The influence of bodyweight and weight controllability attitudes on physical activity levels

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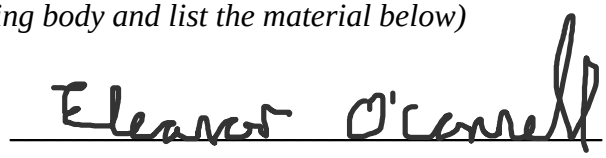
Signature of research student: 

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Abstract

Background: Implicit attitudes towards thinness have predicted goal directed behaviour to achieve thinness. A preference for thinness and a belief that weight is controllable is said to contribute to an anti-fat bias. Research has found that holding weight controllability beliefs is associated with physical activity engagement, yet little is known about how implicit attitudes towards bodyweight and weight controllability beliefs both influence physical activity levels. The current research aimed to investigate the influence of both implicit bodyweight attitudes and weight controllability beliefs on physical activity. It was predicted that implicit weight bias and explicit controllability beliefs would influence physical activity levels. Method: A convenience sample of 33 participants recruited through word of mouth and advertisements completed an Implicit Relational Assessment Procedure [IRAP] to measure implicit bodyweight attitudes, an adaptation of Crandall's original weight controllability subscale, the Godin leisure-time exercise questionnaire and Crandall's original AFA scale to measure explicit anti-fat bias. Results: A large pro-slim bias with the absence of an anti-fat bias was observed in the sample. Multiple regression analysis revealed that the IRAP slim-positive trial type was a significant predictor of physical activity while weight controllability beliefs were not. A significant positive correlation was observed between explicit anti-fat bias and implicit weight bias. Conclusions: Emphasising weight controllability factors may not be sufficient to promote exercise. Implicit processes should be considered when examining behavioural choices including physical activity.

Keywords: Bodyweight bias, weight controllability, IRAP, pro-slim attitudes

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The influence of bodyweight and weight controllability attitudes on physical activity levels

Regular physical activity is essential for maintaining health and well-being and has many health-related benefits including increased cardiovascular health, improved mood and weight management (Haskell et al., 2007). Lack of physical activity has been associated with increased incidence for type 2 diabetes, forms of cancer, osteoporosis, cardiovascular disease, depression and obesity (Wang, McPherson, Marsh, Gortmaker & Brown, 2011; Warburton, Nicol & Bredin, 2006). A minimum of 30 minutes moderate intensity aerobic physical activity 5 days a week is recommended to promote and improve health although in order to improve fitness levels and avoid unhealthy weight gain this recommendation should be exceeded (Haskell et al., 2007). Despite the many health benefits associated with regular exercise, the level of exercise engaged in by obese individuals is low compared to the recommended levels (Ekkekakis, Vazou, Bixby & Georgiadis, 2016). A summary report from the Irish Department of Health (2019) reported that 37% of individuals are overweight and 23% are obese while 46% of individuals were achieving the minimum recommended physical activity level.

Theories of health and social behaviour such as models of attitude behaviour relationships including the theory of planned behaviour (Ajzen & Madden, 1986) and theory of reasoned action (Fishbein & Ajzen, 1975) view intentions to engage in a specific behaviour as playing a key role in behaviour prediction. According to Sheeran, Gollwitzer and Bargh (2013) these theories assume that changing an individual's conscious thoughts such as these behavioural intentions should lead to a substantial change in behaviour. A meta-analysis by Webb and Sheeran (2006) revealed that a medium to large change in intention led to only a small to medium change in a variety of health behaviours including exercise and dieting. The meta-analysis concluded that non-intentional routes into the

prediction of behaviour should be considered. Thus, encouraging behavioural intentions through changing conscious thoughts may not always predict a behaviour change.

Implicit attitudes and anti-fat bias

Implicit processes are automatic cognitive, emotional or motivational processes that influence behaviours and decisions without intention (Sheeran et al., 2016). Implicit attitudes reflect thoughts that individuals are not willing or unable to report explicitly due to either social-desirability concerns or because they are not even aware that they hold such thoughts (Greenwald & Banaji, 1995). This is demonstrated in studies that found explicit and implicit measures of weight bias to be unrelated to each other. Participants rated obese people more positively on the explicit measure of weight bias and more negatively on the implicit association test revealing a difference between reporting attitudes explicitly and a conscious denial of weight bias (Carels et al., 2009; Teachman & Brownell, 2001). According to Friese, Hofmann and Schmitt (2008) it is important for psychological research to focus on implicit processes including implicit attitudes, personality traits and self-esteem that drive behaviour through automatic processes as self-report measures are not only susceptible to social-desirability but rely on introspection which limits the ability for such measures to capture behaviour that inaccessible to conscious awareness.

Implicit attitudes towards exercise (Conroy, Hyde, Doerksen & Ribeiro, 2010) and sedentary behaviour (Chevance, Stephan, Héraud & Boiché, 2018) measured by the implicit association test [IAT] have predicted physical activity even after controlling for behavioural intentions revealing the importance of considering implicit attitudes in the prediction of health behaviours. Ferguson (2007) found that automatic attitudes towards thinness significantly predicted reported successful resistance of tempting foods over a one week period. This resistance was reported to be the most effective strategy to achieve

thinness. Explicit attitudes towards thinness were not found to predict thinness goal pursuit.

Direct self-report measures directly tap into consciously accessible knowledge with limited ability to predict behaviour through inaccessible automatic processes outside of conscious awareness. Implicit measures can be used to measure sensitive topics that may not be answered truthfully on a self-report measure due to fear of negative judgement or labelling (D. Barnes-Holmes, Y. Barnes-Holmes, Stewart & Boles, 2010). Implicit attitudes can be assessed using an Implicit Association Test [IAT] which measures response times in categorising stimuli for example faster responding to 'fat' when paired with negative words than 'slim' when paired with negative words indicates a stronger association for fat with negative attributes revealing an anti-fat bias (Greenwald, Poehlman, Uhlmann & Banaji, 2009).

Studies have found a significantly higher level of anti-fat bias among fitness professionals, regular exercisers (Robertson & Vohora, 2008) and physical education students (O'Brien, Hunter & Banks, 2007) compared to non-PE students. Level of anti-fat bias was found to increase with study progression in physical education (O'Brien et al., 2007). An anti-fat bias appears to be strong among those that may engage in high levels of health maintaining behaviours including physical activity. Although according to Wang, Brownell and Wadden (2004) overweight individuals are unlike most group members that show favourable attitudes towards their own ingroup members. Thin people were more likely to implicitly attribute negative stereotypes such as "bad" and "lazy" to fat people, prefer thin people to fat people and to state explicitly that fat people were less motivated and lazier than thin people. Although a negative relationship was observed between BMI and weight bias, even obese individuals exhibited significant anti-fat bias (Schwartz, Vartanian, Nosek & Brownell, 2006). Vartanian and Novak (2011) found that overweight

individuals who experience weight related stigma also hold anti-fat attitudes themselves which has a positive association with avoidance of physical activity. Although anti-fat attitudes were measured using a single item scale of preference to slim or fat people and an implicit measure was not employed. The IAT remains popular but it has faced criticism in that associations found are relative for example the IAT may indicate a negative attitude towards fat and a neutral attitude towards slim or a positive attitude towards slim and a neutral attitude towards fat thus a separate measure of each attitude is not provided (Roddy, Stewart & Barnes-Holmes, 2010).

The Implicit Relational Assessment Procedure [IRAP] is a behaviour analytic, time reaction-based methodology which has been used to capture relational framing in flight, specifically in relation to implicit cognitions or attitudes (Hughes & Barnes-Holmes, 2013). The IRAP has been used to assess relational responding to socially sensitive issues including weight bias (Roddy et al., 2010; Roddy, Stewart & Barnes-Holmes, 2011). The IRAP assesses participants relational responding under circumstances which are congruent with their learned history, or incongruent with their learned history. In comparison with the IAT, the IRAP assesses complex relations between stimuli, as opposed to equivalence relations, which may be identified in the IAT. Studies have found the IRAP to be more predictive of explicit measures than the IAT confirming predictive validity (D. Barnes-Holmes, Waldron, Y. Barnes-Holmes & Stewart, 2009; Roddy et al., 2010). The current study will use the IRAP to measure implicit attitudes towards bodyweight.

Weight controllability beliefs

According to Crandall (1994) it is not clear why some individuals possess higher levels of anti-fat attitudes than others. Although an association has been observed between weight bias and an endorsement of a just world belief, that people get what they deserve through determination leading to positive outcomes. Crandall outlines two factors that

lead to anti-fat attitudes including a preference for thinness derived from culture and environment and a belief that weight is controllable by the individual (Crandall, 1994).

Normal weight as well as overweight individuals themselves tend to attribute being overweight to a lack of will power, motivation and control (Crocker, Cornwell & Major, 1993). This is demonstrated in a study by Pearl, Puhl and Dovidio (2015) that found weight bias internalisation was associated with a greater belief in the controllability of weight and anti-fat related stereotypes in overweight and obese women. Attributing controllability to weight and holding negative weight bias internalisation such as lazy and unmotivated stereotypes have been found to be a barrier to increasing physical activity in overweight individuals (Ball, Crawford & Owen, 2000; Schmalz, 2010).

A qualitative study looking at barriers and enablers associated with adopting lifestyle behaviour changes in obese adolescents identified a lack of control over sedentary activities and motivation as a barrier to increasing physical activity (Kebbe et al., 2018). Thus, lower weight controllability beliefs may be associated with physical activity avoidance in obese individuals. Tiggemann and Anesbury (2000) found that weight controllability is evident among adolescents through a belief that others are overweight because they eat too much and could lose weight if they exercised more and ate less. A study by Martin, Rhea, Greenleaf, Judd and Chambliss (2011) found that physical education students who displayed weight controllability beliefs were more satisfied with bodyweight and body shape and engaged in more vigorous physical activity per week than students who reported that weight was not controllable. Additionally, Vartanian and Herman (2006) found positive correlations between the belief that weight could be controlled by both exercise and food intake and amount of weekly exercise in undergraduates. Carels and Musher-Eizenman (2010) found that students who believed weight is controllable also display stronger anti-fat bias and a stronger preference for slim

body types. Anti-fat bias also contributed to a pro-thin bias when assigning personality attributes to both overweight and slim figures.

It was mentioned by Juarascio et al. (2011) that revealing some degree of internalisation of the thin ideal was associated with protection against weight gain in an adult student sample. Although it was mentioned that this idea needs additional research.

The current study

Weight controllability beliefs and weight bias may be associated with individuals own health behaviours, yet little is known about how weight bias and controllability beliefs influence important health behaviours such as physical activity among adults. As weight controllability is a factor contributing to an anti-fat attitude, research focusing on these beliefs as well as anti-fat/pro-slim attitudes has not been conducted in relation to their influence on physical activity.

Rationale and research aims

Physical activity is essential to maintain and manage weight as well as other chronic health conditions thus it is important to examine factors influencing the engagement in exercise behaviours in overweight individuals as well as the general population. Physical educators and student populations as well as overweight individuals themselves display anti-fat bias, including both the endorsement of a slim preference and beliefs that weight is controllable (Carels & Musher-Eizenman, 2010; O'Brien et al., 2007; Pearl et al., 2015; Robertson & Vohora, 2008). Thus, it is of interest to assess not only implicit anti-fat attitudes but pro-slim attitudes and controllability of weight beliefs in the prediction of exercise behaviours which has not been given focus in previous research. Thus, the current research will measure physical activity in a general population where physical activity and bodyweight is varied in order to identify factors that may impact

exercise engagement to ultimately identify alternative ways to promote physical activity through encouraging healthy weight management efforts.

The primary aim of the present study is to investigate if implicit attitudes towards bodyweight measured by the IRAP influences physical activity levels in a general population. The secondary aim is to investigate if self-reported weight controllability beliefs predicts physical activity engagement. An additional third aim is to examine the relationship between the explicit and implicit measures of anti-fat attitudes**.** Thus, the current research seeks to answer the following question: Do implicit attitudes towards bodyweight and self-reported weight controllability beliefs contribute to one's own physical activity levels in a general Irish population?

