# Increasing Tolerance to Nutritious Foods through Garden-Based Interventions

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## Introduction

As gardening within educational settings has gained popularity as an intervention to increase children's intake of nutritious foods (Holloway et al., 2023, Savoie-Roskos et al., 2017); however, few studies have evaluated the effects of garden-based interventions to increase the consumption of nutritious foods among individuals with developmental disabilities.

- Children with developmental disabilities often face unique challenges with dietary habits and nutrition
- Introducing nutritious foods can be challenging due to sensory sensitivities, food aversions, or other related factors (Baraskewich et al., 2021)

The current study evaluated the use of a garden-based intervention to increase tolerance to nutritious foods for children and adolescents with developmental disabilities. The study sought to determine if engagement in routine gardening activities like planting, watering, and harvesting within a therapeutic setting would increase the likelihood of tasting nutritious food items.

## Method

**Recruitment:** Participants were recruited from a center-based ABA clinic via e-mail and flyers sent home to caregivers

**Inclusion Criteria:** Individuals attending the clinic between 2-21 years old with a current diagnosis of developmental disability were eligible for participation. Participants were required to be present at the clinic a minimum of two times per week.

**Participants:** 20 children and adolescents ranging between 4-20 years-old

**Setting:** Earl Lee Evans Sensory and Community Garden at Firefly Autism; Therapeutic garden in partnership with Denver Urban Gardens (DUG)

**Experimental Design:**

**Baseline**
- Primary caregivers completed questionnaires about food selectivity
- Center-based RBTs collected 3-days of baseline data indicating time spent in the garden pre-intervention

**Garden-Based Intervention**
- Garden 2 times per week
- Ongoing engagement in planting, watering, and harvesting from mid-May through early-October (per needs of garden)
- 1:1 RBT support and continued implementation of treatment plans during garden sessions
- Assent based procedures

**Tasting Sessions**
- Occurred when food items ready to be harvested
- Food items and/or condiments prepared outside of session; Food paired with crop picked from garden during tastings
- Desensitization for assenting participants (touch/manipulate; smell; "kiss;" hold in mouth; touch tongue; put in and close mouth; bite)

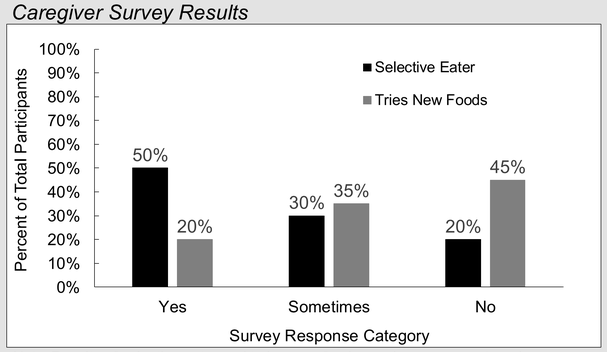
Collaboration with horticultural therapist from DUG one time per week. Prompted engagement with crops and sensory plants during sessions.

**Variables and Data Collection:**
- Yes/no survey completed by 1:1 RBTs via Microsoft Forms post-session
- Survey questions about engagement with garden activities, sensory plants, sensory activities, and crops
- Data for food tasted collected when crops available during tasting sessions; Tasting marked as "yes" if reached step of touching item with tongue, putting in mouth, or consumption

## Results

**Figure 1**

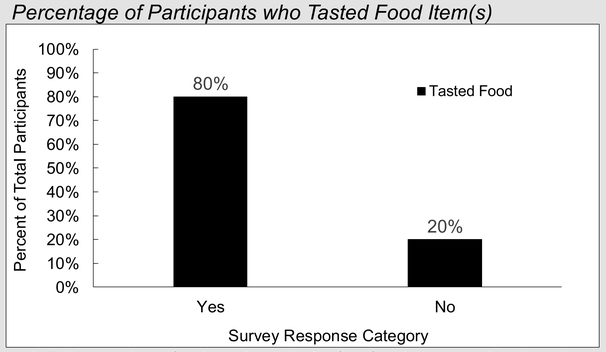
*Caregiver Survey Results*




*Note.* Results of selective eater and trying new food caregiver survey categories.

**Figure 2**

*Percentage of Participants who Tasted Food Item(s)*




*Note.* Total percentage of participants who tasted food from the garden at least one time throughout the study.

