Research Square

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Emotional Dysregulation and Emotional Eating in Relation to Hypertension and Diabetes Among Adult Outpatients in Sokoto Nigeria

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Abstract

Background

Difficulty in regulating emotions may affect eating behaviour and cardiometabolic health, but evidence from hospital patients in Nigeria is limited.

Objective

To measure emotional dysregulation among adult outpatients in Sokoto, and to examine its association with hypertension, diabetes mellitus, body mass index (BMI), emotional eating and appetite loss.

Methods

In this hospital-based cross-sectional study, 204 adults attending the General Outpatient Department (n = 100) and the Medical Outpatient Department (n = 104) of Specialist Hospital, Sokoto, completed an adapted 28-item Difficulties in Emotion Regulation Scale (DERS) and a 36-item section on eating behaviour. All 36 items were analysed as scales for emotional eating, loss of control over eating, eating awareness, appetite loss under stress and general emotion-related eating, and as two single adaptive coping items. BMI, blood pressure and fasting glucose were measured. Data were analysed with chi-square tests, correlation, analysis of variance and regression.

Results

The mean DERS score was 72.8 (SD = 18.8; Cronbach's alpha = 0.95), and 32.8% had high emotional dysregulation. DERS level was not associated with hypertension ($p = 0.458$) or diabetes ($p = 0.516$), and the adjusted odds ratios per 10-point rise were 1.01 and 1.00. DERS score correlated weakly with systolic blood pressure ($r = 0.157$), diastolic blood pressure ($r = 0.154$) and fasting glucose ($\rho = 0.15$). Mean BMI differed across DERS levels (21.5, 23.0 and 23.1 kg/m²; $p = 0.002$) but not after adjustment for age, sex and physical activity ($p = 0.213$). DERS was the strongest predictor of emotional eating ($\rho = 0.73$); each 10-point rise in DERS raised the emotional eating score by 0.35 ($p < 0.001$), and the model explained 59% of its variation. Emotional eating (2.54 against 2.21; $p = 0.011$) and general emotion-related eating (2.59 against 2.26; $p = 0.003$) were higher in participants with hypertension, and emotional eating remained associated with hypertension after adjustment for age, sex and BMI (adjusted OR = 1.50 per point; 95% CI 1.04–2.17). Appetite loss under stress (mean 2.65) was as common as emotional eating (2.43).

Conclusion

Emotional dysregulation was moderate and closely linked to emotional eating, but it was not independently associated with hypertension, diabetes or BMI. Emotional eating, however, was linked to hypertension independently of age, sex and BMI, an exploratory finding that needs confirmation. Clinics should screen for emotional wellbeing and teach healthy ways of coping with stress, and longitudinal studies with validated tools are needed.

Introduction

Difficulty in recognising, accepting and managing emotions, known as emotional dysregulation, is commonly measured with the Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004). Long-lasting stress and poor emotion regulation may raise blood pressure and blood glucose through stress hormones such as cortisol (McEwen & Akil, 2020). If so, emotional dysregulation could add to the risk of hypertension and diabetes mellitus, which are common among adults attending hospitals in Nigeria.

Emotion regulation is the set of ways in which people influence which emotions they have, when they have them and how they feel and express them (Gross, 2015). When regulation is poor, people may struggle to cope with stress, and the body may stay in a state of stress for long periods. Long-lasting psychological stress has been linked to higher blood pressure and a higher risk of hypertension (Spruill, 2010), and to type 2 diabetes through stress hormones, inflammation and unhealthy behaviours (Hackett & Steptoe, 2017). Emotion regulation may therefore be one of the less obvious factors behind cardiometabolic disease.

Emotions also affect eating. Some people eat more when upset, which is called emotional eating, and this has been linked to weight gain (Konttinen, 2020). Others lose their appetite under stress. Difficulty with emotion regulation is seen across many eating problems and may be a shared underlying factor (Sloan et al., 2017). Yet few studies have measured emotional dysregulation, emotional eating and appetite loss together with blood pressure, blood glucose and BMI among hospital patients in Nigeria.

The effects of stress on eating are not the same in everyone. In laboratory and field studies, stress often increases the intake of sweet, fatty and energy-dense foods, partly through the action of cortisol and the brain's reward system (Adam & Epel, 2007), but many people eat less when they are stressed (Torres & Nowson, 2007). Both patterns can harm nutritional status over time, one by promoting weight gain and the other by reducing the amount and quality of food eaten. Measuring both directions together, as we did here, gives a fuller picture than looking at emotional eating alone.

The aim of this study was to measure emotional dysregulation among adults attending the General Outpatient Department (GOPD) and Medical Outpatient Department (MOPD) of Specialist Hospital, Sokoto, and to examine its association with hypertension, diabetes mellitus, BMI, emotional eating and appetite

loss. We tested two null hypotheses: that there is no association between emotional dysregulation and hypertension or diabetes mellitus, and that there is no association between nutritional status and emotional dysregulation. We also analysed all items of the eating-behaviour section of the questionnaire, including items on general emotion-related eating and adaptive coping, and tested whether eating scores were related to hypertension and diabetes independently of age, sex and BMI.

Methods

Research Design

This study adopted a hospital-based descriptive cross-sectional design to assess the association between nutritional status, emotional dysregulation, and the risk of non-communicable diseases among adults attending the General Outpatient Department (GOPD) and Medical Outpatient Department (MOPD) of Specialist Hospital, Sokoto. A cross-sectional design was considered appropriate because it allowed the researcher to measure the exposure and outcome variables at the same point in time and describe the pattern of association between them within the study population (Wang & Cheng, 2020). This design was also relatively quick, cost-effective, and convenient for a study that required the simultaneous assessment of nutritional status, emotional dysregulation, and disease risk indicators among hospital attendees.

Study Area

The study was carried out at Specialist Hospital, Sokoto, a tertiary health facility located in Sokoto metropolis, Sokoto State, Northwestern Nigeria. The hospital serves as a major referral centre for Sokoto State and neighbouring states such as Zamfara and Kebbi. Data were collected in two outpatient units of the hospital: the General Outpatient Department (GOPD) and the Medical Outpatient Department (MOPD). These two units regularly attend to adult patients with hypertension, diabetes mellitus, obesity, and other non-communicable diseases, making them suitable settings for this study.

Study Population

The study population comprised adult patients aged 18 years and above who attended the General Outpatient Department (GOPD) or the Medical Outpatient Department (MOPD) of Specialist Hospital, Sokoto, during the period of data collection.

Inclusion Criteria

The study included:

- • Adults aged 18 years and above attending the GOPD or MOPD of Specialist Hospital, Sokoto.
- • Patients who were conscious, clinically stable, and able to communicate and respond to the study questionnaire.
- • Patients who gave informed consent to participate in the study.

Exclusion Criteria

The following categories of patients were excluded from the study:

- • Patients who were critically ill or too unstable to take part in an interview.
- • Pregnant women, because pregnancy affects body weight and Body Mass Index measurements.
- • Patients with a known severe psychiatric or cognitive impairment that could affect their ability to accurately complete the Difficulties in Emotion Regulation Scale (DERS).
- • Patients who declined to give informed consent.

Sample Size Determination

The minimum sample size for this study was determined using the formula developed by Leslie Kish (1965) for calculating sample size in cross-sectional studies involving a single population proportion.