As no previous research has examined the relationship between implicit attitudes towards bodyweight, self-reported weight controllability beliefs and physical activity levels, the current research is exploratory in nature. Two non-directional hypotheses are made, firstly it is predicted that implicit attitudes towards bodyweight will influence physical activity and secondly self-reported weight controllability beliefs will influence physical activity.

Method

Participants

A total of 33 participants took part in the study (19 females, 14 males) with an age range of 20-58 years (M=33.03, SD=10.17). An additional 16 participants took part in the study but were excluded as they did not meet the predetermined practice criteria of greater than 80% accuracy and <2000 milliseconds response latency across a practice block pair in the IRAP. Another one participant took part in the study but was excluded as they failed to maintain greater than 80% accuracy and <2000 milliseconds across the six test blocks in the IRAP. Participants responded to the study via a flyer posted on notice boards in the researcher's local town library and shopping centre. Participants also heard about the study through word of mouth from those who were aware of the study or had already participated in the study. Thus, the current sample was recruited using a convenience sampling method where a snowball sampling method was used to recruit some participants. No incentives to participate were offered to participants.

Measures and materials

The Implicit Relational Assessment procedure [IRAP]. The IRAP was used to measure participants implicit attitudes towards bodyweight. GO-IRAP is a new version of the IRAP written in JAVA that is easily installed and was conceptualised and designed by Dermot Barnes-Holmes. The GO-IRAP software is available for download at https://go-rft.com/go-irap/. The 64-bit version was downloaded for use in this study. Participants completed the IRAP on a Medion laptop with an Intel(R) Celeron(R) processor, colour monitor and standard keyboard.

Each IRAP trial presented one of two label stimuli, either an image of a slim or overweight silhouette. Below each image one of 12 negative or positive target words was presented with the response options ‘Same’ and ‘Opposite’ presented below the target

words (see table 1). The label images chosen for use with the IRAP were gender neutral as previous research has shown that the gender depicted in the label images and participants gender can influence the amount of implicit bias observed (Nolan, Murphy & Barnes-Holmes, 2013). The images were taken from an article by Opie, Glenister and Wright (2019) which was distributed under the terms of the Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/) which permits unrestricted use, distribution, and reproduction. The first and last silhouettes from figure 1 in Opie et al. (2019) were screenshotted and cropped individually resulting in one slim image and one overweight image used in the current IRAP. The label images were grey in colour with a white background, 5.6cm in height and 2.5cm in width when displayed on screen during the IRAP task (see appendix A) for label and target stimuli.

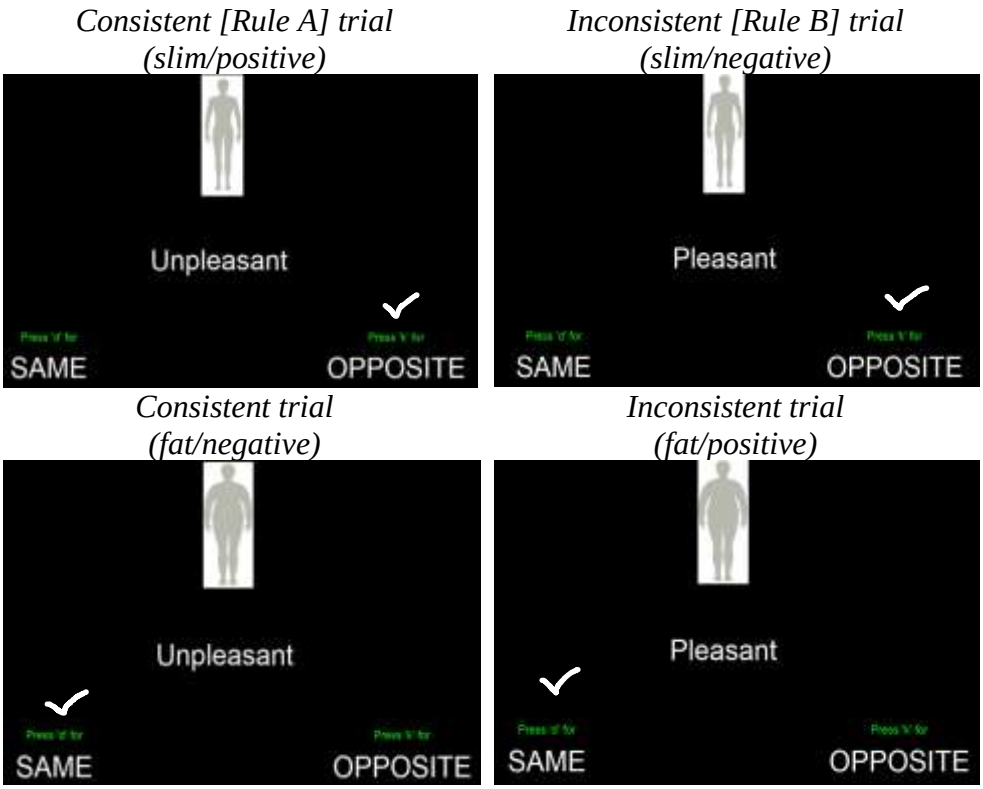
The IRAP includes a maximum of four practice blocks (two practice block pairs each with one consistent and one inconsistent block), six test blocks (three consistent, three inconsistent) with each block containing 24 trials. In an IRAP trial, a label image of the slim or overweight silhouette may be presented with the target word 'Pleasant' or 'Unpleasant' and participants may select response options 'same' or 'opposite'. During a consistent trial block, participants had to adhere to the 'fat is bad and slim is good' rule (Rule A). During an inconsistent trial block, participants had to adhere to the 'fat is good and slim is bad' rule (Rule B). For example, in a Rule A trial block participants were required to select 'Same' when a positive word was presented with the slim silhouette and when a negative word was presented with the overweight silhouette. Participants were required to select 'Opposite' when a negative word was presented with the slim silhouette and when a positive word was presented with the overweight silhouette. In contrast, in a Rule B trial block participants were required to select 'Same' when a positive word was presented with the overweight silhouette and when a negative word was presented with the

slim silhouette. Participants were required to select 'Opposite' when a positive word was presented with the slim silhouette and when a negative word was presented with the overweight silhouette (see figure 1). The difference in response times between Rule A and Rule B trial blocks provides an indication of implicit bias or attitudes. For example, faster responding during consistent trials may indicate a pro-slim/anti-fat implicit bias. Thus, the IRAP outputs scores for four trial types (slim-positive, slim-negative, fat-positive, fat-negative) and provides information about the directionality and combinations of each of these implicit biases.

Table 1
Label, target and response option stimuli presented in the IRAP

Rule A Respond as if fat is bad and slim is good **Rule B** Respond as if fat is good and slim is bad	
Label 1: Slim Silhouette	**Label 2**: Overweight Silhouette
Target: Positive	**Target: Negative**
Good	Bad
Pleasant	Unpleasant
Attractive	Unattractive
Successful	Unsuccessful
Active	Lazy
Motivated	Unmotivated
Response option 1: Same	**Response option 2**: Opposite

Figure 1
Example of each of the four trial types in the IRAP



Note. This example was also shown to participants before the commencement of the IRAP

Godin leisure-time exercise questionnaire [GLTEQ]. The GLTEQ was used to assess individual's self-reported engagement in physical activity during free time (Godin & Shephard, 1985). The GLTEQ contains 3 open ended questions measuring the average amount of engagement (more than 15 minutes) in strenuous (heart beats rapidly), moderate (not exhausting) and mild/light (minimal effort) exercises over a typical seven-day period (week). Various examples of exercises are provided under the Strenuous, moderate and mild exercise domains. Some examples of exercises for each domain were changed to exercises that were common in an Irish context and equal to the same metabolic equivalent total [MET] value as the original examples as outlined in (Jette, Sidney & Blümchen, 1990). MET is the amount of energy or oxygen consumption expended over a time period and increases with exercise intensity. The Oxygen rate consumed during resting periods is

equal to one MET (Cumming, Standage, Gillison & Malina, 2008). Examples of strenuous activity [9 MET] were changed from judo to 'karate', squash to 'kayaking', cross-country skiing to 'boxing', hockey to 'hurling'. Rugby was also added in as an additional strenuous exercise due to its relevance in the Irish context. Moderate activity [5 MET] examples were changed from baseball to 'weight lifting', alpine skiing to 'home aerobic or calisthenics exercises'. Mild/Light activity [3 MET] examples were changed from horseshoes to 'slow-dancing' and from snow-mobiling to 'Pilates'. The number of units of exercises reported under each domain are multiplied by the corresponding MET value and added together to get a total leisure activity score (see appendix B). Higher scores indicate more frequent engagement in exercise with 24 units or more considered to be active. The GLTEQ demonstrated a sufficient level of test-retest reliability (r=.74) in (Godin & Shephard, 1985) and a high level (r=.86) in (Eisenmann, Milburn, Jacobsen & Moore, 2002) and significant moderate to large correlations with accelerometer exercise measures (Miller, Freedson & Kline, 1994; Motl, Bollaert & Sandroff, 2018). The Cronbach's alpha of the GLTEQ for the current study was .43.

Anti-fat attitudes questionnaire [AFA]. Crandall's (1994) anti-fat attitudes questionnaire was used to assess explicit anti-fat attitudes. The AFA contains 13 questions with three subscales including, dislike of the overweight [seven items] (eg."I really don't like fat people much"), fear of fat [three items] (eg. "I feel disgusted with myself when I gain weight") and belief in the controllability of weight or willpower [three items] (eg. "some people are fat pretty much through their own fault") (see appendix C) (p.885). Each item was rated on a Likert scale of one to nine from strongly disagree to strongly agree, with higher numbers indicating greater anti-fat attitudes. The maximum score on the AFA questionnaire is 117. The questionnaire demonstrates good internal reliability with a Cronbach's alpha of .81 (Quinn & Crocker, 1999). Cronbach's alpha for each

subscale was also good .74 (dislike of the overweight), .80 (fear of fat) and .74 (weight controllability) (Roddy, et al., 2010). The Cronbach's Alpha for the AFA questionnaire for the current study was .90.

Weight controllability subscale. Five items were added to the original three item controllability of weight subscale from Crandall's (1994) anti-fat attitudes questionnaire which were taken from Quinn and Crocker's (1999) modified version of the AFA (eg. "Fat people can lose weight if they really want to") (see appendix D). The weight controllability subscale is an eight-item measure. Each item was rated on a Likert scale of one to nine from strongly disagree to strongly agree, with higher numbers indicating greater belief in the controllability of weight. The maximum score on the controllability subscale is 72. The eight-item controllability subscale had a Cronbach's alpha of .85 (Carels & Musher-Eizenman, 2010). The Cronbach's alpha for the 8 item controllability subscale for the current study was .90.

Design

The IRAP is an experimental procedure used to measure differences in response latencies between two responding rules. Presentation of the two rules are manipulated to obtain a measure of implicit bias. Although, the current study does not involve random assignment of participants to conditions. The study involves one group of participants from the general population and collects data at one point in time. Thus, the current research falls under either cross-sectional or quasi experimental quantitative design while employing an experimental procedure.

Participants answered an 18-item anti fat attitudes questionnaire. The first 13 of these items applied to the AFA questionnaire to assess explicit anti-fat attitudes. When entered into IBM SPSS version 26 for data analyses, these 13 items were computed together to create the explicit anti-fat attitudes variable. The 8 items assessing weight

controllability beliefs were computed together to create the separate weight controllability subscale.

The slim-positive, slim-negative, fat-positive and fat-negative IRAP trial types are independent variables. One sample t-tests were conducted for each of these four trial types to determine which trial type is statistically significant from zero. The statistically significant trial types (slim-positive and slim-negative) were entered into a multiple regression analysis as predictor variables. The weight controllability subscale was also a predictor variable entered into the regression analysis. The criterion variable was physical activity levels measured by the GLTEQ.

Finally, the relationship between two independent variables, each participants overall D-IRAP score (average of the four trial types) and explicit anti-fat attitudes measured by the AFA questionnaire was examined in a correlation analysis.

Pilot study

A pilot study was conducted with four participants. Each participant completed the Godin leisure-time exercise questionnaire, anti-fat attitudes questionnaire and the IRAP. A small spelling change was made to the IRAP based on participant feedback. The number of practice blocks in the IRAP were changed from a maximum of eight blocks to a maximum of four blocks (two inconsistent, two consistent practice blocks) to avoid practice effects and to detect a true IRAP effect.

