Indicators of Household Composition are Associated with Adherence to Fruit and Vegetable Intake Recommendations Among Caretakers Eligible for SNAP with Children

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Article

Indicators of Household Composition are Associated with Adherence to Fruit and Vegetable Intake Recommendations Among Caretakers Eligible for SNAP with Children

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Abstract

Inadequate fruit and vegetable consumption is associated with increased risk of chronic disease. Yet, many individuals consume below the recommended intake according to the dietary guidelines for Americans (DGA). This study aimed to examine the association with fruit and vegetable (FV) intake adherence to DGA (2020-2025) recommendations of 1.5-2 cups of fruits and 2-3 cups of vegetables daily for adults. among caretakers with a child(ren) living in households eligible for Supplemental Nutrition Assistance Program (SNAP). We conducted a cross-sectional analysis of 85 caretakers with children in an urban neighborhood of low-income in Bronx, New York (NY). Log-binomial regressions demonstrated that having more children (RR 1.36; 95% CI 1.15-1.59), younger children (RR 1.22; 95% CI 1.07-1.39), or children participating in a school lunch program (RR 1.47; 95% CI 1.16-1.85) was positively associated with caretakers' probability of adhering to the FV DGA recommendations. Future studies are needed to further examine food behaviors among caretakers of low-income.

Keywords: fruit and vegetable intake; household; children; food assistance programs; low-income

1. Introduction

Adequate intake of fruits and vegetables (FVs) is associated with a reduced risk for many chronic diseases, such as obesity[1], [2], type 2 diabetes mellitus [3], [4], cardiovascular disease [5], and cancer [5], [6], [7]. The Dietary Guidelines for Americans (DGA) 2020-2025 recommends adults in the United States (U.S.) consume 1.5-2 cups of fruits and 2-3 cups of vegetables daily [8]. However, only 10% of adults meet the fruit and vegetable (FV) intake recommendations [9].

High food costs, limited availability, and lack of access to FVs, particularly in communities of low-income who disproportionately consume fewer FVs than their counterparts, are among the multifaceted environmental barriers to healthy eating [8], [10]. Concurrently, adults living in households of low-income report limited time to shop and cook as an individual-level barrier to FV intake [8]. The household composition may also play a role in FV intake, as it is associated with eating behaviors that influence food allocation and social norms [11]. Having more children in the household may increase food budgets and preparation time, leading to lower FV intake, particularly among caretakers who may modify their diet to provide for their children in the context of food insecurity [12].

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Previous studies examining household composition and diet have focused on household food purchases [12], [13], [14], [15], [16], intake [17], or the children's diet [17], [18], [19], [20]. These studies have yielded mixed results. Some reported that having more children in the household predicted a higher children's fruit intake [20], whereas others showed a negative association between the number of children and their FV intake [17], [18] as well as vegetable variety [18]. Nonetheless, few studies consider the role of household composition in adult caretakers' FV intake [21], [22], [23], [24], [25]. It is important to understand how indicators of household composition may be associated with the caretakers' diet, as they are important role models and may shape children's food choices over time [26]. Most existing literature compared FV intake between parents and non-parents, with results showing that caretakers consume more sugar-sweetened beverages, total calories, and percent saturated fat as well as fewer FVs [21], [22], [23], [24], [25] due to having less time to eat healthy and consuming more snacks with their children [21]. However, there may be an important heterogeneity aside from the children's presence within households that warrants investigation regarding the caretakers' FV intake.

Numerous studies have examined children's characteristics, such as age and participation in a school lunch program as indicators of household composition [27], [28], [29], [30], [31], [32]. Two cross-sectional studies [27], [28] found that children who are older tend to consume fewer fruits [31] and adopt unhealthier dietary patterns compared to their younger counterparts [32] due to different levels of support from caretakers on FV intake and their emerging independence in food choices [27]. Thus, caretakers with children who are older may purchase and consume fewer FVs. Other studies found that having more children in the household participating in a school lunch program decreased food spending, providing the opportunity to reallocate the food budget for higher-quality food items among other household members [29], [30]. Such studies have urged the current body of literature to move beyond the measure of children's presence in the household to include the number of children and children's characteristics within the household composition.

Therefore, our study contributes to the current body of literature by considering an array of indicators of household composition including household size, number of children, children's age, their participation in a school lunch program, and number of adults to examine the association with FV intake adherence to DGA recommendations among caretakers with a child(ren) living in households eligible for Supplemental Nutrition Assistance Program (SNAP).

2. Materials and Methods

2.1. Participants

We conducted a cross-sectional analysis of 85 caretakers eligible for SNAP with a child(ren) in the Bronx, New York (NY) to examine the association between indicators of household composition and FV intake adherence to the DGA 2020-2025 among caretakers eligible for the SNAP with a child(ren). Our analysis was part of a parent study that examined the feasibility of an online grocery intervention to support healthy food selection among households of low-income with children. The New York University Institutional Review Board (IRB-FY2022-6623) approved our study protocol, and all individual participants provided written informed consent virtually.