Application of the Leslie Kish (1965) Formula

$$\varvec{n} = \varvec{Z}^{2}\varvec{p}\varvec{q} / \varvec{d}^{2}$$

Where:

- • n = minimum sample size
- • Z = standard normal deviate at 95% confidence level = 1.96
- • p = estimated prevalence of the condition of interest

- • q = 1 − p
- • d = margin of error = 0.05 (5%)

Because hypertension is one of the major non-communicable diseases assessed in this study, the prevalence of hypertension among adults in North-West Nigeria, reported as 26.8% (p = 0.268) in a nationwide WHO STEPwise survey (Odili et al., 2020), was adopted as the estimated prevalence (p) for the sample size calculation, since Sokoto State falls within this geopolitical zone.

$$q = 1 - p = 1 - 0.268 = 0.732$$

Substituting the values into the formula:

$$\varvec{n} = (1.96)^2 \times 0.268 \times 0.732 / (0.05)^2$$

$$\varvec{n} = 3.8416 \times 0.268 \times 0.732 / 0.0025$$

$$\varvec{n} = 3.8416 \times 0.196176 / 0.0025$$

$$\varvec{n} = 0.753630 / 0.0025$$

$$\varvec{n} = 301.45$$

Therefore, the minimum calculated sample size was approximately 302 participants.

Adjustment for Finite Population (Using the Specialist Hospital Record)

Because the population of adult patients attending the GOPD and MOPD of Specialist Hospital, Sokoto, is finite rather than infinitely large, a Finite Population Correction (FPC) was applied to adjust the calculated sample size. According to attendance records obtained from the Health Records Department of Specialist Hospital, Sokoto, a total of 320 adults attended these two units over the three months preceding the study, distributed as follows:

- • GOPD: 200 patients
- • MOPD: 120 patients
- • Total population (N) = 320 patients

$$\varvec{n}\varvec{f} = \varvec{n} / [1 + (\varvec{n} - 1)/\varvec{N}]$$

Where:

- • nf = adjusted sample size
- • n = calculated sample size = 302
- • N = total population size = 320

Substituting the values into the formula:

$$\varvec{n}\varvec{f} = 302 / [1 + (302 - 1)/320]$$

$$\varvec{n}\varvec{f} = 302 / [1 + 301/320]$$

$$\varvec{n}\varvec{f} = 302 / [1 + 0.9406]$$

$$\varvec{n}\varvec{f} = 302 / 1.9406$$

$$\varvec{n}\varvec{f} = 155.6$$

Therefore, the finite-population-adjusted sample size was approximately 156 participants.

Adjustment for Non-Response

To account for possible non-response, refusal, or incomplete data during data collection, the finite-population-adjusted sample size was further increased by 10%, using the formula below:

$$\varvec{F}\varvec{i}\varvec{n}\varvec{a}\varvec{l}\ \varvec{n} = \varvec{n}\varvec{f} / (1 - \varvec{n}\varvec{o}\varvec{n} - \varvec{r}\varvec{e}\varv$$

$$\varvec{F}\varvec{i}\varvec{n}\varvec{a}\varvec{l}\ \varvec{n} = 156 / (1 - 0.10)$$

$$\varvec{F}\varvec{i}\varvec{n}\varvec{a}\varvec{l}\ \varvec{n} = 156 / 0.90$$

$$\varvec{F}\varvec{i}\varvec{n}\varvec{a}\varvec{l}\ \varvec{n} = 173.3$$

Therefore, the final minimum sample size for this study was 173 participants. In all, 204 adults were recruited, which is above the minimum required sample size.

Sampling Technique

A two-stage sampling technique, involving purposive selection of the study units and consecutive sampling of participants, was used to recruit the respondents for this study.

Purposive Selection of Study Units

The General Outpatient Department (GOPD) and the Medical Outpatient Department (MOPD) of Specialist Hospital, Sokoto, were purposively selected for this study because they attend to large numbers of adult outpatients and are commonly associated with the diagnosis and management of hypertension, diabetes mellitus, obesity, and other non-communicable diseases.

Sample Recruited

Recruitment was carried out in both units during the period of data collection. A total of 204 participants were recruited: 100 from the GOPD and 104 from the MOPD. This number is above the minimum sample size of 173 and improves the precision of the estimates.

Consecutive Sampling of Participants

Within each of the two selected units, eligible and consenting adult patients were recruited consecutively as they presented for care, until the sample size was reached.

Instrument for Data Collection

Data were collected using a structured, interviewer-administered questionnaire developed after a review of relevant literature and existing validated instruments. The questionnaire was divided into seven sections:

- • Section A: Socio-demographic characteristics of respondents (age, sex, marital status, religion, ethnicity, educational level, occupation, and monthly income).
- • Section B: Health history (diagnosed hypertension, diabetes mellitus and heart disease, medication use, and family history of chronic conditions).
- • Section C: Lifestyle practices (smoking, physical activity, sleep, number of meals, and breakfast habits).
- • Section D: Anthropometric and clinical measurements (weight, height, waist and hip circumferences, blood pressure, and fasting blood glucose).
- • Section E: Food frequency questionnaire covering 67 foods and drinks.
- • Section F: Difficulties in Emotion Regulation Scale (DERS), 28 items.
- • Section G: Emotional eating, loss of control over eating, eating awareness, and appetite loss under stress (36 items).

Equipment used included a calibrated digital weighing scale, a portable stadiometer, a non-stretchable measuring tape, a calibrated digital sphygmomanometer, and a calibrated glucometer with accessories.

Validity of the Instrument

The questionnaire was subjected to face and content validity by experts in Human Nutrition and Dietetics, Public Health, and Mental Health, who reviewed the items for clarity, relevance, and appropriateness in addressing the study objectives, and their corrections were incorporated before data collection. The Difficulties in Emotion Regulation Scale (DERS) is a previously validated instrument (Gratz & Roemer, 2004), and its shorter version, the DERS-18, has shown good psychometric properties (Victor & Klonsky, 2016), including among Nigerian populations (Akinnawo et al., 2022). In this study, the DERS was adapted by the researcher: the items were adapted from the original DERS statements, and an additional subscale on emotional overwhelm was added, giving 28 items in seven subscales. Because the adapted version has not been validated separately, its internal consistency was tested in the main study (see Section 3.10). In addition, a pilot study was conducted among adult patients attending a comparable hospital outside the study setting to assess the clarity and comprehensibility of the questionnaire before the main data collection.

Reliability of the Instrument

The reliability of the questionnaire was assessed using Cronbach's alpha computed from the data of the main study (n = 204). Cronbach's alpha was 0.95 for the 28-item DERS and between 0.69 and 0.86 for its seven subscales. It was 0.94 for the 10-item emotional eating score, 0.86 for the loss-of-control items (5 items), 0.82 for the eating awareness items (6 items), and 0.87 for the appetite loss items (8 items). A Cronbach's alpha value of 0.70 or higher is generally regarded as satisfactory for research purposes. A pilot study of about 20 participants (about 10% of the calculated sample size), drawn from a hospital with a similar patient population that was not part of the main study, was used to check the clarity of the questionnaire items before the main data collection.

Procedure for Data Collection

Data collection began after obtaining ethical clearance from the Ministry of Health, Sokoto State (reference number SMH/1580/V.IV) and the research committee of Specialist Hospital, Sokoto, and permission from the management of the hospital. Trained research assistants with a background in nutrition and nursing assisted with data collection after being taken through the objectives of the study, interview techniques, anthropometric and blood pressure measurement procedures, glucometer use, and administration of the questionnaires.

Eligible patients at each of the two selected units were approached, the purpose and procedure of the study were explained to them, and written informed consent was obtained before participation. The structured questionnaire was then administered through face-to-face interviews, after which anthropometric measurements, blood pressure, and fasting blood glucose were taken following standard procedures. Where necessary, information on existing diagnoses was cross-checked with patients' case notes. Data collection was carried out over a specified period under close supervision to ensure completeness, consistency, and accuracy of the information obtained.