Procedure

Participants contacted the researcher via the email provided on the flyer (see appendix E) which was posted on notice boards in the researcher's local library and shopping centre. These notice boards were freely available to post any type of advertisement and permission was not needed. Participants also heard about the study through word of mouth from those who were aware of the study or had already taken part

in the study. A time and place were arranged with each person who expressed interest in taking part in the study. A quiet distraction free area with a desk or table was chosen by the researcher to conduct the study. A total of 10 participants completed the study at the researcher's residence, seven participants completed the study in their own residence, 11 participants completed the study in a quiet classroom at National College of Ireland and the remaining five participants completed the study in a study area in the researchers local town library. The researcher remained in the same room as the participant when completing the study. Although it was ensured by the researcher to allow the participant privacy to complete the study.

Before beginning, each participant was provided with information about the study via an information sheet displayed on google forms on the researchers own Medion laptop. The information sheet explained that the study involved filling out two questionnaires and the IRAP. Participants were also made aware of the voluntary, confidential and anonymous nature of the study (see appendix F) for information sheet. Participants were given the opportunity to ask any questions before deciding to take part in the study. Participants were free to discontinue participation at any stage.

Before proceeding, participants were required to give informed consent to participate in the study confirming they understood what the study involves as well as the voluntary, anonymous and confidential nature of the study. Informed consent was taken via a consent option on google forms (see appendix G) for consent form.

Explicit measures. Participants then completed the explicit measures via google forms on the researcher's own laptop. The Godin leisure-time exercise questionnaire was presented first followed by the anti-fat attitudes questionnaire. A description of the answering format was provided before the beginning of the first question on both questionnaires (see appendix H) for the questionnaires as displayed on google forms.

After each participant clicked submit, there answers were transferred into a google spreadsheet where the researcher entered an id number for each participant beside their questionnaire answers.

IRAP [Implicit Relational Assessment Procedure]. After completing the two questionnaires, participants commenced the IRAP. Participants were seated at a desk or table in front of the Medion laptop. The researcher entered the id number of each participant into the IRAP program. It was ensured by the researcher that the id number was the same in google spreadsheets. This was vital as the data outputted by the IRAP is stored in a separate file to the questionnaire data. Participants provided their age and gender before beginning the practice blocks. Participants were provided with onscreen instructions about the format of the IRAP and the need to respond accurately (see appendix I). Participants were also provided with onscreen examples of the four trial types before the commencement of the first practice block (see figure 1). Participants were also given oral instructions by the researcher. They were informed that the IRAP would present them with trial blocks but that the rule for responding correctly would change across blocks. They were told that they will be required to respond inconsistently with their beliefs but that this was part of the experiment and they are to respond as quickly and accurately as possible even if it is not consistent with their beliefs. Participants were told that there would be a maximum of four practice blocks and that accuracy must be greater than 80% and the median response latency must be less than 2000 milliseconds. Participants were told to rest their index fingers on the ‘d’ and ‘k’ keyboard keys. The ‘d’ key corresponds to the response option ‘same’ and the ‘k’ key corresponds to the response option ‘opposite’.

Four stimuli were presented in each IRAP trial including the label stimuli (slim or overweight silhouette) which appeared at the top of the screen, target stimuli (a negative or

positive word) appeared in the middle of the screen and the two response options ‘same’ and ‘opposite’ appeared at the bottom left and right corners of the screen (see figure 1). The four stimuli were removed from the screen if the participant selected the correct response option. There is then an interval of 400ms before the presentation of the next trial. If the participant selected the incorrect response option a red x would appear under the target word until the correct response was selected. The IRAP consisted of a maximum of four practice blocks (two consistent blocks, two inconsistent blocks) and a fixed six test blocks (three consistent blocks, three inconsistent blocks) which all contain 24 trials.

A practice block pair requires both consistent responses ‘fat is bad and slim is good’ rule (Rule A) and inconsistent responses ‘fat is good and slim is bad (rule B) and the order of presentation of each rule are counterbalanced between participants. For example, one participant may be required to affirm consistent (Rule A) relations on the first, third and fifth blocks and inconsistent (Rule B) relations on the second, fourth and sixth blocks. While another participant may have to affirm inconsistent (Rule B) relations in the first, third and fifth blocks and consistent (Rule A) relations in the second, fourth sixth blocks. After the 24 trials in each block, participants were presented with onscreen accuracy, response latency feedback and goal scores. If participants did not meet the accuracy and latency criteria, a message stating ‘learn to accurately follow the rule before attempting to respond quickly’ would appear. If the participant met the criteria, a message stating ‘continue responding as accurately and quickly as you can’ would appear. Instructions for the next trial block were then displayed stating that the previously correct and incorrect answers have now been reversed. The participant pressed the spacebar to continue. If participants did not meet practice criteria across a pair within the four practice trial blocks (2 practice block pairs), the screen cleared and a message stated that the task was complete

and to alert the researcher. Participants were then thanked, debriefed and their data was then disregarded. This is because a high level of accuracy and speed is needed to detect a true IRAP effect (Nicholson & Barnes-Holmes, 2012). If a participant met the practice criteria in the first two practice blocks, they would immediately begin the test blocks. Participants were required to meet practice criteria across a pair of practice blocks in order to proceed to the test blocks.

The procedure for the six test blocks was the same as the practice blocks. The presentation order of rule A and rule B in the test blocks were also counterbalanced between participants. A message stating the task was complete and to alert the researcher appeared after completion of the six test blocks. Each participant was thanked for their participation and given a debriefing sheet (see appendix J). Participation included one single session and took between 17-25 minutes depending on speed of the IRAP task and question time.

Ethics

The study complied with the psychological society of Ireland [PSI] and the National College of Ireland [NCI] ethical principles. The American Psychological association [APA] ethical guidelines were also consulted. The study was approved by the NCI ethics committee and any amendments made were agreed with the researcher's supervisor. Participants were made aware of the voluntary, anonymous and confidential nature of the study and their right to withdraw during participation without consequence. Informed consent was taken from all participants before data collection. Participants were told that the researcher was available during or after the study to answer any questions. No deception was used in this study and no data was collected from any vulnerable groups. Participants were also made aware that due to the anonymity of the study, they would be unable to withdraw data at a later stage. It was recognised that due to the sensitive nature

of the topic being studied (body-weight), that participants may become uncomfortable about their own weight. Participants were fully debriefed afterwards and given contact numbers for two helplines in the event that they were too become distressed for any reason.

Results

Descriptive statistics

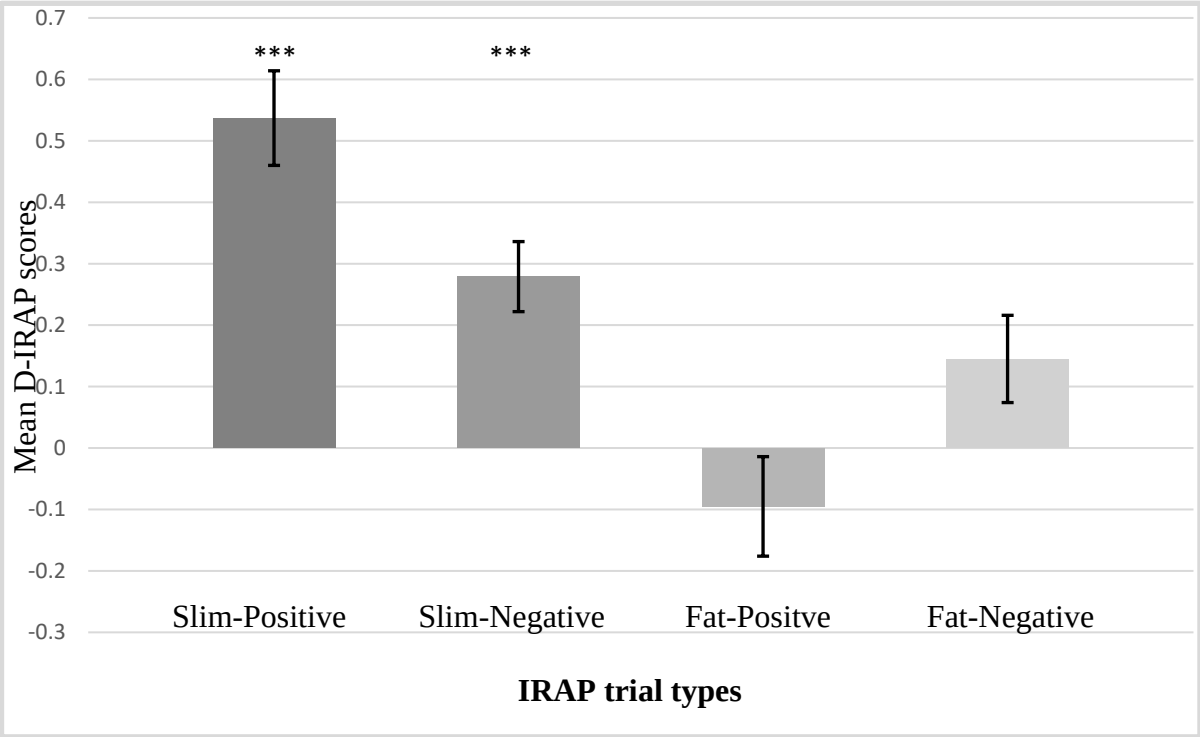
Descriptive statistics for all variables included in the study are presented in table 2 including statistics for the GLTEQ, the AFA questionnaire, the controllability of weight subscale and the four IRAP trial types. The standard deviations for the GLTEQ and the AFA questionnaire were large suggesting that scores are spread out over a wider range. A large range is also evident between minimum and maximum scores on the GLTEQ, AFA and the controllability of weight subscale. Although this is to be expected as the current sample is from the general population where attitudes and activity levels are likely to vary greatly. The mean overall D-IRAP score for the current sample was positive revealing an overall pro-slim/anti-fat bias compared to an anti-slim/pro-fat bias. The IRAP pro-slim trial type had the largest mean value across the four trial types (see below for more details).

Table 2
Descriptive statistics for all continuous variables in the study

Variable	M	SD	M. SE	Median	Range	Minimum	Maximum
GLTEQ	44.36	25.93	4.51	99	45	8	107
Total AFA score	62.88	22.67	3.95	60	93	21	114
Ctl. Subscale	44.58	12.74	2.22	45	53	17	70
IRAP pro-slim trial	.54	.45	.08	.60	1.80	-.34	1.46
IRAP anti-slim trial	.28	.32	.06	.33	1.44	-.36	1.09
IRAP pro-fat trial	-.10	.47	.08	-.07	1.8	-.85	.97
IRAP anti-fat trial	.15	.41	.07	.11	1.56	-.67	.89
Overall D-IRAP score	.76	.85	.15	.60	3.12	-.47	2.64

Note. M=mean, SD=standard deviation, M.SE=standard deviation of mean, AFA=anti-fat attitudes questionnaire, Ctl.subscale=controllability of weight subscale, GLTEQ-Godin leisure time exercise questionnaire.

Figure 2
Mean D-IRAP scores for IRAP trial types



Note. Statistical significance: *p < .05; **p < .01; ***p < .001. Asterisks indicate that the score is significantly different from zero.

Implicit measure [IRAP]. In the IRAP, response latency is defined as time in milliseconds from stimulus onset until a correct response. Response latencies from rule A blocks are subtracted from rule B blocks (Roddy et al., 2010). Response latency is then transformed into D-IRAP scores which is an adaption of Cohen's *d* effect size measure (Hussey, Thompson, McEnteggart, D. Barnes-Holmes & Y. Barnes-Holmes, 2015). D-IRAP scores range from -2 to +2. The specific steps involved in calculating D-IRAP scores are outlined in (Hussey et al., 2015). Positive D-IRAP scores indicated a pro-slim, anti-fat bias while negative D-IRAP scores indicated an anti-slim, pro-fat bias.

