U-shaped association between body mass index and psychological distress in a population sample of 114,218 British adults

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To the Editor

The association between obesity and psychological distress remains controversial. Systematic reviews have highlighted the bi-directional nature of this relationship[1] and other modifying factors may play a role.[2] Mendelian randomization studies, using adiposity-related genetic variants as an unconfounded instrument variable for obesity have produced inconsistent findings.[3,4] In the present study we pooled together data from 10 general population household-based surveys in order to better explore the shape of the association between body mass index (BMI) and psychological distress.

Participants were recruited from Health Survey for England and Scottish Health Survey, described elsewhere.[5] Local research ethics committees approved all aspects of each survey and all participants gave written informed consent. Psychological distress was assessed using the 12 item version of the General Health Questionnaire (GHQ-12), that has been validated against standardised psychiatric interviews to diagnose depression and anxiety.[6] Trained interviewers measured height and weight to derive BMI, which was categorised as underweight (<18.5 kg.m^{-2}), normal weight ($18.5 - 24.99$ kg.m^{-2}), overweight ($25 - 29.99$ kg.m^{-2}), obese I ($30 - 34.99$ kg.m^{-2}), and obese II / III (≥35 kg.m^{-2}). In multinomial regression, the dependent variable (psychological distress) was modelled as three categories (GHQ-12 score = zero [Ref]; $1 - 3$; >3). The models were adjusted for age, sex, smoking (never; ex-smoker; current), participation in moderate to vigorous physical activity (inactive; <150 min/wk; $\geq$ 150 min/wk), chronic illness (yes or no). All analyses were performed using SPSS version 22 (IBM Inc.).

The sample comprised 114,218 participants (45.9±17.5 years, 45.7% men). Psychological distress (GHQ-12>3) was prevalent in 14.7% of the sample, particularly in

younger participants, women, smokers, physically inactive and those with chronic illness. We observed a U-shaped association between BMI and psychological distress; compared with normal weight, the underweight and stage II/III obese participants had higher odds whilst the overweight and obese stage I had lower odds of psychological distress (Table). When examining sub-clinical levels of distress (GHQ-12 score= 1 – 3), the overweight and obese both had lower odds of distress compared with normal weight participants.

This study represents the largest individual participant analysis to date on objectively assessed BMI and psychological distress. We found a U-shaped association between BMI and psychological distress, with overweight and obese stage I displaying the lowest odds of distress. Data were only collected at one time point thus it is not possible to infer what direction the associations were operating in. It has been previously hypothesized that overweight or obesity might be related to increased risk of psychological distress via mechanisms involving stigmatization and low self-esteem, although this may no longer be the case as the population distribution increasingly shifts towards higher BMI and excess adiposity becomes the norm (i.e., 58.8% of the present sample were overweight or obese). In fact the present results suggest overweight /obesity (<35 kg.m^{-2}) was associated with lower odds of psychological distress. These findings are partly consistent with previous evidence showing people with low genetic risk scores for obesity had over three times greater odds of stress and anxiety compared to their high risk counterparts.[4] Nevertheless, the mechanisms remain unclear.

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Table . Multinomial regression to examine association between body mass index and psychological distress (n=114,218)

BMI category	N	Sub-clinical psychological distress (GHQ-12 score = 1 – 3)	Psychological distress (GHQ-12 score >3)
Underweight (<18.5 kg.m^{-2})	1,168	1.02 (0.89, 1.18)	1.21 (1.03, 1.41)
Normal (18.5-24.99 kg.m^{-2})	45,864	1.0 (Ref)	1.0 (Ref)
Overweight (25-29.99 kg.m^{-2})	43,252	0.94 (0.91, 0.97)	0.89 (0.86, 0.93)
Obese I (30-34.99 kg.m^{-2})	17,288	0.93 (0.89, 0.97)	0.91 (0.86, 0.96)
Obese II/III (≥35 kg.m^{-2})	6,629	0.99 (0.93, 1.05)	1.13 (1.05, 1.21)

The reference category for dependent variable is GHQ-12 = 0.

Models adjusted for age, sex, smoking, physical activity, chronic illness (comorbidities were selected from 41 different codes describing families of common chronic conditions).