

# Hyperphagia in Children with Prader-Willi Syndrome: Insights From Eye Gaze and Brain Response Measures

## A Research Report for Families

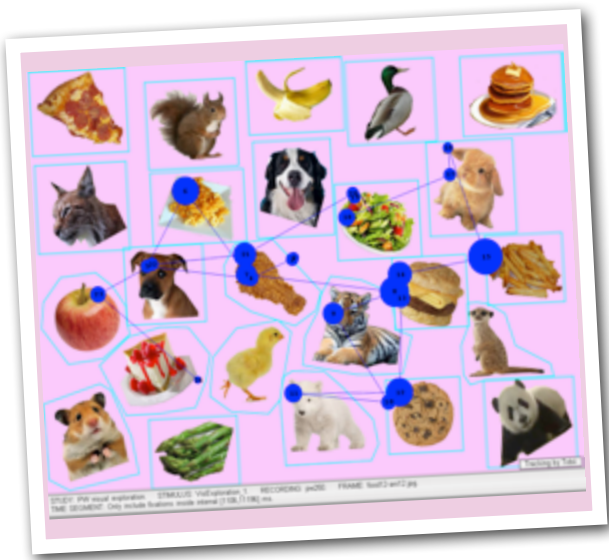
Alexandra (Sasha) Key, Ph.D., Research Associate Professor of Hearing & Speech Sciences and of Psychiatry & Behavioral Sciences; Director, Vanderbilt Kennedy Center Psychophysiology Lab

### Introduction

Hyperphagia, or intense hunger, is one of the distinctive features of Prader-Willi syndrome (PWS). It emerges in early childhood and remains a life-long concern for individuals with PWS and their caregivers. Yet, detecting hyperphagia onset, monitoring progression, and/or evaluating treatment effects is challenging due to the lack of sensitive objective measures.

In this study, our aim was to use eye tracking and brain responses recorded directly from children with PWS to obtain new insights into processes underlying emerging hyperphagia in PWS.





## What the Study Involved

This study focused on visual attention and emotional responses to food images during passive viewing in children with PWS. Without the need for a behavioral response, these measures are optimal for use across ages and also circumvent any bias associated with task understanding or the desire to provide “correct” responses.

We used eye tracking during visual exploration of multi-picture displays to examine whether children with PWS attend to food stimuli more than to other image types. Eye movements are a natural human behavior that does not need to be taught, and more salient stimuli are known to attract an increased number and duration of eye gaze fixations.

We also used EEG (electroencephalography) to measure brain responses called visual event-related potentials. An event-related potential (ERP) is the change in brain electrical activity in response to a specific stimulus. Wearing a soft sensor net with many sponges, your son or daughter looked at color photographs showing food, animals, and office supplies one at a time. If food images elicited more emotionally charged reactions, they were expected to generate larger brain responses compared to the less salient pictures.

## The Study's Questions

- ❑ Do children with PWS respond to food cues differently than age-matched typical peers?
- ❑ Is emerging hyperphagia in PWS associated with increased attention and affective response to food?

## Study Design

You and your daughter or son were a part of a study sample of 57 families of children with PWS. All participants had genetically confirmed PWS and were between 3 and 11 years of age (mean age was 7 years). The study also included 47 families of children without PWS. We recorded eye movements and brain responses during a single research visit completed within 90 minutes after the most recent meal or snack.

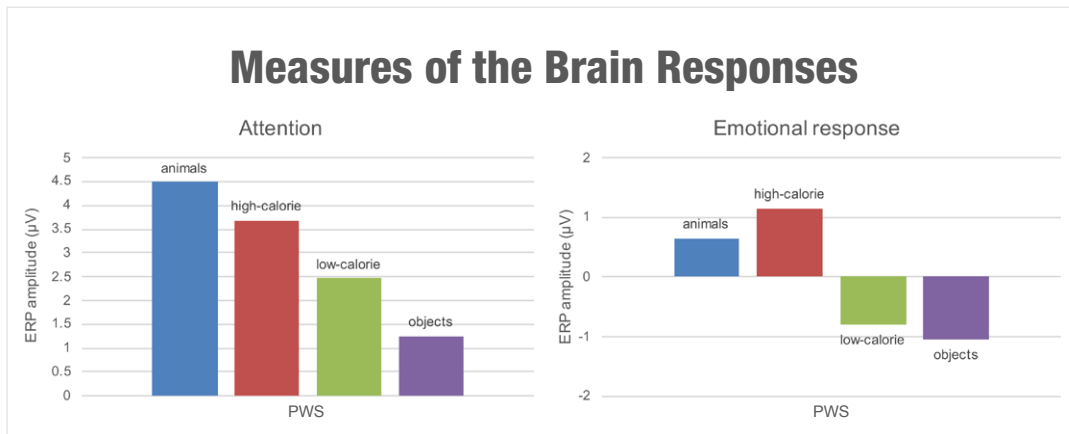
Our measure of hyperphagia came from the questionnaire about the food-related behaviors you had observed in your son or daughter over time at home and in other settings.

The information you shared during the interview with the clinical team allowed us to estimate your child's nutritional phase, or the position on the continuum of hyperphagia progression in PWS, from failure to thrive to normal feeding to weight gain and increased interest in food to hyperphagia.

## Findings

**Eye tracking:** The results revealed that food items are not exceptionally attention-grabbing for children with PWS when hyperphagia is first emerging. As a group, children with PWS did not look at food more often or for a longer period of time compared to the typical peers. However, at the individual level, more severe hyperphagia and more advanced nutritional phase were associated with increased attention to food relative to other high-interest items (e.g., animals), reflected in the increased number and duration of fixations as well as a higher number of gaze returns to images of edible items. Similar findings have been previously reported in older children and adults with PWS.

**Brain activity:** Children with PWS tested after a meal did not generate larger than typical neural responses to food cues, providing further evidence that food may not be the most motivationally significant stimulus in PWS. Instead,



increasing hyperphagia was associated with faster than typical neural responses as well as more prolonged and detailed stimulus categorization in terms of edibility and caloric content. In particular, only children with PWS demonstrated neural differentiation between the high-calorie and low-calorie foods, indicating greater salience of more energy-dense stimuli.

## Conclusion

With your help, this study provided new objective evidence that emerging hyperphagia in children with PWS is associated with increased attention to food above other high-interest stimuli (e.g., animals) as well as faster detection of edible items and more detailed analysis of high calorie versus low calorie content, even when tested shortly after a meal. These results are consistent with a delayed satiety response model of hyperphagia in PWS.

## Heartfelt Thanks

We are grateful to the families who participated in this study. You are our partners in discovery. Without families taking part in research, we could not advance our understanding of hyperphagia in Prader-Willi syndrome.

*This research study was supported by funding from the Foundation for Prader-Willi Research. The Vanderbilt Kennedy Center Psychophysiology Lab is supported in part by the EKS NICHD of the NIH under Award #U54HD083211. The content is solely the responsibility of the author and does not necessarily represent the official views of funding agencies.*



*Graphic services supported in part by EKS NICHD Grant 1P50HD103537-01 to the Vanderbilt Kennedy Center, 03/2021*