Mean D-IRAP scores and standard errors for each trial type are presented in (figure 2). A relatively strong mean D-IRAP score for the slim positive trial type was observed and indicated that participants responded faster to same than opposite. In the slim-negative trial type, participants responded faster to opposite than same. A relatively weak

negative mean D-IRAP score was observed for the fat-positive trial type indicating faster responding to same than opposite and for the fat-negative trial type indicating faster responding to same than opposite.

Inferential statistics

Results of the one sample t-tests conducted on the four IRAP trial types are displayed in table 3. Shapiro Wilk test of normality revealed that the (slim-positive trial type, W(33)=.96, p=.31), (slim-negative trial type, W(33)=.983, p=.86), (fat-positive trial type, W(33)=.96, p=.31) and the (fat-negative trial type, W(33)=.97, p=.53) were all normally distributed and suitable for one sample t-test analyses. The One sample t-tests indicated that the mean D-IRAP scores for the slim-positive, slim-negative and fat-negative trial types were statistically significant from zero. While the fat-positive trial type was not statistically significant from zero. Bonferroni corrections were applied for multiple comparisons. As a result the trial types must meet an alpha level of .0125 to remain statistically significant from zero. Results indicated that the D-IRAP scores for the slim-positive and slim-negative trial types remained statistically significant from zero**.** Overall, the IRAP indicated a positive implicit bias towards the slim silhouette with the absence of any bias towards the fat silhouette. Participants were pro-slim compared to pro-fat.

Table 3
Results of one sample t-tests for each IRAP trial type

IRAP trial type	M	*df*	*t*	*p*
Slim-positive	.54	32	6.93	<.001
Slim-negative	.28	32	4.90	<.001
Fat-positive	-.09	32	-1.20	.25
Fat-negative	.14	32	2.04	.049

Note. M=mean, *df*= degrees of freedom, *t*= t-test statistic, *p*= p value

Multiple regression analysis. According to Austin and Steyerberg (2015) two participants per predictor variable can accurately estimate regression coefficients in linear regression analyses provided the adjusted R^2 is used to interpret variance explained by the model instead of the conventional R^2. Thus, the number of participants in the current study is deemed acceptable to conduct linear regression analyses. The adjusted R^2 will be used to interpret variance in the subsequent analyses.

Multiple regression analysis was performed to determine how well physical activity levels could be explained by three variables including the two significant IRAP trial types (slim-positive and slim-negative) and beliefs in the controllability of weight. Preliminary analyses were conducted to ensure no violation of the assumptions of multicollinearity, normality, linearity, and homoscedasticity. The normal probability plot, scatterplot and histogram of the regression standardised residuals were visually inspected for normality, linearity and homoscedasticity. The residuals appear to be normally distributed as well as display a linear relationship and homoscedasticity (see appendix K). No outliers were identified in the standardised residual scatterplot. The correlations between the predictor variables and the criterion variable included in the study were examined (see Table 4 for full details). The slim-positive and slim-negative IRAP trial

types were significantly correlated with the criterion variable. The correlations between the predictor variables were also assessed with r values ranging from .20 to .38. The assumption of multicollinearity was not violated as correlations above .9 were not observed between predictor variables. Tolerance and VIF values were also within an acceptable range. These results indicate that the data was suitable for examination through multiple regression analysis.

Table 4
Correlations between all continuous variables included in the regression model

	1	**2**	**3**	**4**
1. Total PA score	**1**			
2. Slim-positive trial type	.61***	**1**		
3. Slim-negative trial type	.38*	.38*	**1**	
4. Weight controllability	.23	.32*	.20	**1**

Note. Statistical significance: *p < .05; **p < .01; ***p < .001, Total PA score= total physical activity score measured by the GLTEQ, controllability= weight controllability subscale

Since no *a priori* hypotheses had been made to determine the order of entry of the predictor variables, a direct method was used for the analysis. The three predictor variables explained 33% of variance in physical activity levels ($F(3, 29) = 6.25$; $p = .002$). One of the three variables were found to uniquely predict physical activity levels to a statistically significantly level: slim-positive trial type ($\beta = .53$, $p = .003$) (see table 5 for full details).

The estimated coefficient (B) when divided by its own standard error revealed that only one predictor variable, the slim-positive IRAP trial type belonged in the regression model.

Table 5
Multiple regression model predicting physical activity

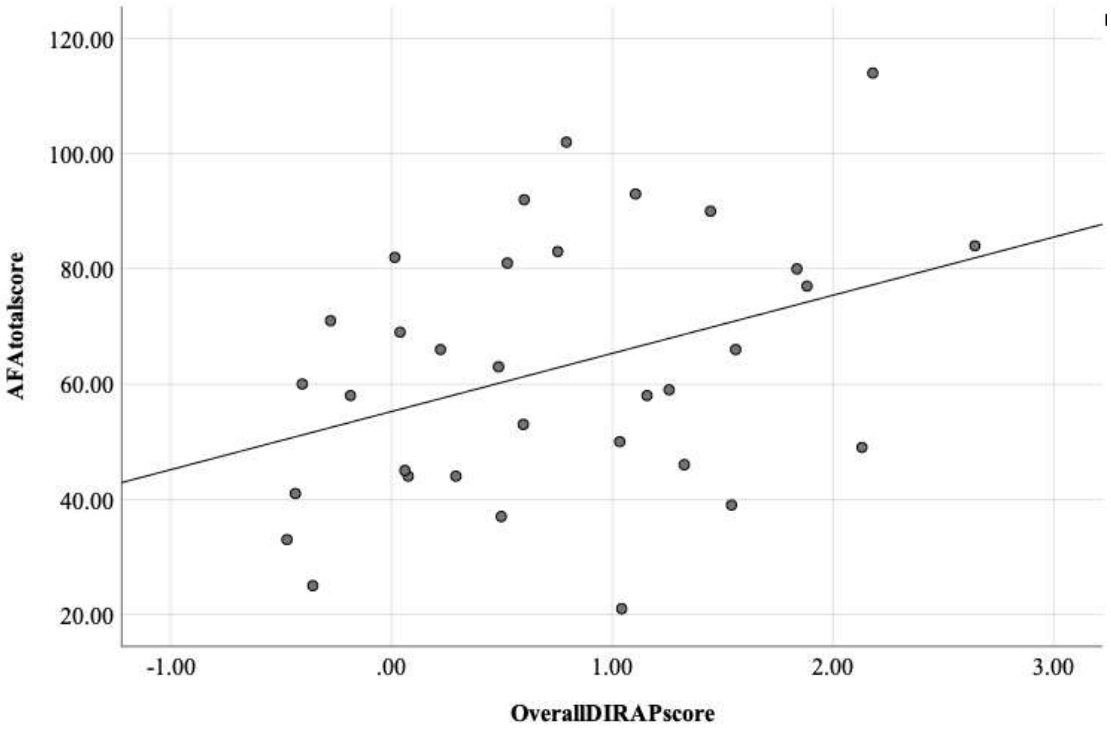
	R	Adj. R^2	β	B	SE	t	CI 95% (B)
Model	.63	.33**					
Slim-positive trial type			.53**	31.07	9.44	3.29	11.77-50.37
Slim-negative trial type			.17	13.29	12.41	1.07	-12.09-38.66
Weight controllability			.03	.05	.31	.17	-.58-.69

Note. Adj. R^2 = Adjusted R-squared; β = standardized beta value; B = unstandardized beta value; SE = Standard errors of B; t = estimated coefficient (B) divided by its own SE. If **t < 2** the PV does not belong to the model; CI 95% (B) = 95% confidence interval for B; N = 33; Statistical significance: *p < .05; **p < .01; ***p < .001.

Implicit/explicit correlation. A one sample t-test revealed that the overall D-IRAP score was statistically significant from zero t(32)=5.14, p<.001. A Pearson's correlation coefficient was computed to assess the relationship between implicit attitudes using the overall D-IRAP score and explicit attitudes using the AFA total score. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. Shapiro-Wilk tests showed that the (overall D-IRAP score, W(33)=.96, p=.31) and the (AFA total score, W(33)=.98, p=.89) were both normally distributed. Normal Q-Q plots, histograms and the standardized residual plot displaying homoscedasticity for the overall D-IRAP score and AFA total score are displayed in (appendix L). The two variables displayed a linear relationship (see figure 4). There was a significant moderate positive correlation between the overall D-IRAP score and the AFA total score, r(33)=.38, [95% CI= 0.8-.61], p=.03. This indicates that the two variables share approximately 14.4% of variance in common. Results indicate that higher levels of implicit pro-slim, anti-fat bias on the IRAP are associated with higher levels of self-reported anti-fat bias on the AFA questionnaire.

Figure 4

Scatterplot of the positive relationship between implicit and explicit weight bias



A strong significant level of pro-slim bias was observed in the current sample with the absence of significant anti-fat bias. The IRAP pro-slim trial type was the only significant predictor of physical activity. Controllability of weight beliefs was not a significant predictor of physical activity. Finally, a significant positive relationship was observed between explicit anti-fat bias and implicit pro-slim/anti-fat bias. The interpretation and implications of these results are discussed below.

Discussion

The current study aimed to investigate if implicit attitudes towards bodyweight measured using the IRAP and self-reported weight controllability beliefs predicted physical activity levels in a general population. A significant level of pro-slim bias was observed in the current sample while the presence of an anti-fat bias was not found. This finding is inconsistent with previous studies which found a strong anti-fat bias using the IAT (O'Brien et al., 2007; Robertson & Vohora, 2008; Schwartz et al., 2006). Similar to current findings, studies that used the IRAP found a stronger positive implicit bias towards slim rather than a negative implicit fat bias (Roddy et al., 2010; Roddy et al., 2011). Overall, participants were pro-slim rather than anti-fat.

Firstly, it was predicted that implicit attitudes towards bodyweight would influence physical activity levels. The major finding from this study was that an implicit pro-slim attitude predicted physical activity levels. We believe this is the first study to investigate the relationship between implicit weight bias and physical activity. This is similar to Ferguson's (2007) finding that attitudes towards thinness predicted avoidance of tempting foods which was seen as a goal directed behaviour to achieve thinness. Physical activity could also be seen as a goal behaviour to achieve thinness.

The slim-negative IRAP trial type was not a significant predictor of physical activity. Although a significant correlation between this trial type and physical activity was observed when examining the regression correlational matrix. This positive relationship indicates that faster responding to opposite when a negative word was paired with the slim silhouette was associated with higher physical activity. As the two fat IRAP trial types were not found to be significant from zero, these were not examined as predictors of physical activity. This means that the first hypothesis was partially supported.

Secondly, it was predicted that weight controllability beliefs would influence physical activity levels. This hypothesis was not supported. Weight controllability beliefs were not a significant predictor of physical activity. This finding is inconsistent with previous studies that have linked higher weight controllability beliefs with higher physical activity levels (Martin et al., 2011; Vartanian & Herman, 2006). Previous research has also found weight controllability beliefs to be linked with physical activity avoidance in overweight adults **(**Ball et al., 2000; Kebbe et al., 2018; Schmalz, 2010). Thus, the current findings as well as the previous research has not confirmed the direction of the relationship between these beliefs and physical activity. This relationship may be effected by the weight of the individual themselves. Future research could seek to clarify and investigate this relationship further by examining how weight controllability beliefs may influence exercise engagement differently in overweight and normal weight individuals.

Higher weight controllability beliefs appear to contribute to internalised weight bias including a preference for slim body types (Carels & Musher-Eizenman, 2010; Crandall, 1994). It was observed that both the slim-positive and slim-negative trial types were significantly correlated with weight controllability beliefs. This provides additional support that a pro-slim attitude may incorporate weight controllability beliefs, but only the implicit pro-slim attitude significantly predicted physical activity.

The third and final aim was to examine the relationship between the explicit and implicit measures of anti-fat attitudes. Social desirability responses can prevent the expression of explicit anti-fat bias (Friese et al., 2008; Greenwald & Banaji, 1995). However, findings in the current study showed a significant positive moderate relationship between implicit pro-slim/anti-fat bias and explicit anti-fat bias. Although it is recognised that this relationship is mainly due to the prevalent implicit pro-slim bias as a significant level of implicit anti-fat bias was not found. Thus, the more pro-slim participants were the

higher they scored on the explicit measure of anti-fat bias. This is inconsistent with findings that found no association between explicit and implicit weight bias on the IAT (Carels et al., 2009; Teachman & Brownell, 2001). Studies found significant positive correlations between implicit and explicit weight bias using the IRAP which is consistent with current findings (Nolan et al., 2013; Roddy et al., 2010). The observed relationship also provides support that a pro-slim bias may be associated with an anti-fat bias (Carels & Musher-Eizenman, 2010) at least when one of these biases is reported explicitly. The IRAP may be a more reliable measure of weight bias and future research in this area could consider using the IRAP.

