models + negative words
4 (Test)	40	Normal weight models + positive words	Underweight models + negative words
5	40	Underweight models	Normal weight models
6 (Practice)	20	Underweight models + positive words	Normal weight models + negative words
7 (Test)	40	Underweight models + positive words	Normal weight models + negative words