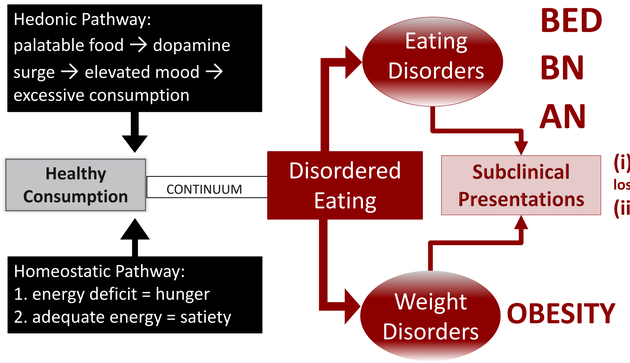
HEART RATE VARIABILITY AND EMOTION REGULATION IN ADULTS WITH EATING DISORDERS OR OBESITY: A SYSTEMATIC REVIEW

CHLOE GILKINSON
MICHAELA FLYNN, LUCY GALLOP & PROFESSOR ULRIKE SCHMIDT
Department of Psychological Medicine, Institute of Psychiatry, Psychology & Neuroscience



1. INTRODUCTION

BACKGROUND

1.1. Disordered Eating

Eating behaviour exists on a continuum from healthy eating to disordered eating: obesity / eating disorders (EDs), including binge eating disorder (BED), bulimia nervosa (BN), anorexia nervosa (AN), and/or their subclinical presentations. [1]

Eating and weight disorders are prevalent public health concerns with high rates of morbidity and mortality, yet suboptimal clinical outcomes.

Eating behaviour is governed by hedonic [2] & homeostatic [3] pathways. Healthy consumption requires adequate emotion regulation & balanced reward-circuitry to avoid shifts → disordered eating. [4]

1.2. Emotion Regulation (ER)

ER is any process involved in influencing the type, magnitude, temporal features & expression of emotions being experienced. ER-impairment = failure to implement contextually appropriate, timely ER strategies. [5,6]

ER difficulties are central trans-diagnostic phenomena across the eating disorder spectrum. [7,8] Pathological eating is deployed to inhibit / suppress negative emotions. [9,10,11] Specific ER-impairments:

- ❑ **AN**: **nonacceptance** & ↑**punishment sensitivity** [12]
- ❑ **BN**: **impulsivity** & **inhibitory control deficits** [13]
- ❑ **BED**: **stress vulnerability** [14] & **emotion suppression** [15]
- ❑ **Obesity**: **alexithymia** & **impaired social-regulation** [16]

1.3. Heart Rate Variability (HRV) as an Index of ER

HRV: variation in time interval between consecutive cardiac cycles. [19]

It is a quantitative marker of autonomic (ANS) activity. [20,21]
ANS flexibility = adaptability to environmental demands. [22]

- ❑ HRV data is derived from non-invasive monitors such as ECG, making it cheap & easily accessible, with the potential for mobile psycho-physiological assessment. [23]
- ❑ HRV is an alternative to subjective measures of ER.
  - ➢ Self-reporting is limited by various biases. [17,18]
- ❑ Theoretical support for HRV as a tool to assess ER capacity:
  - ➢ Porges' Polyvagal [24] & Neurovisceral Integration Models [25,26]
- ❑ Empirical research: HRV positively correlates with ER capacity (through shared neural circuitry). [27,28]

OBJECTIVES

RESEARCH QUESTIONS

1. How does HRV relate to ER in adults with disordered eating?

2. Is HRV a valid biomarker of ER in adults with disordered eating?

3. Can HRV index post-intervention ER change?

2. METHODS

2.1. Systematic literature search :

- ❑ **PROSPERO ID: CRD42020201406**
- ❑ PRISMA search was performed on PubMed, MEDLINE & PsycInfo.
- ❑ Identified studies screened against a *priori* eligibility criteria.

2.2. Study eligibility criteria (PICOS) :

(P) Participants/population – Inclusion: human, adult, clinically significant ED or irregular eating behaviour. Excluded: organic cause.
(I) Investigation – HRV (time/frequency domain)
(C) Control – not required
(O) Outcome – ER (self-reporting or emotional task/paradigm)
(S) Study design – Inclusion: full peer-review papers, editorials, letters & student dissertations. Exclusion: systematic reviews, meta-analyses, conference abstracts, posters, or book chapters.

2.3. Risk of bias / quality assessment:

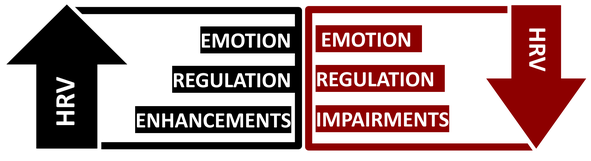
Joanna Briggs Institute Critical Appraisal Tools.