Implications

Explicit controllability beliefs alone may not account for physical activity engagement. Thus, encouraging physical activity in weight management or other health interventions through emphasising the controllability factors of weight may not be sufficient to predict physical activity outcomes. Although an Implicit pro-slim attitude which incorporates implicit weight controllability beliefs such as faster responding to active and motivated when paired with the slim silhouette significantly predicted physical activity. This highlights the importance for research to examine the implicit processes that may underlie behavioural choices.

Health and weight management interventions could attempt to focus on the implicit or automatic associations between slim body types and controllability factors to promote physical activity. Previous research successfully used diversity training using a variant of the IAT to improve men's implicit associations towards women in certain occupations (Jackson, Hillard & Schneider, 2014). Individuation perceptual training has been found to improve the ability to differentiate between races to ultimately reduce implicit racial bias (Lebrecht, Pierce, Tarr & Tanaka, 2009). Although it is recognised that other associations

also lead to an implicit pro-slim attitude such as the target stimuli used in this study such as good, successful, pleasant and attractive. Emphasising these implicit associations in any health intervention may increase bias as well as unhealthy weight management attempts to achieve the thin ideal. Any intervention should take extra caution if attempting to modify or influence health beliefs through automatic association or perceptual training.

Limitations

The Cronbach's alpha reliability coefficient for the GLTEQ was below that of an acceptable level for a psychometric measure. This suggests that the measure lacks internal consistency. The small number of questions in the GLTEQ may contribute to this low Cronbach's alpha. It was noticed that some participants reported engaging in a large number of mild exercises a week for example easy walking but reported engaging in no strenuous or moderate exercise. This lack of consistency between items is an issue with this measure. This limitation should be considered when interpreting the current results. Future research could examine the influence of implicit attitudes towards slim on different types of physical activity. It may be of interest to examine if individuals with a stronger pro-slim bias may engage in more strenuous voluntary exercise such as sporting activity. The current sample size was relatively small and may limit generalisability of results. Although, the sample size is similar to sample sizes used in other research that used an IRAP to measure implicit weight bias (Nolan et al., 2013; Parling, Cernvall, Stewart, Barnes-Holmes & Ghaderi, 2012).

The current research does not claim to offer a complete explanation for physical activity engagement. An Implicit pro-slim attitude may make a significant contribution in predictive models of physical activity. Future research could seek to clarify the findings outlined in this research through controlling for other factors related to physical activity engagement.

Conclusion

This main aim of the present research was to investigate if implicit attitudes towards bodyweight and self-reported weight controllability beliefs influenced physical activity levels. The current findings extended the bodyweight bias literature. A strong level of pro-slim bias was observed. The use of the IRAP allowed for a complex measurement of the directionality and combinations of this bias and revealed a pro-slim rather than an anti-fat bias which is consistent with previous IRAP literature. This pro-slim bias significantly predicted physical activity levels. Explicit weight controllability beliefs was not a significant predictor of physical activity which is inconsistent with the previous literature. It is recognised that training implicit pro-slim attitudes to increase physical activity in health interventions may have a negative effect on weight loss attempts. Thus, it is concluded that these findings should be considered carefully when attempting to modify attitudes through any type of implicit association training. Intervention could focus on the implicit controllability factors that relate to an implicit pro-slim attitude rather than the positive attributes such as attraction or success. This was the first study that we know of to examine the relationship between implicit bodyweight bias, explicit weight controllability factors and physical activity engagement. Future research could attempt to build and extend upon these findings as they may be relevant to public health intervention.

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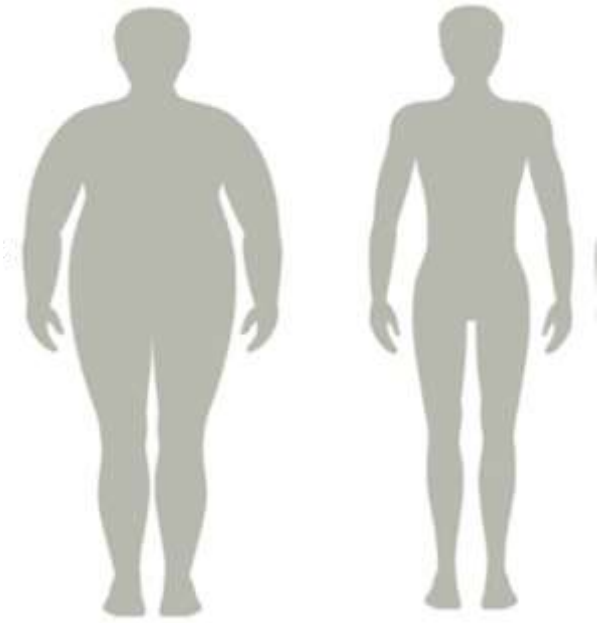
Appendix A

Label stimuli for IRAP



Target stimuli for IRAP

Good	Bad
Pleasant	Unpleasant
Attractive	Unattractive
Successful	Unsuccessful
Active	Lazy
Motivated	Unmotivated

Appendix B

Godin Leisure-Time Exercise Questionnaire

INSTRUCTIONS

In this excerpt from the Godin Leisure-Time Exercise Questionnaire, the individual is asked to complete a self-explanatory, brief four-item query of usual leisure-time exercise habits.

CALCULATIONS

Weekly frequencies of strenuous, moderate, and light activities are multiplied by nine, five, and three, respectively. Total weekly leisure activity is calculated in arbitrary units by summing the products of the separate components, as shown in the following formula:

Weekly leisure activity score = (9 x Strenuous) + (5 x Moderate) + (3 x Light)

EXAMPLE

Strenuous = 3 times/wk

Moderate = 6 times/wk

Light = 14 times/wk

Total leisure activity score = (9 x 3) + (5 x 6) + (3 x 14) = 27 + 30 + 42 = 99

Godin Leisure-Time Exercise Questionnaire

1. During a typical **7-Day period** (a week), how many times on the average do you do the following kinds of exercise for **more than 15 minutes** during your free time (write on each line the appropriate number).

Times Per Week

a. STRENUOUS EXERCISE

(HEART BEATS RAPIDLY) _____

(e.g., running, jogging, hurling, rugby, football, soccer,

kayaking, basketball, boxing, karate,

roller skating, vigorous swimming,

vigorous long-distance bicycling)

b. MODERATE EXERCISE

(NOT EXHAUSTING) _____

(e.g., fast walking, weightlifting, tennis, easy bicycling,

volleyball, badminton, easy swimming,

home aerobic or calisthenics exercise, popular and folk dancing)

c. MILD EXERCISE

(MINIMAL EFFORT) _____

(e.g., yoga, archery, fishing, bowling,

slow-dancing, golf, Pilates, easy walking)

Appendix C

Anti-fat Attitudes Questionnaire (AFA)

The AFA is scored using a Likert-type response format (1 = Strongly disagree; 9 = Strongly agree). Higher scores indicate stronger anti-fat attitudes [13 items]

Dislike

1. I really don't like fat people much.
2. I don't have many friends that are fat.
3. I tend to think that people who are overweight are a little untrustworthy.
4. Although some fat people are surely smart, in general, I think they tend not to be quite as bright as normal weight people.
5. I have a hard time taking fat people too seriously.
6. Fat people make me somewhat uncomfortable.
7. If I were an employer looking to hire, I might avoid hiring a fat person.

Fear of Fat

1. I feel disgusted with myself when I gain weight.
2. One of the worst things that could happen to me would be if I gained 25 pounds.
3. I worry about becoming fat.

Controllability of weight/Willpower

1. People who weigh too much could lose at least some part of their weight through a little exercise.
2. Some people are fat because they have no willpower.
3. Fat people tend to be fat pretty much through their own fault.

Appendix D

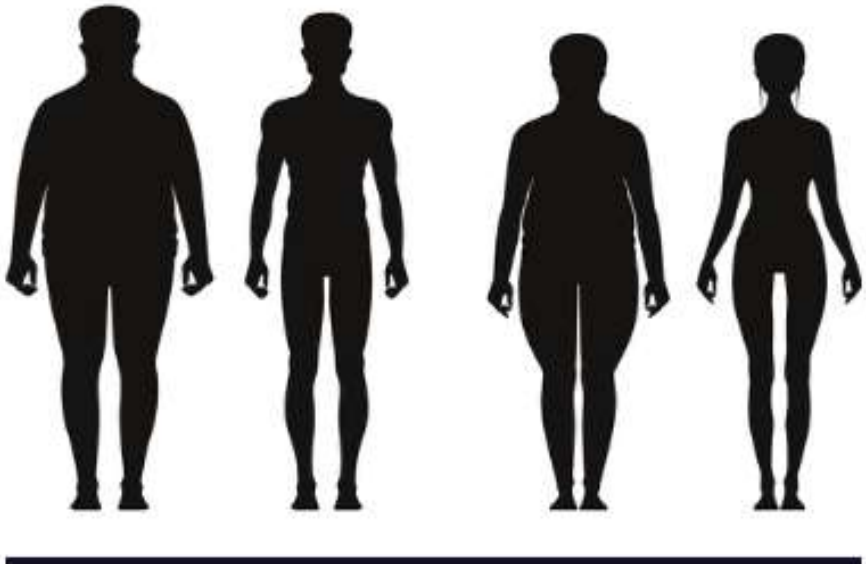
Controllability of weight subscale

The subscale is scored using a Likert-type response format (1 = Strongly disagree; 9 = Strongly agree). Higher scores indicate greater beliefs in the controllability of weight [8 items]

1. People who weigh too much could lose at least some part of their weight through a little exercise.
2. Some people are fat because they have no willpower.
3. Fat people tend to be fat pretty much through their own fault.
4. Fat people can lose weight if they really want to
5. Through a combination of exercise and dieting, anyone can lose weight and keep it off indefinitely.
6. The medical problems that overweight people have are their own fault.
7. Overweight people are responsible for their own problems
8. Weight is something which is under a person’s control

Appendix E

Flyer to recruit participants



PARTICIPANTS NEEDED

For a psychological study on:

The influence of bodyweight and weight controllability attitudes on physical activity levels

Involves filling out two questionnaires and one experimental procedure
Participation time: 15-20 minutes

If you are interested and over 18 years old- Email Eleanor at
x16121180@student.ncirl.ie

Appendix F

Information sheet

The influence of bodyweight and weight controllability attitudes on physical activity levels:

I would like to invite you to take part in my research study. Before you decide you need to understand what my research is about and what I am asking you to do. Please read this information sheet carefully and feel free to ask me any questions before deciding if you would like to take part.

Who am I and what is the study about?

My name is Eleanor and I am doing this research for my thesis/research project for the final year of my Psychology degree at National College of Ireland. The aim of my study is to investigate the influence of implicit attitudes towards bodyweight and weight controllability beliefs on the amount of physical activity engaged in by those in the general Irish population.

What will taking part involve?

Taking part in this study will involve you having to fill out the Godin leisure time exercise questionnaire. This is a short questionnaire consisting of 3 questions that will ask you about the time you spend being physically active over a typical 7-day period. You will then fill in the anti-fat attitudes questionnaire which consists of 18 questions assessing your belief in the controllability of weight, dislike towards overweight individuals and fear of fat. An implicit measure of attitudes towards bodyweight will be taken using the Implicit Relational Assessment Procedure [IRAP]. The IRAP measures implicit attitudes which are those we are not aware for example an implicit preference or dislike towards a particular group. These attitudes although they are unintentional are said to predict behaviour. The IRAP used in this study will assess implicit attitudes towards

overweight/obese and slim individuals. A trial IRAP will be run first to familiarize yourself with the procedure. Participation is expected to take around 15-20 minutes. Before beginning the IRAP, you will be asked to report your gender and age.