**Table 1**

*Percentage of Participants Tasted Food by Survey Categories*

| Survey Category | Selective Eater | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Yes | | Sometimes | | No | | "Tries New Food" Tasted Total | |
| | n | % | n | % | n | % | n | % |
| Tries New Foods | | | | | | | | |
| Yes | 0/0 | 0% | 1/1 | 100% | 3/3 | 100% | 4/4 | 100% |
| Sometimes | 2/3 | 66.67% | 2/3 | 66.67% | 1/1 | 100% | 5/7 | 71.43% |
| No | 5/7 | 71.43% | 2/2 | 100% | 0/0 | 0% | 7/9 | 77.78% |
| Totals | "Selective Eater" Tasted | | | | | | Participants Tasted | |
| | 7/10 | 70% | 5/6 | 83.33% | 4/4 | 100% | 16/20 | 80% |

*Note.* Total percentage of participants who tasted food by combined selective eater and tries new food survey categories. 77.78% of participants whose caregivers indicated they did not try new foods tasted food during the study. 71.43% of participants whose caregivers indicated they were selective eaters and did not new foods tasted food during the study.

**Table 2**

*Statistical Analysis and Findings*

| Analysis | Research Question | Findings | Descriptive Statistics | p-value | Interpretation |
|---|---|---|---|---|---|
| Binomial Test (Exact) | Did more participants taste food than expected from a survey baseline of 20% in the "yes" category for trying new foods and 20% in "no" category for selective eating? | Observed = 0.8<br>Test = 0.2 | N=20; M=1.8; SD=0.41 | < .001 | Significantly more participants tasted food than expected from 20% baseline |
| One-Sample t-test: Value 0.375[a] | Is the average proportion of tastings greater than baseline or the estimate value of tasting new foods without the intervention? | t(18) = 1.052 | N=19; M=0.45; SD=0.29<br>95% CI | .153 | Participants tasted during ~45% of opportunities; not significantly different from 37.5% |
| One-Sample t-test: Value 0.2[b] | Is the average proportion of tastings greater than baseline or the estimate value of tasting new foods without the intervention? | t (18) = 3.643 | N=19; M=0.45; SD=0.29<br>95% CI | < .001 | Participants tasted during ~45% of opportunities; significantly different from 20% |
| Logistic Regression | Did the number of tasting opportunities or exposures predict whether the participant would taste food? | $\chi^2(1)$ =7.32, Nagelkerke $R^2$= .485, B=0.64, OR=1.90 | — | .038 | Each additional opportunity nearly doubled odds of tasting |
| Linear Regression | Was tasting food predicted by the categorical survey traits of food selectivity, trying new foods, and/or garden experience? | F(3,16) = 0.51,<br>$R^2$ = .087 | — | .682 | No significant linear relationship between predictors and tasting |
| Crosstabs / Chi-square | Were the categorical survey traits of food selectivity, trying new foods, and/or previous garden experience related to whether the participant tasted food? | $\chi^2$ range = 0.22–1.67 | — | .43–.64 | No significant associations; descriptive trends consistent with predictions |

*Note.* Results from statistical analysis tests evaluating garden study data set

[a] Test value of 0.375 based on survey baseline data of 20% (4/20) of participants in the "yes" category and ½ of 35% (3.5/20) of participants in the "sometimes" category for tasting new foods

[b] Test value of 0.2 based on survey baseline data of 20% (4/20) of participants in the "yes" category for trying new foods

## Discussion

Tasting behavior increased four times above survey baseline levels, suggesting garden-based interventions may effectively increase tolerance to tasting novel and/or nutritious foods

- Survey results for willingness to try new foods, selective eating, and prior garden experience did not significantly predict the likelihood of tasting
- Each additional tasting opportunity nearly doubled the odds of participants tasting a novel food item, highlighting the importance of repeated, assent-based exposure during garden-based interventions

Results support the use of garden-based interventions to increase tolerance to nutritious foods

**Limitations:**
- Data collected by participants' individual teams of RBTs; Limited to binary survey methods (decrease response effort and increase reliability)
- Unable to obtain high percentage of data for interactions with the garden outside of scheduled sessions (84% data collected during scheduled sessions; only scheduled session data reported)
- Attrition rate of 13%

**Future Research:**
- Further evaluate increasing tolerance and intake of nutritious foods over time
- Identifying which components of garden-based interventions most strongly influence increased tasting and intake of nutritious foods

## References

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