Measurement of Variables

Socio-Demographic Characteristics

Socio-demographic characteristics, including age, sex, marital status, religion, ethnicity, educational level, occupation, and monthly income, were obtained using Section A of the questionnaire.

Anthropometric Measurements (Body Mass Index)

Weight was measured to the nearest 0.1 kg using a calibrated digital weighing scale, with participants wearing light clothing and no footwear. Height was measured using a portable stadiometer, with participants standing erect without shoes. Body Mass Index (BMI) was calculated as weight in kilograms divided by the square of height in metres (kg/m²). During data cleaning, BMI was recalculated from the recorded weight and height for every participant, and the recalculated values were used in all analyses. BMI was classified according to the World Health Organization cut-off points: underweight (BMI < 18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obese (≥ 30.0 kg/m²) (NCD-RisC, 2021). Waist and hip circumferences were measured with a non-stretchable tape, and the waist-hip ratio was calculated. Waist circumference was classified as increased risk (≥ 80 cm in women and ≥ 94 cm in men) and substantially increased risk (≥ 88 cm in women and ≥ 102 cm in men).

Blood Pressure Measurement

Blood pressure was measured using a calibrated digital sphygmomanometer with participants seated and rested for at least five minutes, with the arm supported at heart level. Two readings were taken five minutes apart, and the average was recorded in millimetres of mercury (mmHg). Blood pressure was classified as normal (< 120/80 mmHg), pre-hypertension (120–139/80–89 mmHg), or hypertension (≥ 140/90 mmHg) (Odili et al., 2020).

Diabetes-Related Information

Information on diabetes was obtained in two ways. First, participants were asked whether they had a previous diagnosis of diabetes mellitus, and the answer was cross-checked with case notes where necessary. Second, fasting blood glucose was measured using a calibrated glucometer following standard finger-prick technique. A fasting blood glucose of 7.0 mmol/L (126 mg/dl) or higher was considered suggestive of diabetes mellitus, a value of 5.6–6.9 mmol/L was considered impaired fasting glucose (pre-diabetes), and a value below 5.6 mmol/L was considered normal, in line with standard diagnostic criteria (American Diabetes Association Professional Practice Committee, 2022).

Classification of Non-Communicable Disease Status

For the analysis, hypertension was defined as a measured blood pressure of 140/90 mmHg or above, or a reported diagnosis of hypertension. Diabetes mellitus was defined as a fasting blood glucose of 7.0 mmol/L or above, or a reported diagnosis of diabetes mellitus. A reported diagnosis was included because many patients were already on treatment, which could bring their measured values down. Overweight and obesity (BMI of 25 kg/m² or above) and increased waist circumference were treated as nutrition-related risk conditions.

Scoring of the Difficulties in Emotion Regulation Scale (DERS)

Emotional dysregulation was assessed using a 28-item adaptation of the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). The items were adapted from the original DERS statements, and an emotional overwhelm subscale was added to the original subscales. Each item was rated on a five-point Likert scale ranging from 1 (almost never) to 5 (almost always). The scale has seven subscales, namely Non-acceptance, Goals, Impulse, Awareness, Strategies, Clarity, and Overwhelm, with four items measuring each subscale. Positively worded items were reverse-scored so that a higher score always means greater difficulty. Total scores range from 28 to 140, with higher scores indicating greater difficulty in regulating emotions. Based on the distribution of total scores obtained in this study, participants were classified into low (28–64), moderate (65–77), and high (78–140) emotional dysregulation groups using tertile splits.

Dietary, Lifestyle and Eating Behaviour Measures

Food intake was assessed with a food frequency questionnaire of 67 foods and drinks. Responses were converted to approximate times per week (never = 0, rarely = 0.1, 1–3 times a month = 0.5, once a week = 1, 2–4 times a week = 3, 5–6 times a week = 5.5, daily = 7), and average frequencies were calculated for each food group. An ultra-processed food score was calculated as the total weekly frequency of snacks, fast foods, soft drinks, and energy drinks. Physical activity, sleep, smoking, and meal habits were obtained from the lifestyle section. Eating behaviour was measured with items on emotional eating (10 items), loss of control over eating (5 items), eating awareness (6 items), and appetite loss under stress (8 items), each scored from 1 to 5 as a mean item score. Mean scores were grouped as low (1.00–2.33), moderate (2.34–3.66), and high (3.67–5.00).

Data Analysis

Completed questionnaires were checked daily for completeness and consistency before being coded and entered into a spreadsheet for analysis. The data were cleaned and analysed using Python (pandas and SciPy libraries). Descriptive statistics, including frequencies, percentages, means, and standard

deviations, were used to summarise the socio-demographic characteristics, nutritional status, blood pressure, blood glucose, dietary pattern, and DERS scores of the respondents. The Chi-square test (or Fisher's exact test when expected counts were small) was used to determine the association between nutritional status, categories of emotional dysregulation, and non-communicable diseases. Pearson's and Spearman's correlation coefficients were used to examine the relationship between Body Mass Index and DERS scores and between these variables and blood pressure and blood glucose. Differences in mean scores between groups were tested with the independent-samples t-test or Mann-Whitney U test (two groups) and one-way ANOVA or Kruskal-Wallis test (three or more groups). Binary logistic regression was used to identify independent predictors of hypertension, diabetes mellitus, and overweight or obesity while controlling for relevant confounding variables, and multiple linear regression was used for BMI. All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

Emotional dysregulation

Emotional dysregulation was assessed with a 28-item adaptation of the DERS (Gratz & Roemer, 2004). The items were adapted from the original statements, and an emotional overwhelm subscale was added, giving seven subscales of four items each: non-acceptance, goals, impulse control, awareness, strategies, clarity and overwhelm. Each item was rated from 1 (almost never) to 5 (almost always). Items marked for reverse scoring in the questionnaire were already reversed in the data file, because they correlated positively with the other items of their subscale, so they were not reversed again; a higher score always meant greater difficulty. Total scores range from 28 to 140, and subscale scores were expressed as mean item scores. Participants were grouped into low (28–64), moderate (65–77) and high (78–140) emotional dysregulation using tertiles of the total score. The adapted scale was not validated separately, so its internal consistency was tested in this sample.

Eating behaviour

The eating-behaviour section of the questionnaire had 36 items rated from 1 (almost never) to 5 (almost always), and all 36 items were analysed. They formed five scores, calculated as mean item scores from 1 to 5: emotional eating (10 items), loss of control over eating (5 items), eating awareness (6 items), appetite loss under stress (8 items) and general emotion-related eating (5 items). The emotional eating items were the same five statements asked twice in the questionnaire, and because the two sets were closely related (average inter-item correlation 0.63), they were combined into one 10-item score. The general emotion-related eating items opened the section and ask in a broad way about eating more when stressed, losing appetite, using food to cope, craving certain foods and feeling guilty after eating. The last two items measure adaptive coping, which means calming down without food and keeping regular eating patterns when stressed. Because these two items were almost unrelated to each other ($r = -0.06$), they could not form a scale and were analysed as single items. One item combined two statements because of a typing error in the questionnaire, and one statement appeared in two sections (Supplementary Material 2). [State the source of these items.] Scores were classed as low (1.00–2.33), moderate (2.34–3.66) or high (3.67–5.00). The questionnaire was reviewed by experts in human nutrition and dietetics, public health and mental health, and was pre-tested at a similar hospital outside the study setting.