Do you have to take part?

Participation is completely voluntary, and you are under no obligation to take part or answer any questions you do not want to. If at any stage during participation you decide you do not want to take part or continue you can withdraw without any consequence.

What are the possible risks and benefits of taking part?

You are contributing to research on the influence of attitudes towards bodyweight on physical activity in Ireland. It may be possible participants may begin to worry about their weight due to participation or experience discomfort due to the sensitive nature of the topic. Each participant will be fully debriefed afterwards and given a contact number for a helpline. Participants with photosensitive epilepsy are not advised to take part in this study, due to the nature of flashing stimuli on the computer screen during the IRAP.

Will taking part be confidential?

Any data or information collected in written form, verbally or electronically will be kept entirely confidential and not shared with any third party. Informed consent will be collected from you before the study begins and this will be kept private and only for my viewing.

How will information you provide be recorded, stored and protected?

Data collected from the IRAP, The Godin leisure time activity questionnaire and The Anti-fat attitudes questionnaire will be transcribed into a dataset on my own personal laptop where data will not be identifiable to the person who provided it. Each participant will be given an id number, and this will be displayed in the data file. Computer based data will be stored on an encrypted, password protected device, accessible only by the researcher.

What will happen to the results of the study?

The results of the study will be submitted to National College of Ireland for grading as part of my final year research project. They may also be included in publications and presentation at a psychological research conference.

Who should you contact for further information?

Contact Eleanor O'Connell at x16121180@student.ncirl.ie if you have any further queries about the study. Contact my supervisor Dr.Conor Nolan at conor.nolan@ncirl.ie.

Appendix G

Consent form

I voluntarily agree to participate in this research study. I understand that I can withdraw during participation or not answer any question without any consequence. I have read the information sheet and understand what the study involves and have been given the opportunity to ask questions. I understand the study involves having to fill out three questionnaires and partake in an Implicit Relational Assessment Procedure. I understand the benefits associated with participating in this research and that all my data will be kept completely confidential. I understand that my personal data such as my name will remain anonymous in the written report, any publication or in any presentation. I understand that this signed consent form will be securely stored until the researcher receives their results of their research project after which they will be discarded. I understand that I am entitled to contact the researcher or their supervisor to ask any further questions or seek additional information on the study. I further confirm that I do not have photosensitive epilepsy.

Contact

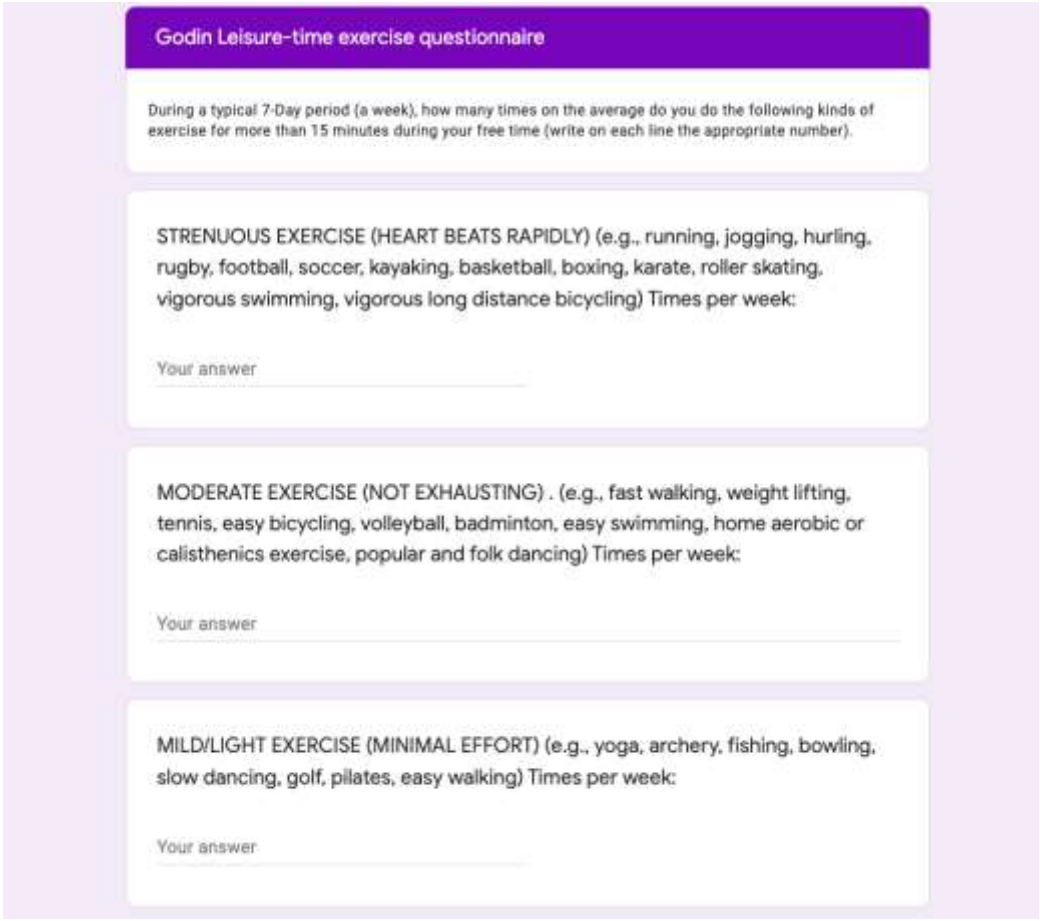
Eleanor O'Connell, National College of Ireland, x16121180@student.ncirl.ie

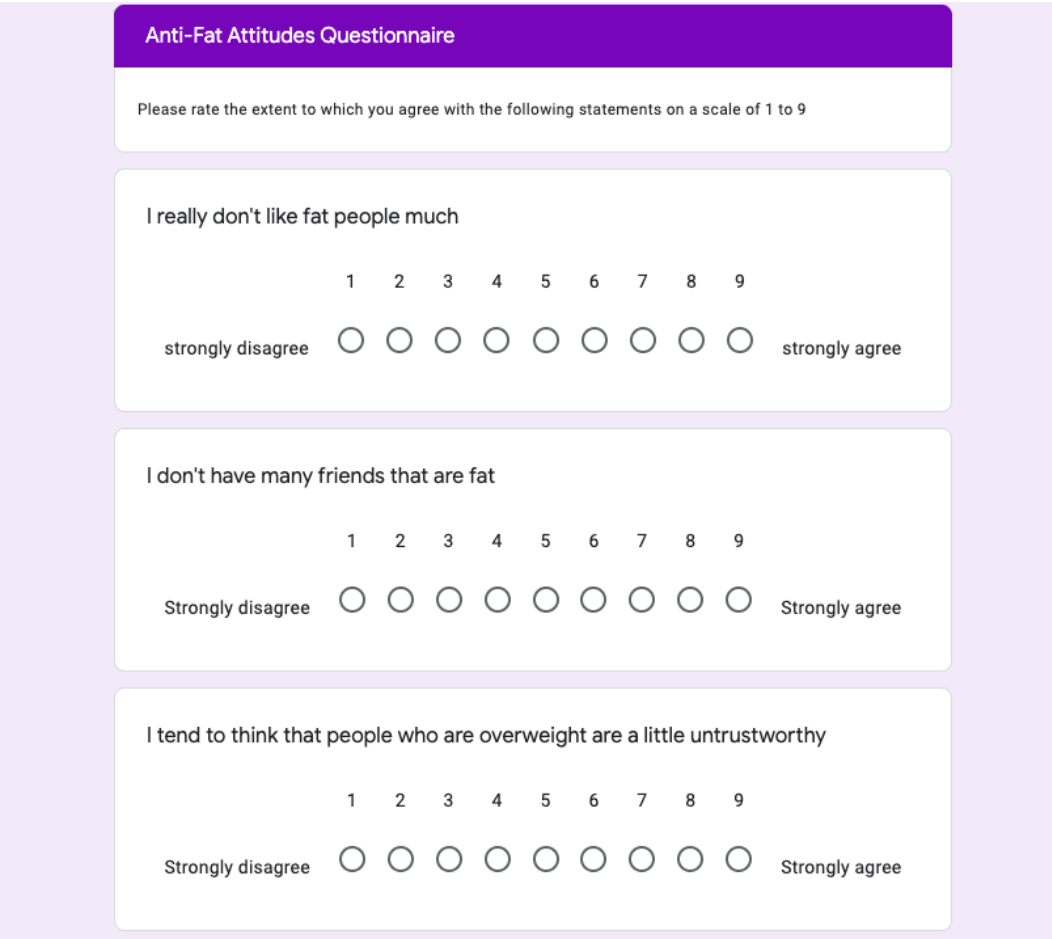
Dr Conor Nolan, National College of Ireland, conor.nolan@ncirl.ie

Appendix H

Questionnaires as presented on google forms

https://docs.google.com/forms/d/e/1FAIpQLSeh4eWC1p6qfAU39fnAYIterIIsm2f61zEXq78fqJsvB0tRjg/viewform?usp=sf_link





Anti-Fat Attitudes Questionnaire

Please rate the extent to which you agree with the following statements on a scale of 1 to 9

I really don't like fat people much

	1	2	3	4	5	6	7	8	9	
strongly disagree	○	○	○	○	○	○	○	○	○	strongly agree

I don't have many friends that are fat

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

I tend to think that people who are overweight are a little untrustworthy

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

Although some fat people are surely smart, in general, I think they tend not to be quite as bright as normal weight people

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

I have a hard time taking fat people too seriously

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

Fat people make me somewhat uncomfortable

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

If I were an employer looking to hire, I might avoid hiring a fat person

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

I feel disgusted with myself when I gain weight

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

One of the worst things that could happen to me would be if I gained 25 pounds

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	strongly agree

I worry about becoming fat

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

People who weigh too much could lose at least some part of their weight through a little exercise

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

Some people are fat because they have no willpower

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

Fat people tend to be fat pretty much through their own fault

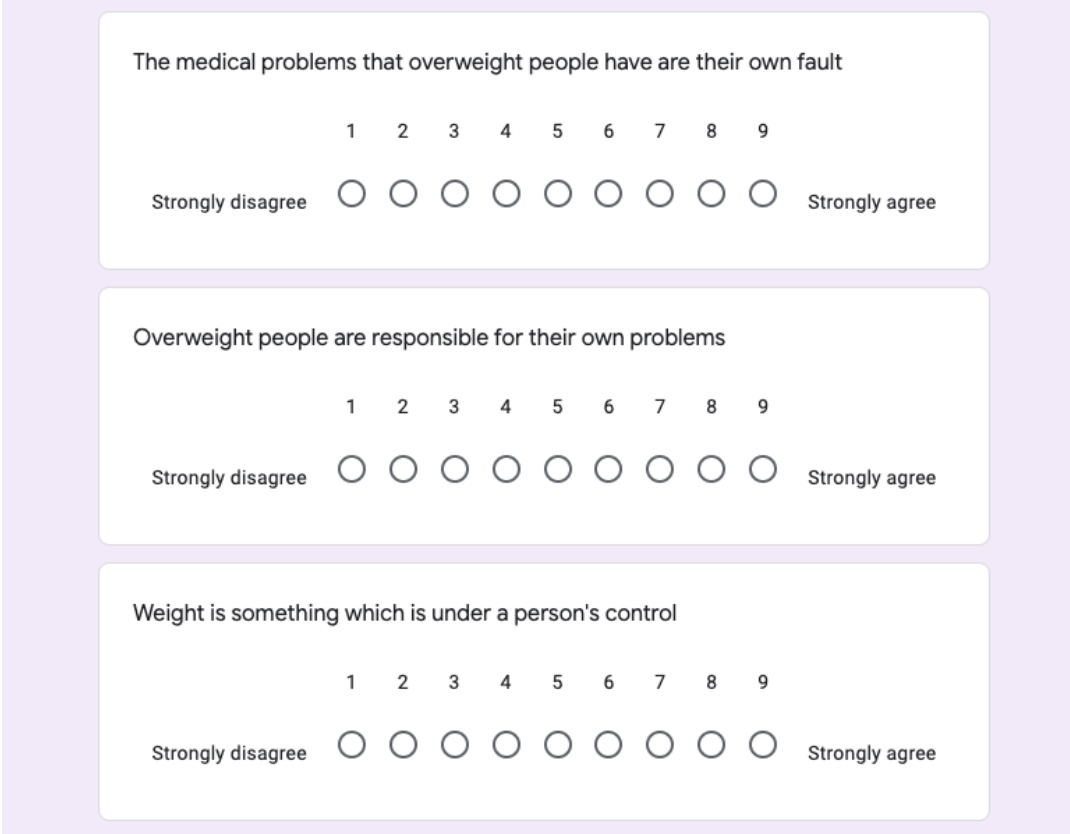
	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

