School Lunch Cafeteria Noise is Associated with Fruit and Vegetable Consumption Among Elementary Students

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Schools can help promote fruit and vegetable (FV) consumption



- Fewer than 1 in 10 meet federal recommendations for daily FV consumption[1]
- With over 50% of calories consumed in schools, they offer an advantageous setting for interventions[2]
- The NSLP offers an opportunity to increase FV consumption

1. *2015-2020 Dietary Guidelines for Americans*
2. Briefel et al. *J Am Diet Assoc*. 2009

Factors associated with FV consumption at school lunch



- Updated HHFKA standards associated with increased FV consumption at school lunch[1]
  - Unregulated factors may further constrain or enhance consumption[2]

- Focus has been on physical and social environmental factors, such **recess placement**, **time for lunch**, and **access to salad bars**

- Previous studies have generally only considered one factor in isolation[3]

[1] Cullen & Daves. *J Acad Nutr Diet.* 2017
[2] Dixon et al. *FASEB J.* 2015
[3] Gorman et al. *Obesity.* 2007

Noise is a novel factor



- Exposure to noise associated with **adverse health and cognitive effects**[1]

Agency	Guideline
Nat'l Inst Occupational Safety & Health (NIOSH)	Hearing loss likely at **>85 decibels**; implement noise reduction
World Health Organization (WHO)	**>80 decibels** for 160min/day may result in hearing loss
American Academy of Pediatrics (AAP)	**Reduce noise exposure** among children

- Cafeteria noise may influence FV consumption, but this has not been examined empirically[2]

[1] Hammer et al. *J Am Pub Health.* 2014
[2] Bryker et al. *JNEB.* 2014

Research question



- What is the association between the following *environmental factors* and consumption of FV at school lunch among 2nd and 3rd grade students participating in the NSLP?
  - Noise (decibels)
  - Presence of a salad bar (yes/no)
  - Lunch length (minutes)
  - Recess before lunch (yes/no)
  - Number of FV options at lunch (count)

Methods



- All data collected between May and June 2016
- 2nd and 3rd grade students from 20 schools participating in FoodCorps
- Stratified sampling methodology
  - School-level sociodemographic variables race/ethnicity, enrollment, and race/ethnicity
  - Healthy Schools Progress Report Score

See Poster #211 until 12:00pm

Digital photography







- Cameras placed on tripods at 60-degree angle
- Before- and after-meal photo protocol [1-2]
- Interrater reliability: 99% for items on tray; 83% for amount consumed

1. Swanson et al., 2008
2. Taylor et al., 2014

Measurement of environmental factors



- Environmental factors measured via **observational checklist**
  - Recess relative to lunch
  - Time allocated for lunch
  - Presence of salad bar
  - Number of FV items offered

- **Noise** measured via sound level meter placed in cafeteria ~5ft from lunch tables