Statistical analysis

Data were analysed in Python (pandas and SciPy). Associations between categorical variables were tested with the chi-square test or Fisher’s exact test. Pearson’s and Spearman’s coefficients were used for correlations, the Welch t-test or Mann–Whitney U test for two groups, and one-way ANOVA or the Kruskal–Wallis test for three or more groups. Logistic regression was used for hypertension, diabetes and overweight or obesity, with the DERS score entered per 10 points; the full models are reported in the companion paper. Multiple linear regression was used for BMI, adjusting for age, sex and physical activity, and for emotional eating, adjusting for age, sex, BMI and physical activity. To test whether eating scores were related to hypertension and diabetes independently of body size and age, we also fitted a logistic regression model for each eating score (per 1-point rise), first adjusted for age, sex and BMI and then also for the DERS score. These analyses were not planned before data collection and should be seen as exploratory. All tests were two-tailed, $p < 0.05$ was taken as significant, and no adjustment was made for multiple testing.

Ethical considerations

Ethical approval and informed consent are described under the headings Ethical Approval and accordance and Consent to participate. Participation was voluntary, and no personal identifiers were recorded.

Results

Participants

The 204 participants (mean age 40.9 years, SD = 14.4; 53.4% women) are described in the companion paper [Companion paper citation]. Hypertension was present in 65.2% and diabetes mellitus in 52.5%, and 15.2% were overweight or obese. Most participants were married (68.6%) and had tertiary education (65.7%), and 49.0% attended the GOPD and 51.0% the MOPD.

Emotional dysregulation

The mean DERS score was 72.8 (SD = 18.8), a mean item score of 2.60 out of 5, which shows a moderate level of difficulty. Reliability was very good for the total scale (Cronbach’s alpha = 0.95) and acceptable to good for the subscales (0.69 to 0.86). The highest subscale means were for awareness (2.85), goals

(2.70) and clarity (2.63), and the lowest was for overwhelm (2.46) (Table 1, Fig. 1). By tertiles, 34.3% had low, 32.8% moderate and 32.8% high emotional dysregulation.

Table 1
Descriptive statistics and reliability of the DERS (n = 204)

Scale	Items	Score, mean ± SD	Cronbach's alpha
DERS total (range 28–140)	28	72.8 ± 18.8	0.95
Non-acceptance	4	2.52 ± 0.90	0.86
Goals	4	2.70 ± 0.82	0.83
Impulse control	4	2.48 ± 0.81	0.83
Awareness	4	2.85 ± 0.73	0.69
Strategies	4	2.58 ± 0.81	0.81
Clarity	4	2.63 ± 0.75	0.73
Overwhelm	4	2.46 ± 0.80	0.82

Study data (n = 204); adapted 28-item DERS, mean item scores 1–5.

Subscale scores are mean item scores (range 1–5).

Emotional dysregulation did not differ between women and men or across age groups, but participants attending the MOPD scored higher than those attending the GOPD (77.8 against 67.7; $p < 0.001$) (Table 2). The score also differed by physical activity level ($p = 0.043$), with the lowest mean (61.1) in the very active group, which was small (n = 15).

Table 2
DERS total score by sex, clinic, age group and physical activity

Comparison	Group 1, mean ± SD	Group 2, mean ± SD	Test statistic	p
Women vs men	74.0 ± 17.0	71.5 ± 20.6	t = 0.91	0.364
GOPD vs MOPD	67.7 ± 13.6	77.8 ± 21.6	t = − 4.0	< 0.001
Age group (4 groups)	—	—	H = 4.03	0.259
Physical activity level	—	—	H = 8.12	0.043

Welch t-test for two groups; Kruskal–Wallis test for more than two groups.

Emotional dysregulation, hypertension and diabetes mellitus

The proportion with hypertension rose slightly from the low to the high DERS group (60.0%, 65.7% and 70.1%), and so did the proportion with diabetes (47.1%, 53.7% and 56.7%), but neither difference was significant (hypertension: $\chi^2 = 1.56$, df = 2, $p = 0.458$; diabetes: $\chi^2 = 1.32$, df = 2, $p = 0.516$) (Table 3, Fig. 2). Overweight or obesity also did not differ significantly ($p = 0.069$). When blood pressure and glucose were treated as continuous values, there were small positive correlations with the DERS score: systolic blood pressure ($r = 0.157$, $p = 0.025$), diastolic blood pressure ($r = 0.154$, $p = 0.028$) and fasting glucose ($\rho = 0.15$, $p = 0.032$). Mean systolic blood pressure was highest in the high DERS group (142.8 mmHg, against 135.2 and 135.8 mmHg), but the difference was not significant ($p = 0.064$), and neither was the difference in glucose (6.7, 6.9 and 7.4 mmol/L; $p = 0.142$). In the adjusted models, the DERS score did not predict hypertension (adjusted OR = 1.01 per 10 points; 95% CI 0.85–1.20; $p = 0.922$), diabetes (adjusted OR = 1.00; 95% CI 0.85–1.18; $p = 0.981$) or overweight or obesity (adjusted OR = 0.96; 95% CI 0.76–1.22; $p = 0.734$).

Table 3
Hypertension, diabetes mellitus and overweight or obesity by level of emotional dysregulation

DERS level	n	Hypertension, n (%)	Diabetes, n (%)	Overweight or obese, n (%)
Low (35–64)	70	42 (60.0)	33 (47.1)	5 (7.1)
Moderate (65–77)	67	44 (65.7)	36 (53.7)	13 (19.4)
High (78–127)	67	47 (70.1)	38 (56.7)	13 (19.4)
Chi-square p		0.458	0.516	0.069

Study data (n = 204); chi-square p = 0.458 (hypertension) and p = 0.516 (diabetes).

Emotional dysregulation and nutritional status

Mean BMI differed significantly across the three DERS levels (ANOVA F = 6.72, p = 0.002; Kruskal–Wallis p = 0.004). It was lowest in the low group (21.5 kg/m²) and similar in the moderate (23.0) and high (23.1) groups, so the difference was mainly between the low group and the other two (Table 4, Fig. 3). Only 7.1% of the low group were overweight or obese, against 19.4% in each of the other groups (p = 0.069), and the distribution across the three nutritional status groups did not differ significantly (χ^2 = 7.28, df = 4, p = 0.122). The correlation between DERS score and BMI was weak and significant for Spearman's coefficient (ρ = 0.162, p = 0.021) but not for Pearson's (r = 0.10, p = 0.153). After adjustment for age, sex and physical activity, the DERS score no longer predicted BMI (B = 0.13 kg/m² per 10 points; 95% CI − 0.07 to 0.34; p = 0.213) (Table 5). Age and female sex were the significant predictors, and the model explained about 10% of the variation in BMI.

Table 4
BMI and nutritional status by level of emotional dysregulation

DERS level	n	BMI, mean ± SD	Underweight, %	Normal weight, %	Overweight or obese, %
Low	70	21.5 ± 2.3	11.4	81.4	7.1
Moderate	67	23.0 ± 3.1	6.0	74.6	19.4
High	67	23.1 ± 3.1	4.5	76.1	19.4

Study data (n = 204); one-way ANOVA p = 0.002, not significant after adjustment (p = 0.213).

ANOVA F = 6.72, p = 0.002; Kruskal–Wallis H = 10.90, p = 0.004; chi-square for nutritional status groups p = 0.122.

Table 5
Multiple linear regression for BMI

Predictor	B	95% CI	p
Age (per 10 years)	0.60	0.33 to 0.86	< 0.001
Female sex	1.04	0.26 to 1.82	0.009
DERS total (per 10 points)	0.13	−0.07 to 0.34	0.213
Physical activity (ordinal)	0.13	−0.34 to 0.60	0.593

R^2 = 0.116, adjusted R^2 = 0.099, F(4, 199) = 6.55, p < 0.001. B = change in BMI (kg/m²) per unit of the predictor.