Fat people can lose weight if they really want to

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree

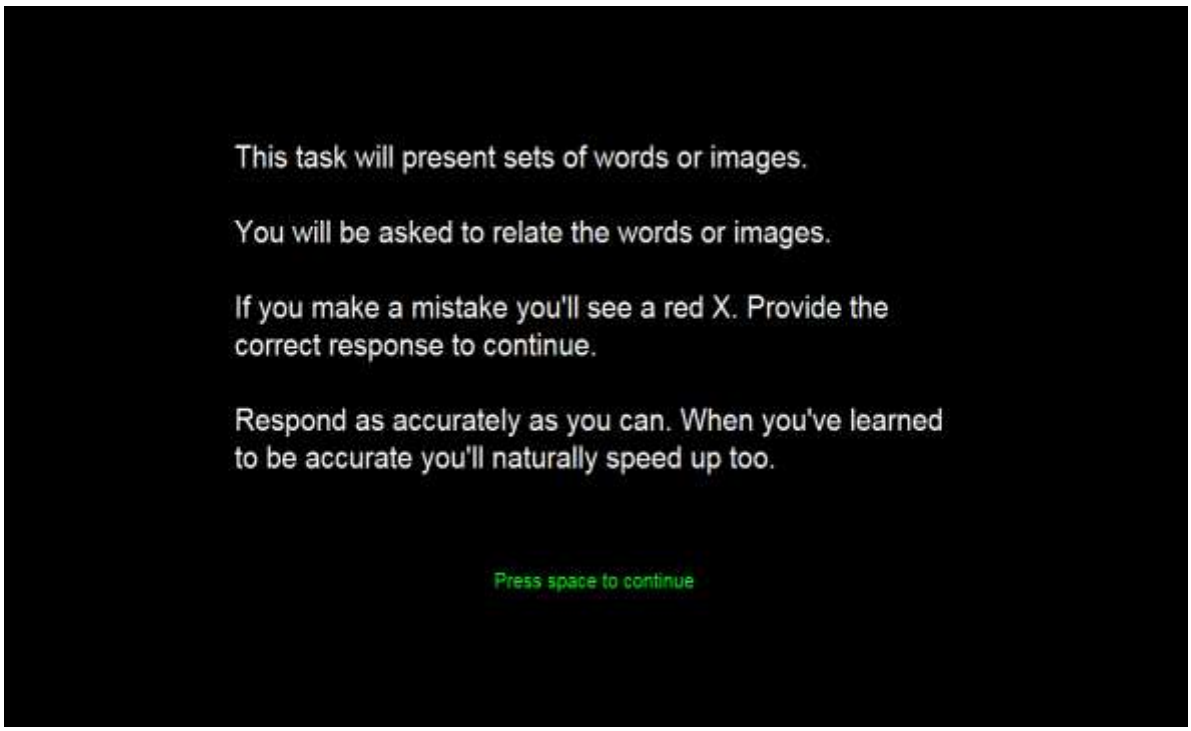
Through a combination of exercise and dieting anyone can lose weight

	1	2	3	4	5	6	7	8	9	
Strongly disagree	○	○	○	○	○	○	○	○	○	Strongly agree


The medical problems that overweight people have are their own fault
1 2 3 4 5 6 7 8 9
Strongly disagree
Strongly agree
Overweight people are responsible for their own problems
1 2 3 4 5 6 7 8 9
Strongly disagree
Strongly agree
Weight is something which is under a person's control
1 2 3 4 5 6 7 8 9
Strongly disagree
Strongly agree

Appendix I

Onscreen instructions at the beginning of IRAP



Appendix J

Debriefing form

Thank you for participating in this research. Your time and participation are much appreciated. Please feel free to contact myself Eleanor O'Connell at x16121180@student.ncirl.ie or my supervisor Dr. Conor Nolan at conor.nolan@ncirl.ie if you wish to ask any further questions or seek any additional information about the study. No personal details have been collected or retained. Due to the anonymous nature of the study, it is not possible to withdraw or access the data you have provided. Thank you again for your participation and time.

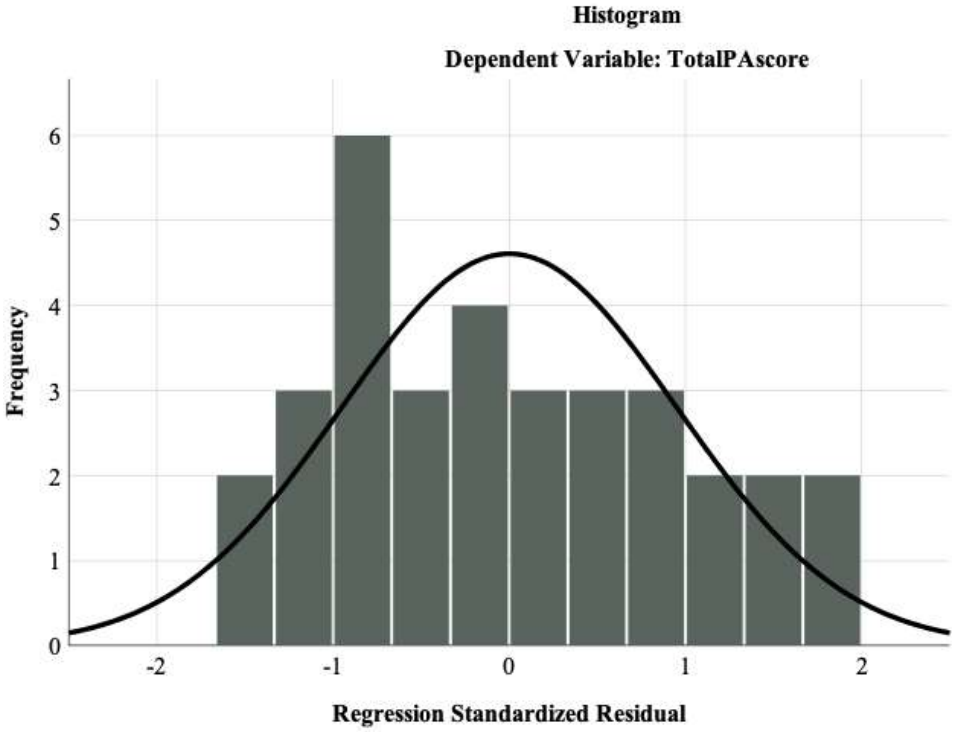
Should the content of this research have caused you any distress, please avail of the below services:

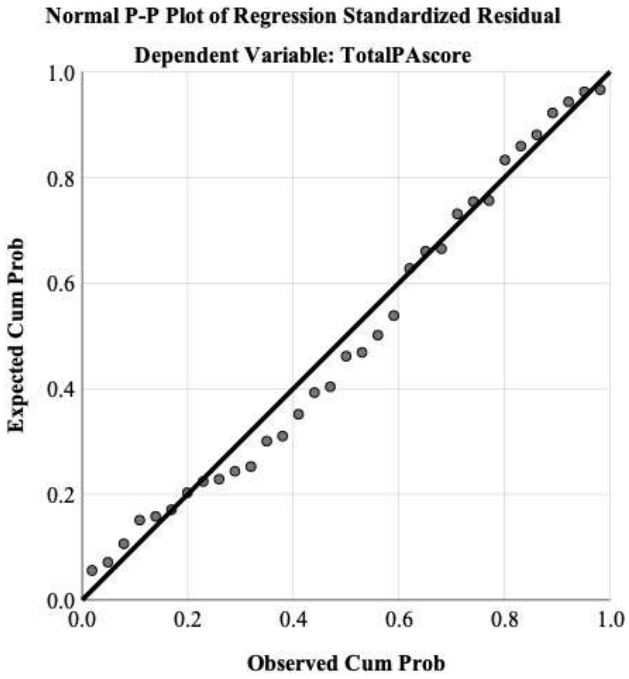
Samaritans: 116123

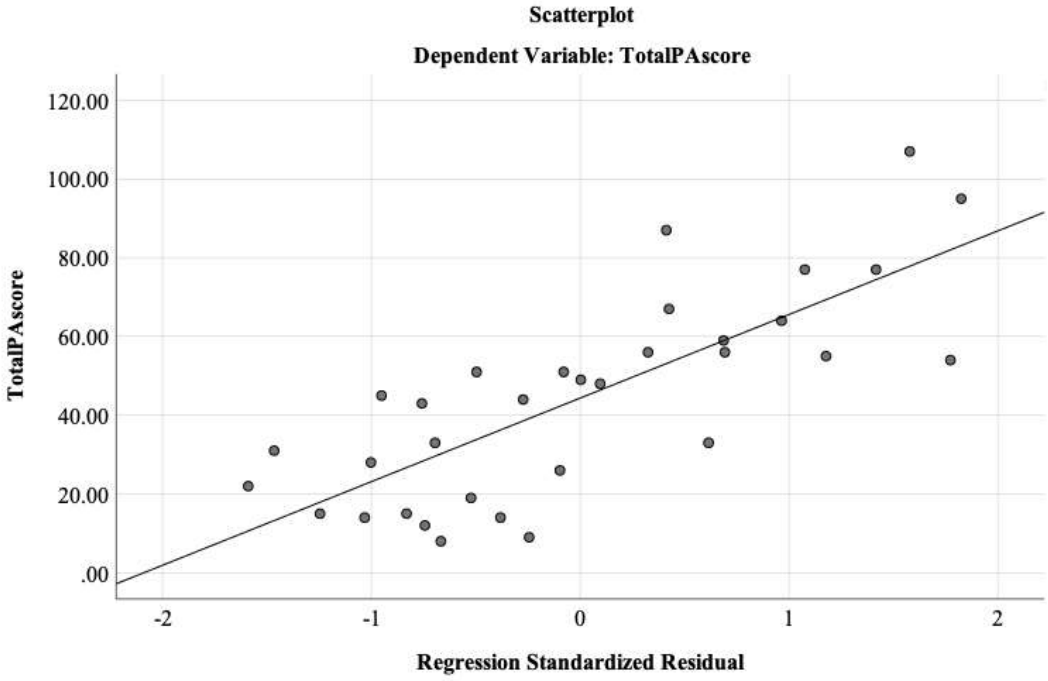
Aware: 1800 80 4848

Appendix K

Regression standardised residual plots



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80.00
60.00
40.00
20.00
.00
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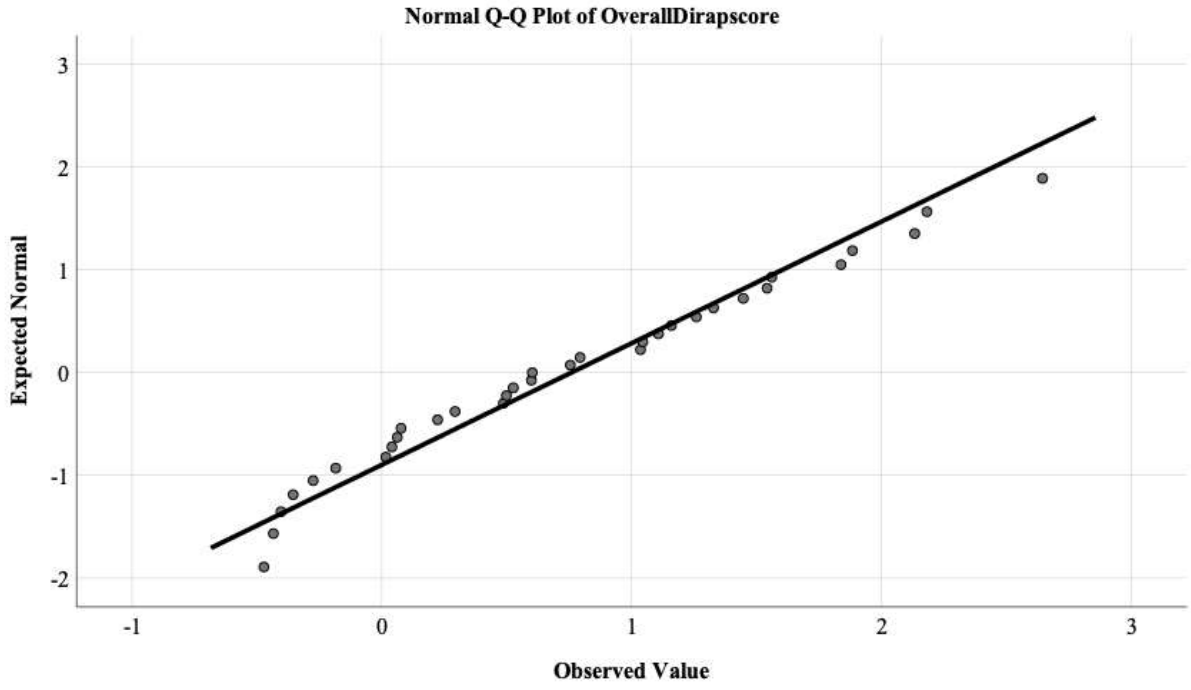
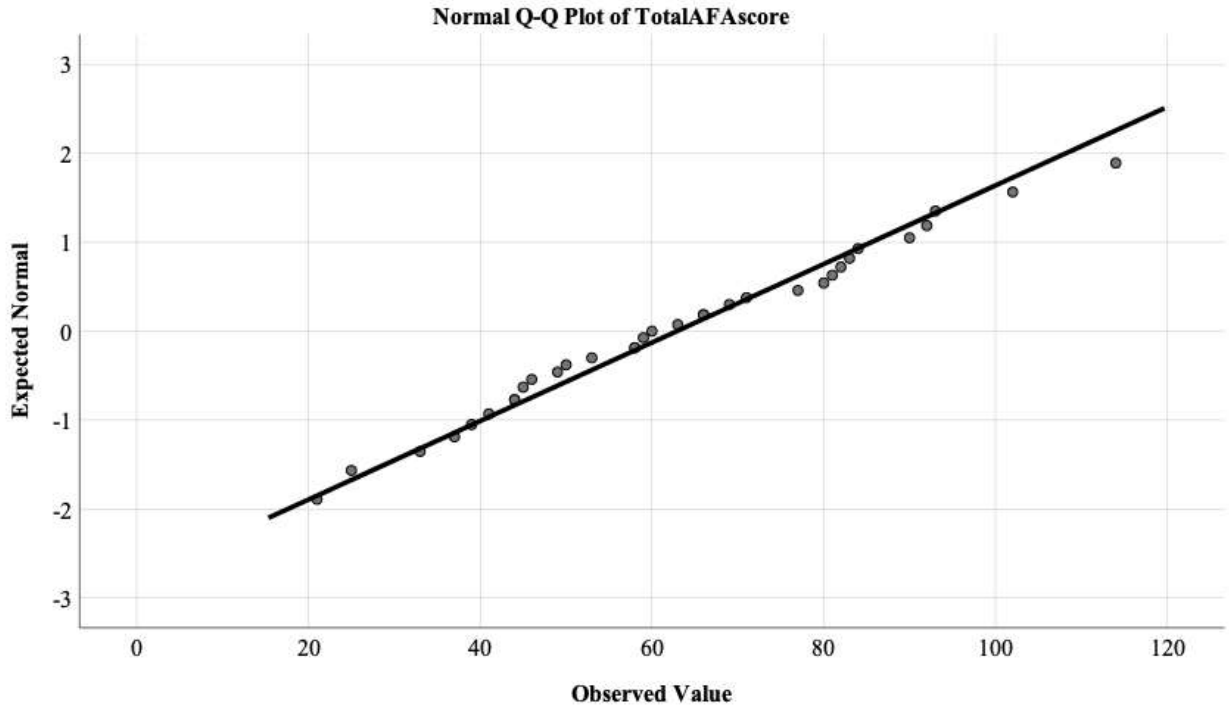
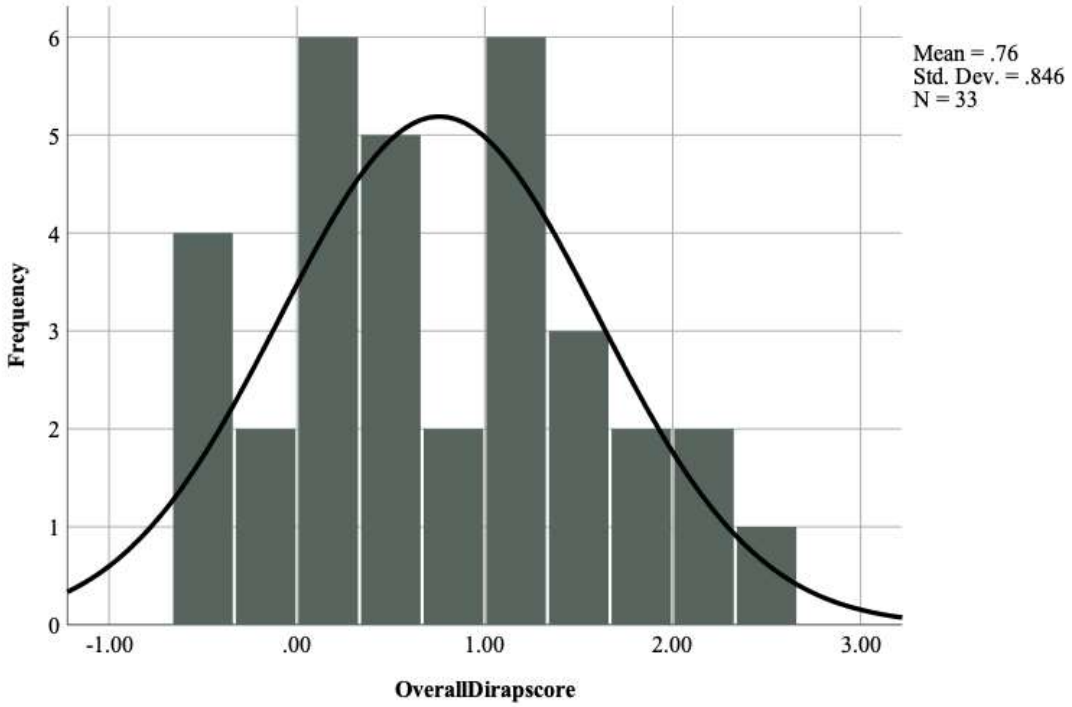
-1
0
1
2
Regression Standardized Residual

Appendix L

Normal Q-Q plots, histograms and standardized residual plot for overall D-IRAP score and total AFA score



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2
3
4
5
6
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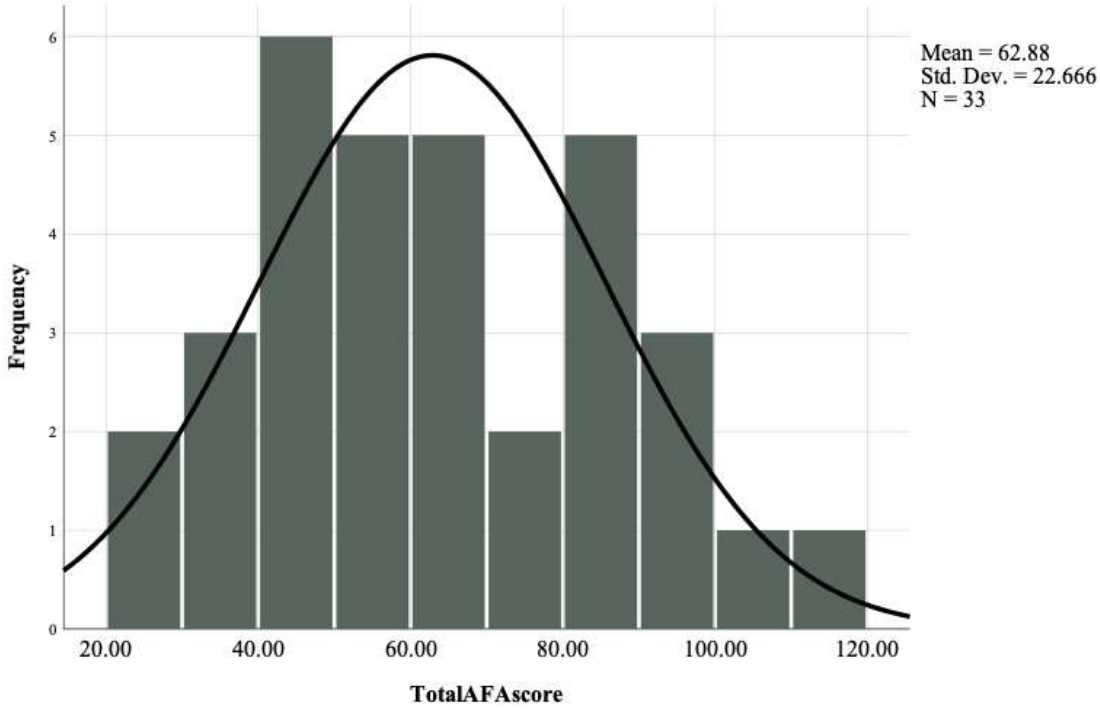
.00
1.00
2.00
3.00
OverallDirapscore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N = 33
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2
3
4
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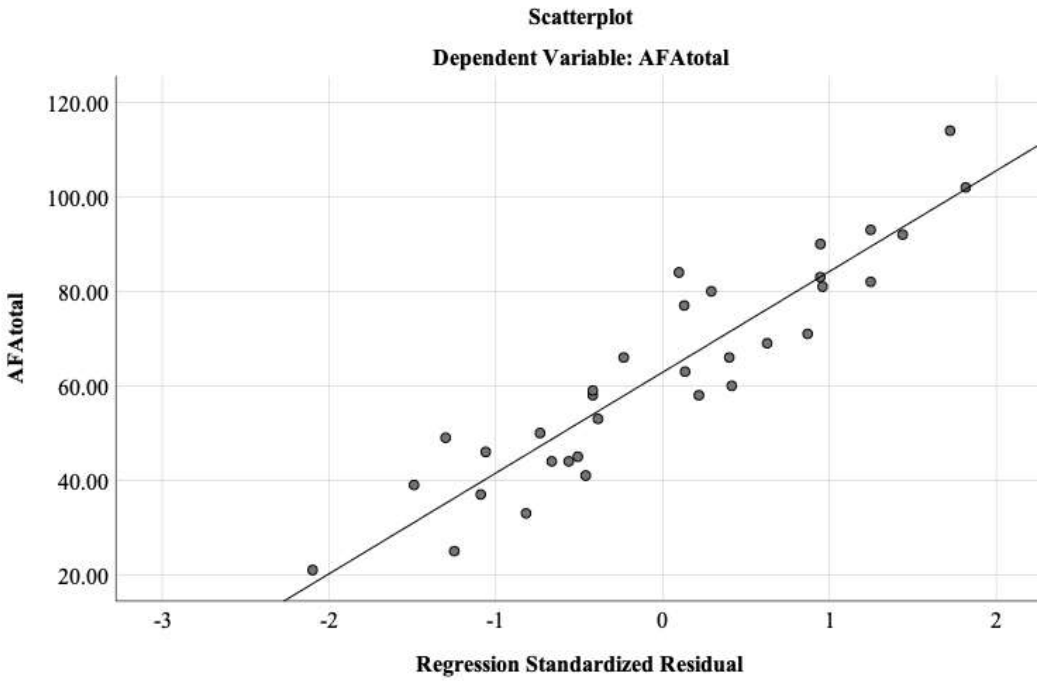
6
20.00
40.00
60.00
80.00
100.00
120.00
TotalAFAscore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Dependent Variable: AFAtotal
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60.00
40.00
20.00
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-2
-1
0
1
2
Regression Standardized Residual

Appendix M

Evidence of data collection in SPSS