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Measuring Physiological Responses and Emotional Expression during Treatment of Pediatric Feeding Disorders: A Pilot Study

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Background

- There are difficulties verifying the accuracy of child self-report of internal states (i.e., emotions) when children are young or experience cognitive delays (Durbin, 2010).
- Children with feeding disorders who require intensive feeding treatment may experience increased positive or negative emotional responding (Phipps et al., 2022).
- Psychological arousal can serve as a reliable indicator for distress during treatment (Pfeiffer et al., 2019) and differences in Heart Rate Variability (HRV) may indicate happy and sad emotional states (Zhao et al., 2017).
- Previously recorded physiological data (by a wrist-worn biosensor) has been used to successfully predict aggressive behavior in autistic children during behavioral treatment (Goodwin et al., 2019).
- **This study aims to identify possible associations between measures of physiological and behavioral data in children with feeding disorders during treatment.**

Methods

Setting, Participants, Materials

- University-Based Pediatric Feeding Disorders Clinic
- 4 children with a feeding disorder (ages 4-14, 75% male, 50% with a language impairment) who assented to wearing device
- Empatica E4 wrist-worn biosensor
- Cometics data collection system used on laptop computers

Data Collection Procedures

- We collected physiological data for ~ 180 minutes of treatment sessions across multiple days of treatment for each participant with concurrent behavioral coding.
- *Behavioral measures*: indices of happiness, indices of unhappiness, duration of access to food, to toys and/or electronic device
- *Physiological Measures*: HR (Heart Rate), HRV, EDA (Electrodermal Activity), motion
- An independent observer collected data on behavioral measures for at least 20% (range, 20%-47%) of the total minutes of data collection.
- Mean interobserver agreement across participants for happiness was 95% and unhappiness was 98.5%.

Data Analysis

- Cometics divided the data (physiological and behavioral) into 20 s intervals and output into excel spreadsheet for data analysis.
- We reviewed HR data for each participant to calculate an average heart rate and identify the heart rate ranges per appointment.
- We reviewed the number of 20 s intervals with indices of happiness, unhappiness, and no indices scored per appointment and calculated a percentage of total 20 s intervals for each dependent variable.

Major Findings

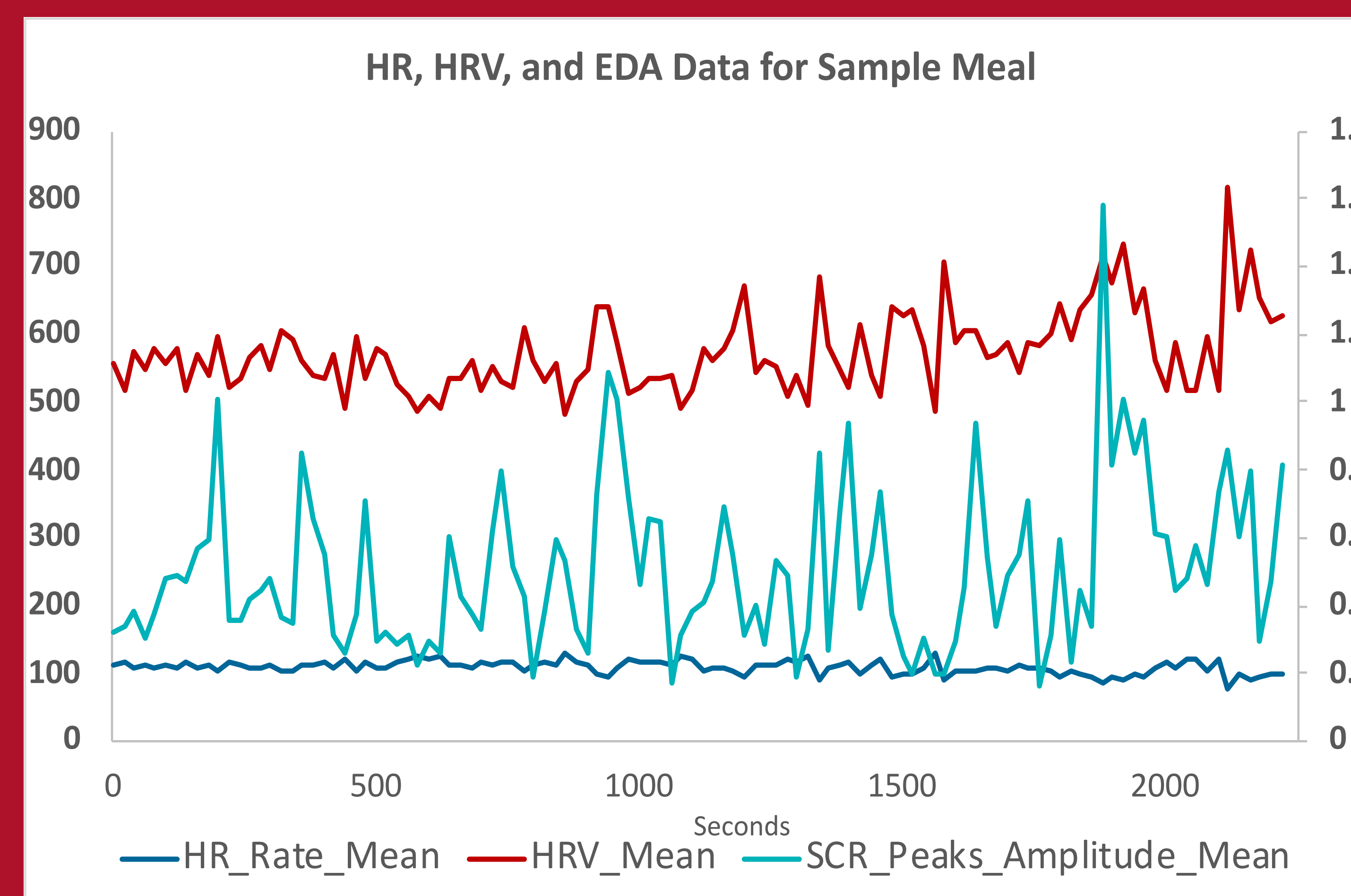
- **All children demonstrated an average normal heart rate during feeding therapy appointments.**
- **All children demonstrated a primarily neutral emotion.**
- **3 out of 4 children demonstrated a brief elevation in heart rate outside the normal range for a 20 s interval during at least one appointment.**