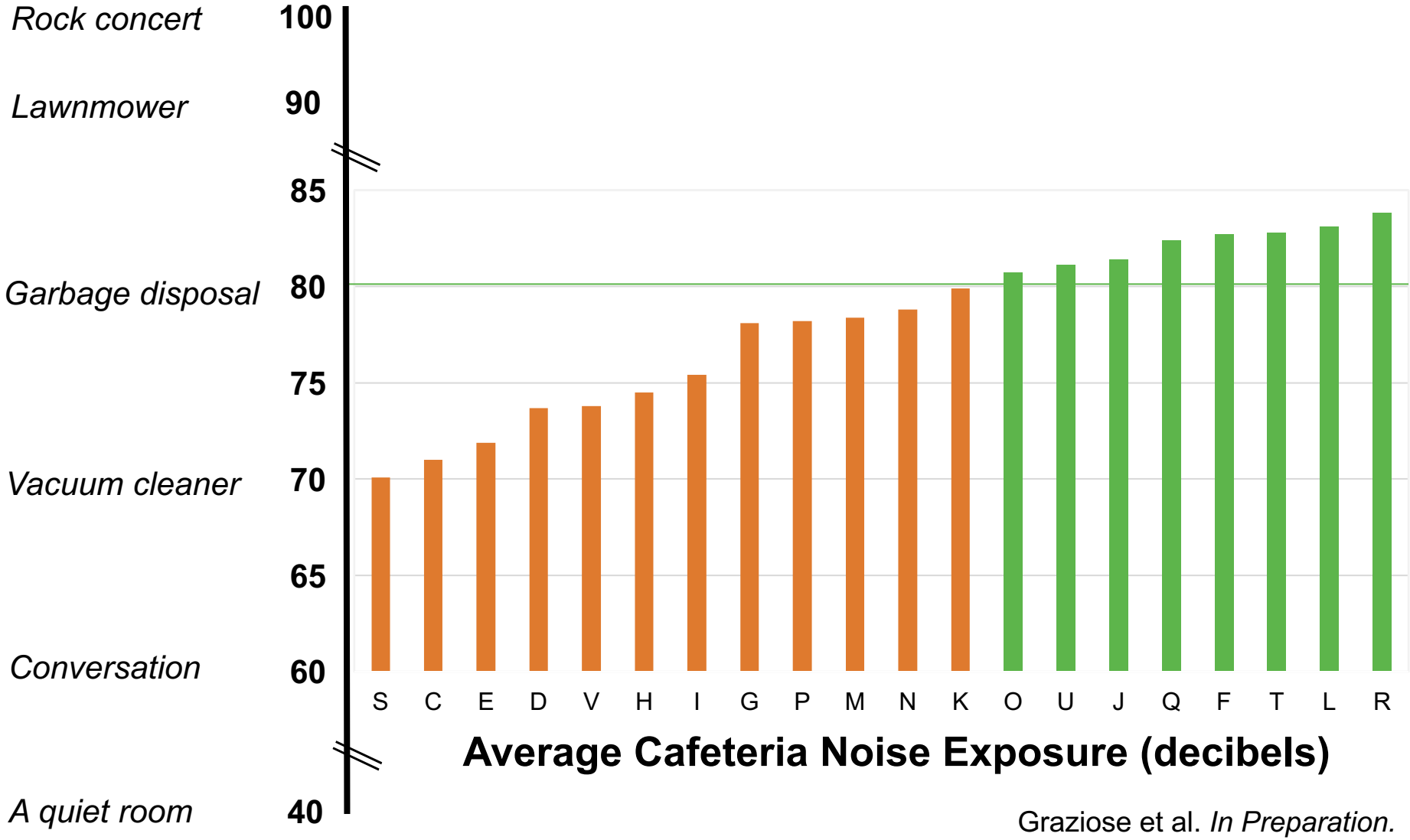


Lunch tray observations (n=2,571)	*n, %*	
Grade		
• 2nd grade	1,360	53
• 3rd grade	1,065	44
Recess structure		
• Recess before lunch	695	27
• Recess after lunch	1,876	73
Salad bar access		
• No salad bar	1,021	40
• Salad bar	1,550	60
Schools (n=20)	*Mean, range*	
Ethnicity		
• White (%)	29.4	0 - 98
• Black (%)	40.1	0 - 90
• Hispanic (%)	22.1	0 - 76
• Asian (%)	3.5	0 - 36
Healthy Schools Progress Report	55	28 - 97
FRPL eligible (%)	76.5	32 - 100
FoodCorps participation (years)	2.2	1 - 4
Time for lunch (min)	27.9	21 - 39
FV items offered	7.4	3 - 14

Graziose et al.
In Preparation.

Sound (noise) levels of cafeterias are high





Graziose et al. *In Preparation.*

Noise is negatively associated with FV consumption



Hierarchical linear models with FV consumption outcomes square-root transformed

	Vegetable consumption (cups)		Fruit consumption (cups)		Fruit + vegetable consumption (cups)	
	B	*(S.E.)*	*B*	*(S.E.)*	*B*	*(S.E.)*
Lunch length (min)	0.003	(0.003)	-0.001	(0.003)	0.003	(0.003)
Noise (decibels)	-0.004	(0.004)	**-0.012****	(0.004)	**-0.017****	(0.004)
FV items (count)	**0.021****	(0.006)	0.002	(0.007)	0.002	(0.006)
Salad bar						
• No	ref	ref	ref	**ref**	ref	ref
• Yes	-0.004	(0.103)	0.029	**(0.084)**	0.006	(0.107)
Recess structure						
• After lunch	ref	ref	ref	**ref**	ref	ref
• Before lunch	0.003	(0.026)	**0.100****	**(0.023)**	**0.096****	(0.023)

Graziose et al. *In Preparation.*

Conclusions



- Environmental factors are associated with F/V consumption
  - **Recess before lunch positive**
  - **Number of FV items positive**
  - **Noise negative**
  - **Time allocated for lunch null**
  - **Access to salad bar null**

- Difference of about 0.15 cups per decibel between 25th and 75th percentile for noise

Implications for research and practice



- Noise and recess before lunch are potentially amenable to intervention
- Researchers should control for these potentially confounding effects in C-RCTs
- Future research is needed to manipulate noise levels and explore a mechanism

Thank you!

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