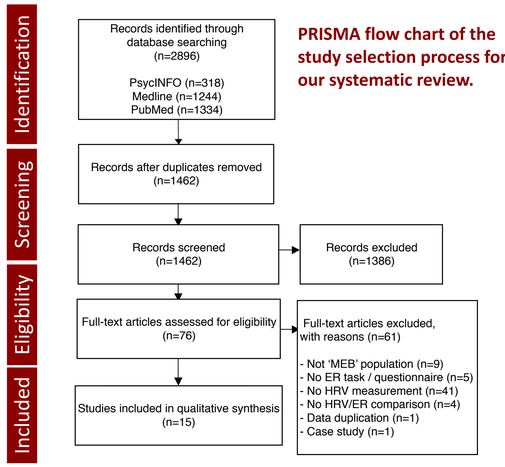
2.4. Data extraction and synthesis:

Data was extracted and synthesised in a qualitative manner.

3. RESULTS

15 publications were included, which involved individuals with obesity, BED, BN, AN, their subclinical presentations, and mixed MEB populations. Studies were small (n=49), predominantly female (89.1%), and were highly variable in methodology, with different diagnostic tools, self-report measures & emotional tasks / paradigms used.





PRISMA flow chart of the study selection process for our systematic review.

4. DISCUSSION

1.

- ❑**BED**: stress-related ↓vagal activity & ↑bingeing = stress predisposition (independent of obesity).
- ❑**OBESITY**: altered vagal activity to social information & palatable food cues under positive mood states.
- ❑**BN vs BED**: ↓ANS adaptability to generalised mental stress (BN>BED) & idiosyncratic stress (BN only).
- ❑**BN**: Startle potentiation + ↓HRV = ↓inhibitory control.
- ❑**AN:** ↓tonic WT-HRV & ↓vagal recovery after emotion.

2.

- ❑**BN:** HRV is a more sensitive biomarker of ER (but maybe only for idiosyncratic stress).
- ❑**BED**: frequency domain HRV is a biomarker of momentary ER & HRV may index specific ER strategies.
- ❑**Obesity**: reliance on contextual factors
- ❑**AN**: tonic WT-HRV can index ER.
- ❑**Mixed**: HRV is ineffective index (potential masking effect).

3.

- ❑Overall, included studies support utility of HRV as an index of altered ER capacity in response to intervention
- ➢**HRV biofeedback**: intervention ↑HRV & ↑ER (self-reported) & HRV-BF can used to test if ↑ANS adaptability in response to treatment.
- ➢**PlayMancer**: effective intervention, marked by post-intervention ↑HRV & ↑ER (self-reported).

STRENGTHS & LIMITATIONS

Moderate risk of bias in 53% & high risk in 27% of studies = possibility of under-reporting.

Small sample sizes = limited statistical power to detect differences between groups.

Excluded if <18 years = gap in the literature regarding HRV & ER in children/ adolescents with EDs. [29]

5 studies didn't control for age and/or sex as covariates (which can confound HRV). [30]

Unequal representation (most studies in obesity, BED & ill-defined mixed groups) – need further research in more clearly defined groups & AN.

Only 4 studies controlled for respiratory influences on HRV.

Wide range of disordered eating: variation in diagnoses, diagnostic measures & tools used to assess ER outcomes meant that quantitative statistical analysis was not feasible.

Controversies exist in what can be inferred from the various HRV indices which limits interpretation. [31]

FUTURE DIRECTIONS

- ❑ **HRV-Biofeedback**: Real-time feeding back of HRV data during breathing in resonance frequency to ↑HRV. [32,33]
  - ➢ HRV-BF was an effective intervention for ↑ER in obesity. [34]
  - ➢ Future investigations using ↑samples sizes & populations of BED / BN / AN / subclinical needed.
- ❑ **PlayMancer:** Videogame to ↑ER by training ↑self-control skills and ↓impulsive behaviours. [35]
  - ➢ Therapeutic potential shown in BN.
  - ➢ Future studies should explore applicability in other EDs/obesity.
- ❑ Debate exits to whether self-reported eating behaviours (e.g., binge & restrained eating) reliably correspond to the actual occurrence of pathological eating. [36]
  - ➢ Future studies should objectively measure real-life consumption / restraint (+ subjective self-reporting).

5. CONCLUSIONS

Overall, the evidence suggests that HRV is a valid, objective biomarker of ER impairments in AN, BN, BED, and obesity.

Despite some inconsistencies, likely attributable to the methodological heterogeneity present throughout the included literature, disordered eating appears to be characterised by reduced resting state vagal activity and abnormal stress reactivity.

Furthermore, the ANS dysfunction observed across the spectrum of EDs/ obesity may be reversible by novel effective treatments, e.g., HRV-biofeedback or PlayMancer videogame therapy.

REFERENCES