Emotional eating, loss of control and appetite loss

The mean emotional eating score was 2.43 (SD = 0.86) and the mean appetite loss score was 2.65 (SD = 0.70) (Table 6, Fig. 4). Half of participants (51.0%) had low emotional eating, 41.2% moderate and 7.8% high. Appetite loss under stress was moderate in 60.8% and high in 8.3%, and 8.3% had a high loss of control over eating. On average, participants were somewhat more likely to lose their appetite than to overeat when upset.

Emotional eating was strongly related to emotional dysregulation (ρ = 0.73, p < 0.001) and was almost the same behaviour as loss of control over eating (ρ = 0.84). The DERS score was by far the strongest predictor of emotional eating: each 10-point rise raised the emotional eating score by 0.35 points (p < 0.001), and DERS together with age, sex, BMI and physical activity explained 59% of the variation. Emotional eating and appetite loss had little relationship with BMI, but loss of control correlated weakly with it (ρ = 0.19, p = 0.007) (Table 7). Systolic blood pressure correlated weakly with emotional eating (ρ = 0.25) and loss of control (ρ = 0.24). Participants with hypertension had higher emotional eating (2.54 against 2.21; p = 0.011) and loss of control (2.55 against 2.21; p = 0.005), and those with diabetes had higher loss of control (2.58 against 2.28; p = 0.012) (Table 8). Appetite loss was not related to either condition.

Table 6
Emotional eating, loss of control, eating awareness and appetite loss under stress

Score	Mean ± SD	Alpha	Low, n (%)	Moderate, n (%)	High, n (%)
Emotional eating	2.43 ± 0.86	0.94	104 (51.0)	84 (41.2)	16 (7.8)
Loss of control over eating	2.43 ± 0.87	0.86	93 (45.6)	94 (46.1)	17 (8.3)
Eating awareness	2.49 ± 0.74	0.82	—	—	—
Appetite loss under stress	2.65 ± 0.70	0.87	63 (30.9)	124 (60.8)	17 (8.3)

Study data (n = 204); low = 1.00–2.33, moderate = 2.34–3.66, high = 3.67–5.00 (mean item score).

Mean item scores (range 1–5). Low = 1.00–2.33, moderate = 2.34–3.66, high = 3.67–5.00.

Table 7
Spearman correlations of DERS and eating scores with age, body size and clinical readings

Variable	Age	BMI	Waist	SBP	DBP	Glucose
DERS total	0.04	0.16*	−0.02	0.18*	0.16*	0.15*
Emotional eating	0.12	0.09	0.05	0.25***	0.24***	0.13
Loss of control	0.12	0.19**	0.08	0.24***	0.19**	0.19**
Eating awareness	0.06	0.08	0.02	0.21**	0.16*	0.17*
Appetite loss	−0.12	0.08	−0.07	0.03	0.07	0.02

* p < 0.05, ** p < 0.01, *** p < 0.001. SBP = systolic blood pressure; DBP = diastolic blood pressure.

Table 8
Eating scores by hypertension and diabetes status

Condition	Score	Without condition, mean	With condition, mean	p
Hypertension	Emotional eating	2.21	2.54	0.011
	Loss of control	2.21	2.55	0.005
	Appetite loss	2.63	2.66	0.898
Diabetes mellitus	Emotional eating	2.30	2.54	0.074
	Loss of control	2.28	2.58	0.012
	Appetite loss	2.71	2.60	0.111

Mann–Whitney U test.

General emotion-related eating and adaptive coping

The five general emotion-related eating items had a mean score of 2.47 (SD = 0.86; alpha = 0.85), and 45.1% of participants scored low, 45.6% moderate and 9.3% high (Table 9). Item means ranged from 2.38 to 2.55. The score was very closely related to emotional dysregulation (ρ = 0.83, p < 0.001) and weakly related to BMI (ρ = 0.21, p = 0.003), systolic blood pressure (ρ = 0.28, p < 0.001) and diastolic blood pressure (ρ = 0.20, p = 0.005). It was higher in participants with hypertension (2.59 against 2.26; p = 0.003) and tended to be higher in those with diabetes (2.56 against 2.39; p = 0.076). It was not related to waist circumference (ρ = −0.02) or age (ρ = 0.12, p = 0.088).

The two adaptive coping items were not related to each other (r = − 0.06), so they were examined one at a time. Their means were 2.96 (calming down without eating) and 2.59 (keeping regular eating patterns when stressed). Both were positively correlated with the DERS score (ρ = 0.29 and ρ = 0.39, both p < 0.001), which is the opposite of what would be expected if they measured healthy coping well. Neither item was related to hypertension (p = 0.513 and p = 0.579) or diabetes (p = 0.213 and p = 0.611).

Table 9
General emotion-related eating and adaptive coping items (n = 204)

Score or item	Items	Mean ± SD	Alpha	Spearman ρ with DERS
General emotion-related eating	5	2.47 ± 0.86	0.85	0.83
Adaptive coping: calm down without eating	1	2.96 ± 1.14	—	0.29
Adaptive coping: keep regular eating when stressed	1	2.59 ± 0.91	—	0.39

Mean item scores (range 1–5). The two adaptive coping items were not correlated with each other (r = − 0.06), so no scale score was calculated.

Eating behaviour, hypertension and diabetes after adjustment

We next tested whether the eating scores were related to hypertension and diabetes independently of age, sex and BMI (Table 10). Emotional eating remained associated with hypertension (adjusted OR = 1.50 per 1-point rise; 95% CI 1.04–2.17; p = 0.030). Loss of control over eating was borderline for hypertension (p = 0.051) and for diabetes (p = 0.054), and the general emotion-related eating score was borderline for hypertension (p = 0.070). Appetite loss under stress was not associated with either condition. When the DERS score was also added to the models, the odds ratios for emotional eating, loss of control and general emotion-related eating became larger and remained significant for hypertension, but the confidence intervals became wider. This is because these scores are very closely related to the DERS score (ρ = 0.73 to 0.83), which makes estimates from models containing both less stable.

Table 10
Eating scores and the odds of hypertension and diabetes mellitus (adjusted odds ratios per 1-point rise)

Eating score	Outcome	Adjusted for age, sex and BMI: aOR (95% CI), p	Also adjusted for DERS: aOR (95% CI), p
Emotional eating	Hypertension	1.50 (1.04–2.17), 0.030	2.06 (1.17–3.63), 0.012
	Diabetes	1.30 (0.93–1.83), 0.125	1.66 (0.96–2.85), 0.068
Loss of control	Hypertension	1.44 (1.00–2.09), 0.051	1.77 (1.04–2.99), 0.034
	Diabetes	1.40 (0.99–1.98), 0.054	1.81 (1.09–3.01), 0.022
General emotion-related eating	Hypertension	1.41 (0.97–2.05), 0.070	2.47 (1.16–5.25), 0.019
	Diabetes	1.14 (0.82–1.61), 0.434	1.28 (0.67–2.44), 0.447
Eating awareness	Hypertension	1.44 (0.93–2.23), 0.098	1.81 (0.94–3.48), 0.074
	Diabetes	1.26 (0.85–1.87), 0.255	1.45 (0.80–2.63), 0.226
Appetite loss under stress	Hypertension	1.11 (0.71–1.72), 0.652	1.03 (0.61–1.74), 0.914
	Diabetes	0.79 (0.52–1.20), 0.267	0.65 (0.39–1.09), 0.105

These analyses were exploratory and no correction was made for multiple testing. aOR = adjusted odds ratio.