Scan for more information

Figure 1

Physiological Data for Sample Meal



Note. The red line and the dark blue line correspond to the axis on the left, while the light blue line corresponds to the axis on the right

Results

1 Heart Rate Data Summary

Table 1

Heart Rate Data Analysis Results

	Normal HR range	Average HR	# of appointments with episode of atypical HR elevation
Participant 1	80-120 BPM	90 BPM	2 out of 7 appointments
Participant 2	60-100 BPM	82.9 BPM	4 out of 7 appointments
Participant 3	80-120 BPM	83.8 BPM	0 out of 5 appointments
Participant 4	70-110 BPM	83.4 BPM	2 out of 5 appointments

Note. The normal ranges for heart rate are based on age and collected from Children's HealthSM. They are reported as beats per minute (BPM). The sum of the participants' average heart rate for each appointment divided by the total number of their appointments is displayed as their average heart rate. Atypical heart rate elevation was defined as a heart rate that exceeded the normal heart rate range for at least one 20 s interval per appointment.

2 Indices Data Summary

Table 2

Percent Indices of Happiness, Unhappiness, or Neither Across all Appointments

	% Total Happiness	% Total Unhappiness	% Total Neutral
Participant 1	18.38%	5.83%	75.79%
Participant 2	16.20%	1.96%	81.84%
Participant 3	11.66%	13.28%	75.06%
Participant 4	2.29%	0.40%	97.31%

Note. The percentages of total happiness, unhappiness and neither are equal to the number of 30 s intervals with happiness, unhappiness, or neither scored, respectively, summed and divided by the participant's total number of 30 s intervals of data collection.

Conclusions

Limitations

- Sampling rate for heart rate variability for children is low (see QR)
- Possible effects of medication on heart rate (75% of participants were taking medication throughout treatment)
- Components of treatment sessions varied across participants
- Limited information on baseline heart rate outside of feeding sessions

Future Directions

- Conduct a statistical analysis to determine if there are any significant associations between presence of food and indices of happiness, indices of unhappiness, elevated heart rate, and heart rate variability.
- Conduct an in-depth analysis to determine environmental variables at play during elevated heart rate (e.g., presence of electronic device)
- Investigate whether preceding physiological and motion data measured by a wrist-worn biosensor can be used to predict and monitor negative (unhappiness) and positive (happiness) emotional states in children with feeding disorders during treatment.