Hypothesis testing

The null hypothesis of no association between emotional dysregulation and hypertension or diabetes mellitus was not rejected ($p = 0.458$ and $p = 0.516$), although the DERS score correlated weakly with blood pressure and glucose. The null hypothesis of no association between nutritional status and emotional dysregulation was rejected on the unadjusted tests (ANOVA, Kruskal–Wallis and Spearman correlation), but the evidence is weak, because the association was not significant after adjustment, for Pearson's correlation or for the nutritional status groups. In an exploratory analysis, emotional eating, but not the DERS score, was linked to hypertension after adjustment for age, sex and BMI (Table 10).

Discussion

In this study of 204 adult outpatients in Sokoto, emotional dysregulation was moderate and was very closely linked to emotional eating, but it was not independently associated with hypertension, diabetes mellitus or BMI. Emotional eating, in contrast, was linked to hypertension independently of age, sex and BMI, although this finding is exploratory.

The mean DERS score corresponded to a moderate level of difficulty (2.60 out of 5), and a third of participants had high emotional dysregulation. Participants in the MOPD scored higher than those in the GOPD. Patients in the MOPD are usually followed up for long-term conditions, and living with chronic illness may add emotional strain, but this was not tested, and the design cannot show which came first. The lowest scores were in the small group of very active participants ($n = 15$), so this finding needs confirmation.

Chronic stress and poor emotion regulation are expected to raise blood pressure and glucose through stress hormones such as cortisol (McEwen & Akil, 2020). Our results point in that direction, because hypertension and diabetes became slightly more common from the low to the high DERS group, and the DERS score correlated weakly with blood pressure and glucose. However, none of the group differences was significant, and the adjusted odds ratios were close to 1. There are several possible reasons. The study was cross-sectional and had only 204 participants, so small effects could not be detected. Many participants were on treatment, which lowers measured blood pressure and glucose. The DERS describes difficulty with emotions over a long period, whereas blood pressure and glucose were measured on a single day. The result does not prove that emotional dysregulation has no effect on health; it shows that no independent association was found in this sample.

Participants with low emotional dysregulation had a lower mean BMI than the other two groups, and the rank correlation was small but significant. This is in the direction suggested by research linking difficulty with emotions to unhealthy eating and weight gain (Konttinen, 2020). However, the association was not significant after adjustment for age, sex and physical activity, nor for Pearson's correlation or the nutritional status groups. Age and sex explained much of the difference, so the link between emotional dysregulation and nutritional status is weak in this sample.

Emotional dysregulation was by far the strongest predictor of emotional eating, which fits the view that eating is used to cope with emotions when other ways of coping are lacking (Konttinen, 2020; Sloan et al., 2017). Emotional eating and loss of control over eating were almost the same behaviour ($\rho = 0.84$), and all the scales came from the same questionnaire, so overlap between the scales and shared reporting style may have made the link look stronger than it is. Emotional eating had little relationship with BMI, although loss of control and the general emotion-related eating score were weakly related to it. Emotional eating and loss of control were higher among participants with hypertension, and loss of control was higher among those with diabetes. In the adjusted models, the link between emotional eating and hypertension remained after age, sex and BMI were taken into account, and the links between loss of control and both conditions were borderline. Appetite loss under stress (mean 2.65) was as common as emotional eating (2.43). Stress therefore seems to affect eating in both directions, with some people eating more and others eating less, and both patterns may affect nutritional status.

The link between emotional eating and hypertension is the most interesting finding beyond the main hypotheses, and it was not what we expected from the unadjusted comparisons. Several explanations are possible. Eating in response to emotions often involves foods rich in salt, fat and sugar, and these foods

can raise blood pressure. Stress may also raise blood pressure directly and, at the same time, drive emotional eating, so one stress process could explain both (McEwen & Akil, 2020; Spruill, 2010). The opposite direction is also possible: patients who learn that they have hypertension may become anxious or guilty about food, and treatment advice may change how they feel about eating. The cross-sectional design cannot separate these explanations. It is also notable that the DERS score was not an independent predictor, while emotional eating was. One reading is that what matters for blood pressure is not emotional difficulty alone but how a person responds to it, and eating is only one such response. We tested many associations without correction, and adding the DERS score made the estimates wider, so this finding should be treated as a lead for larger studies with repeated measurements.

Some items did not behave as expected. The two adaptive coping items were unrelated to each other, and both were positively related to emotional dysregulation. This may mean that participants who were more distressed also reported making more effort to cope, or that the positively worded items were understood in different ways. The general emotion-related eating items overlapped in content with other scales, and one statement was repeated, so this score is best seen as another view of emotional eating and not as a separate behaviour. We analysed all 36 items so that no part of the questionnaire was left out, but these observations show how much scale design affects results and why validated tools are needed.

These findings have practical meaning for clinics in this setting, which have few mental health staff and need simple tools. A short question on whether a patient eats more or less when stressed could open a conversation about coping and about food choices. Nutrition counselling for patients with hypertension could include practical advice for stressful times, such as keeping regular meals, avoiding salty snacks and seasoning cubes, and finding other ways to relax. Because appetite loss was as common as emotional eating, the advice should cover both overeating and skipping meals.

Strengths and limitations

The adapted DERS and the eating scales showed high internal consistency, and BMI, blood pressure and glucose were measured directly. The study also has limitations. The design was cross-sectional, so it cannot show cause and effect, and illness itself may cause emotional distress. The DERS was adapted by the researchers to 28 items with an added overwhelm subscale, and its factor structure and validity were not tested separately. The source and validity of the eating scales also need to be confirmed. All emotional and eating measures were self-reported in one questionnaire. Participants were patients at two outpatient departments of one hospital and were not chosen at random, so the results cannot be generalised to the population of Sokoto State. Some groups were small, many tests were run without adjustment for multiple testing, and treatment may have lowered the measured blood pressure and glucose. The eating section contained repeated and overlapping items, one item combined two statements, and two coping items did not form a scale, which limits what can be concluded from them. The adjusted analyses of eating scores were not planned in advance, and the DERS and eating scores are so closely related that models containing both gave wide confidence intervals.

Conclusion

Emotional dysregulation was moderate among adult outpatients in Sokoto. It strongly predicted emotional eating and loss of control over eating, but it was not independently associated with hypertension, diabetes mellitus or BMI. Stress-related appetite loss was as common as emotional eating, so stress affects eating in both directions. Emotional eating was also associated with hypertension independently of age, sex and BMI, an exploratory finding that deserves confirmation in larger studies.

Recommendations

Clinics, especially medical clinics, should include a short screening of emotional wellbeing and emotional eating, and patients with high scores should be offered counselling or stress management support. Patients should be taught simple and healthy ways to cope with stress, such as talking to someone, exercise, prayer, relaxation and regular meals, instead of eating more or skipping meals. Clinicians may also consider asking patients with hypertension about how they eat when they are stressed. Future studies should use larger, randomly selected samples, follow participants over time, include stress hormones, repeated blood pressure readings and HbA1c, use validated tools for emotion regulation and eating behaviour, and validate the adapted DERS.

Declarations

Author Contribution

K.A.B. conceptualised the study, developed the methodology, coordinated data collection, conducted the data analysis, and wrote the main manuscript text. A.I.M., F.Y., M.M., A.S.S., and M.S.. contributed to data collection, interpretation of the findings, and critical revision of the manuscript. All authors reviewed and approved the final manuscript.

Ethical Approval and accordance

The study protocol was approved by the Ministry of Health, Sokoto State (reference number SMH/1580/V.IV) and the research committee of Specialist Hospital, Sokoto. The research was carried out in accordance with the guidelines of these committees and the principles of the Declaration of Helsinki.

Consent to participate

Written informed consent was obtained from all individual participants included in the study. The purpose, procedures, benefits and possible risks of the study were explained to each participant before participation, participation was voluntary, and participants could withdraw at any time without penalty.

Consent for publication: Not applicable.

Data availability statement: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: [State]

Funding: [State]

Author contributions: [State each author's contribution]

Acknowledgements: [State]

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Figures

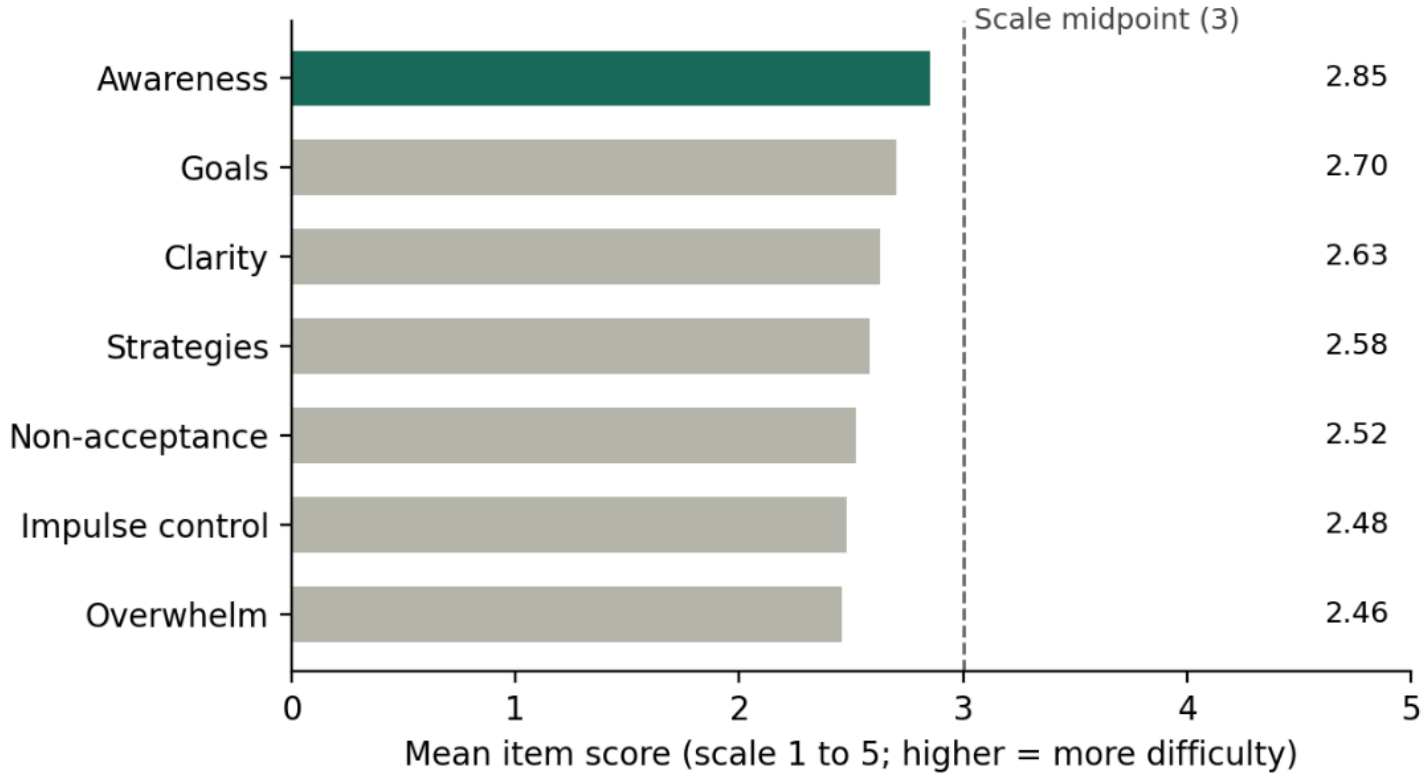

Figure 1

Mean scores for the seven areas of emotion regulation difficulty

Study data (n = 204); adapted 28-item DERS, mean item scores 1–5.

Subscale scores are mean item scores (range 1–5).

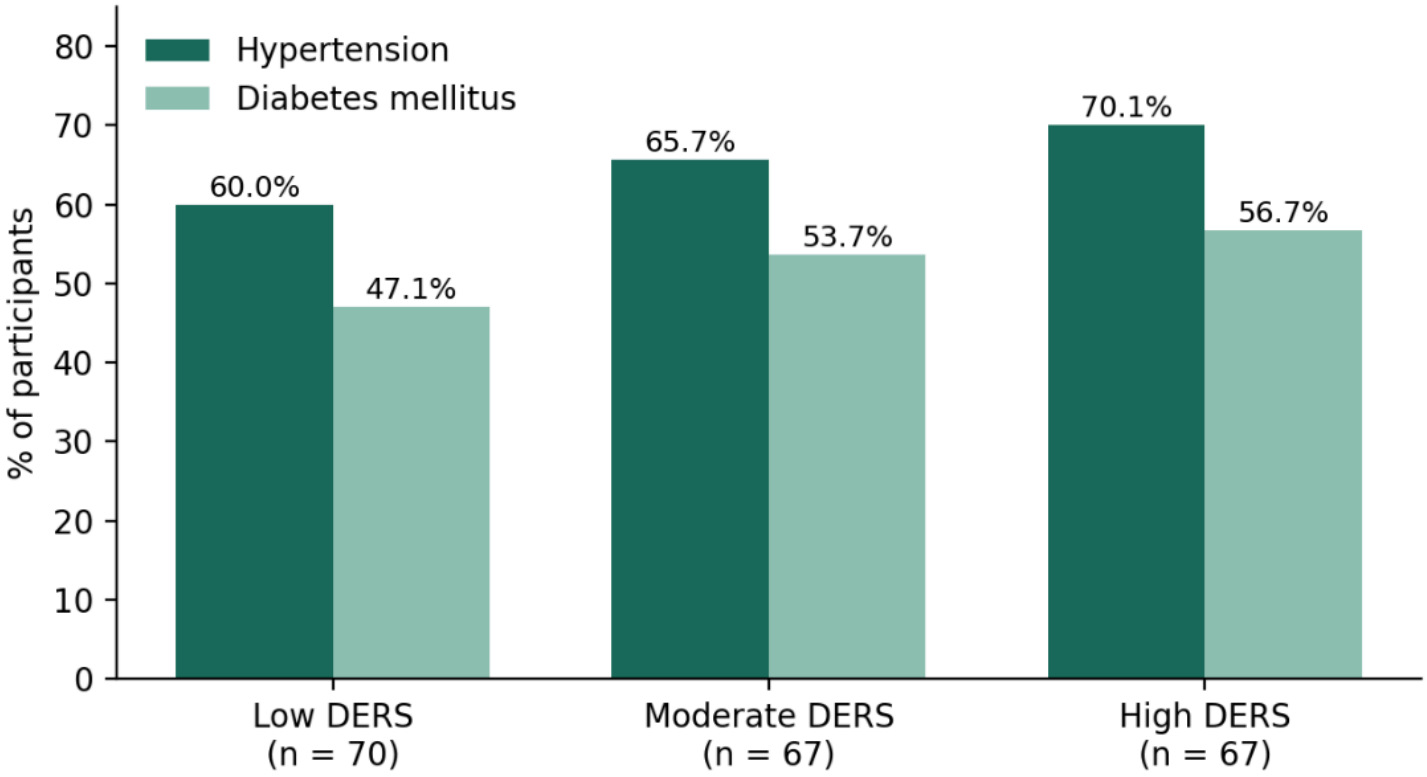

Figure 2

Hypertension and diabetes mellitus by level of emotional dysregulation

Study data (n = 204); chi-square p = 0.458 (hypertension) and p = 0.516 (diabetes).

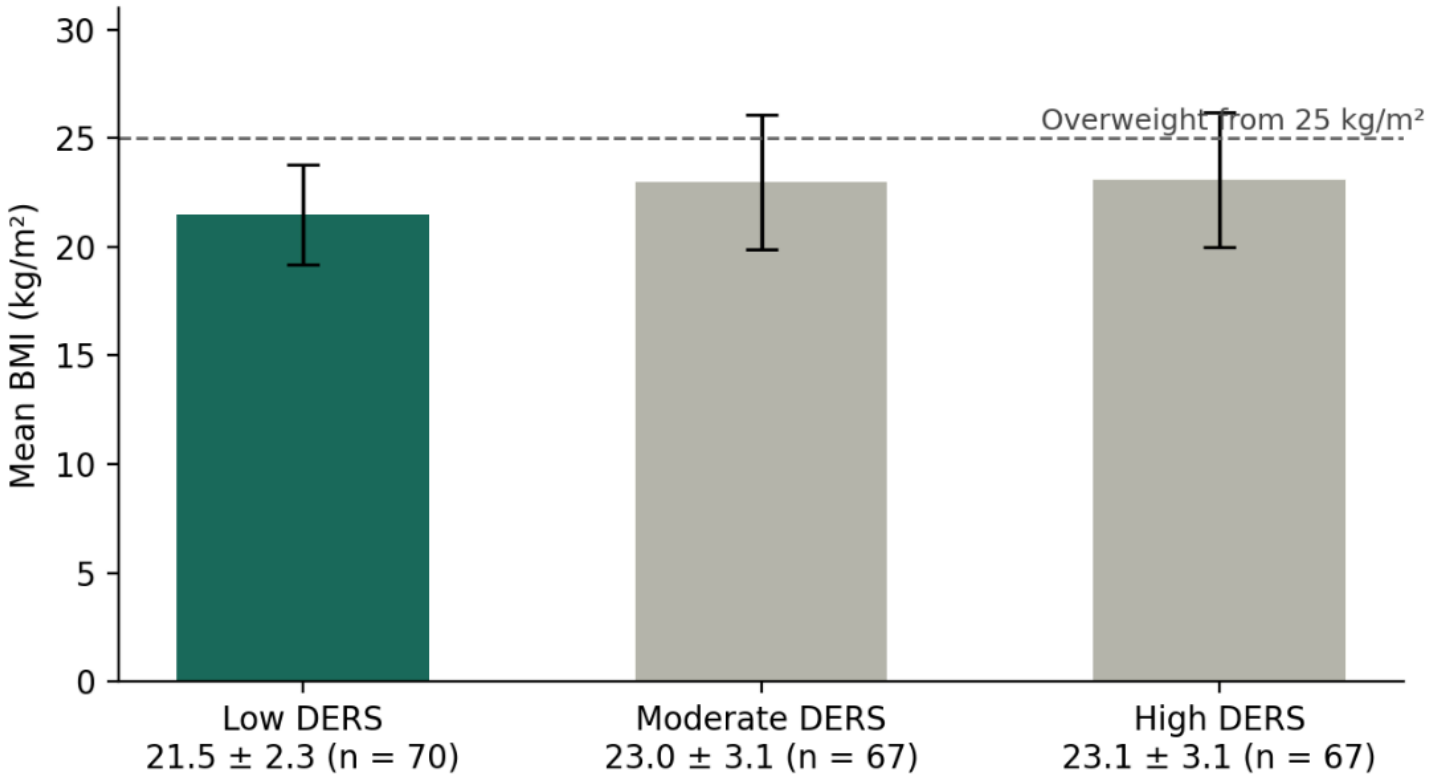

Figure 3

Mean BMI by level of emotional dysregulation

Study data (n = 204); one-way ANOVA p = 0.002, not significant after adjustment (p = 0.213).

ANOVA F = 6.72, p = 0.002; Kruskal–Wallis H = 10.90, p = 0.004; chi-square for nutritional status groups p = 0.122.

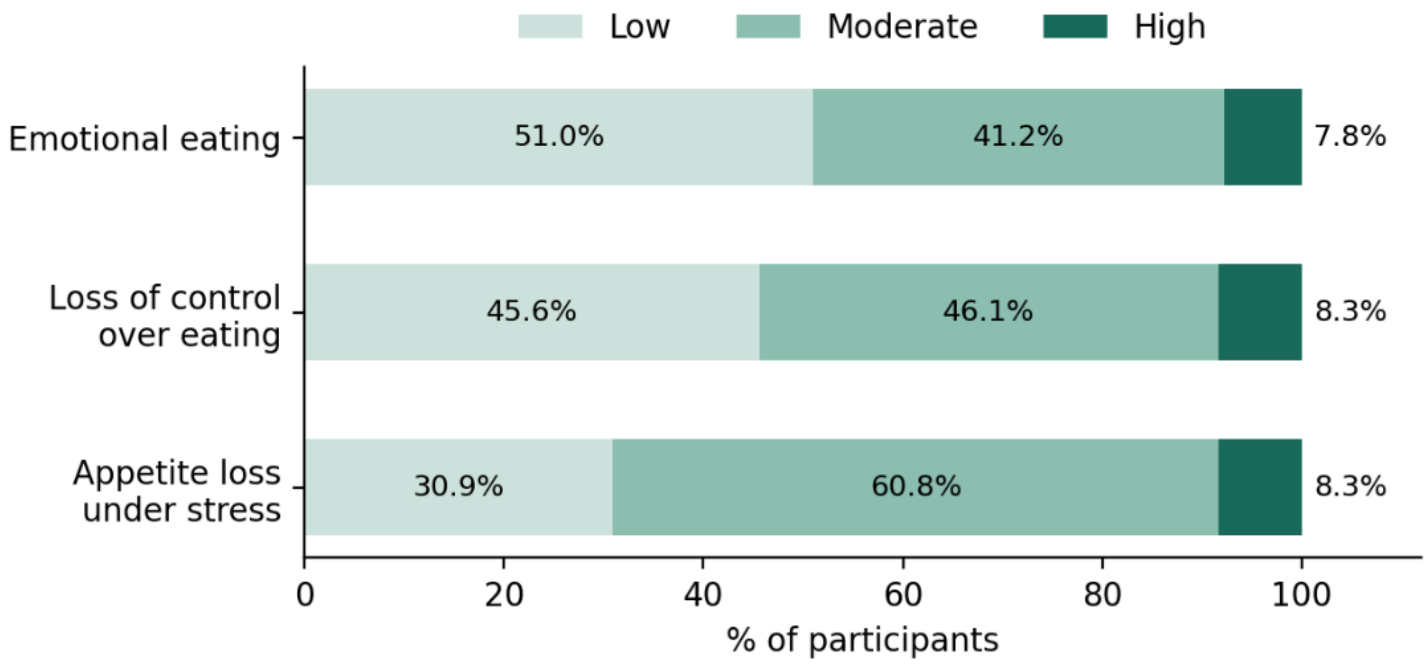

Figure 4

Levels of emotional eating, loss of control over eating and appetite loss under stress

Study data (n = 204); low = 1.00–2.33, moderate = 2.34–3.66, high = 3.67–5.00 (mean item score).

Mean item scores (range 1–5). Low = 1.00–2.33, moderate = 2.34–3.66, high = 3.67–5.00.