2.2. Data Collection

We collected data between July and September 2022 in five Head Start centers located in two neighborhoods in the Bronx, NYC with the highest poverty rates compared to the city estimates [33].

We approached caretakers who, if interested, scanned a barcode or texted our study's texting line to receive a link to an online survey available in English and Spanish via Qualtrics. Caretakers answered screening questions to assess eligibility for the parent study: 1) be the primary food shopper of a household with a child(ren) $\leq$ age 10, 2) be a SNAP participant in the past year or have an annual household income $\leq$130% of the federal poverty level, 3) have a smartphone to facilitate participation in the parent intervention, and 4) speak English or Spanish. Those who met the eligibility

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requirements continued to answer other survey questions regarding demographic characteristics (i.e., age, sex, race/ethnicity, and preferred language), household food security via the United States Department of Agriculture (USDA) 6-item Food Security [34], SNAP participation in the past year, indicators of household composition (i.e., household size, number of children ≤ age 10, children ≤ age 5, children participating in a school lunch program), and FV intake via the National Care Institute (NCI) FV Screener [35]. We used reCAPTCHA verification and cookie technology to confirm human answers and single submission per participant, respectively. Caretakers took approximately 15 minutes to complete the online survey and received $20 after completing it.

2.3. Measures

2.3.1. Outcome Variable

We assessed the caretakers' FV intake using the NCI FV Screener. The screener is a self-reported assessment of usual FV intake in either cups or servings. The screener inquired about the amount as well as daily, weekly, and monthly intake of ten FV categories (i.e., juice, fruits, lettuce salad, French fries/fried potatoes, other white potatoes, cooked dried beans, other vegetables, tomato sauce, vegetable soups, and mixtures that included vegetables) in the past month [35]. Some advantages include its validity, high association with 24-hour recalls, ease, and low cost compared to other measurement tools [35], [36], [37].

2.3.2. Exposure Variable

Caretakers self-reported their household size via multiple-choice questions (with options between 2 and 10+), number of children ≤ age 10 (between 1 and 6+), number of children ≤ age 5 (between 1 and 5+), and number of children participating in a school lunch program (between 1 and 6+).

We calculated the ratio of adults to children by dividing the number of adults by the number of children ≤ age 10 (adult-children). We obtained the number of adults by subtracting the number of children ≤ age 10 from the household size. Similarly, we calculated the ratio of younger children (≤ age 5) to older children (ages 6-10) by dividing the number of younger children by older children (younger-older children). We obtained the number of older children by subtracting the number of younger children from the number of children ≤ age 10.

2.3.3. Covariates

The online survey included multiple-choice questions regarding age (with options between 18-24 and 65+), sex (female, male, non-binary, prefer not to say, or prefer to self-describe), race/ethnicity (African American/Black, American Indian/Alaska Native, Asian American, Asian Indian/Asian Chinese/Asian Filipino/Asian Korean/Asian Vietnamese, other Asian, Hispanic/Latin American, Middle Eastern/North African, Native Hawaiian/other Pacific Islander, White/Caucasian, another race/ethnicity not listed [as an open-ended question], or do not know), preferred language (English or Spanish), and SNAP participation in the past year (yes or no).

We assessed household food security using the USDA 6-Item Food Security Survey which examined the caretakers' concerns about their household food quantity, quality, and variety in the past month [34]. We categorized food security as very low (five to six affirmative), low (two to four affirmative), or high or marginal (zero to one affirmative) [34]. Compared to the 18-item U.S. Household Food Security Survey, the USDA 6-item Food Security Survey is less burdensome and has a reasonably high specificity, high sensitivity, and minimal bias [38].

2.4. Analysis

We conducted descriptive analyses to include frequencies and percentages for categorical variables as well as the median and interquartile range (IQR) for continuous variables of the caretakers' demographic characteristics (i.e., age, sex, race/ethnicity, and preferred language),

 doi:10.20944/preprints202603.2493.v1

household food security, SNAP participation in the past year, indicators of household composition (i.e., household size, number of children ≤ age 10, children ≤ age 5, children ages 6-10, children participating in a school lunch program, and adults), and caretakers' FV intake.

We analyzed the normality of residuals using the Shapiro-Wilk test which demonstrated violations of the assumption when regressing indicators of household composition on FV daily servings. We categorized FV intake as meeting or not meeting the DGA recommendations: ≥2 servings/day as meeting the fruit recommendation, ≥2.5 servings/day as meeting the vegetable recommendation, and ≥3.5 servings/day as meeting the FV recommendation [8]. Considering the prevalence of the outcome was high, we conducted log-binomial regression models [39], [40] to assess the association between indicators of household composition and adherence to FV recommendations adjusted for the caretakers' age, sex, race/ethnicity, preferred language, household food security, and SNAP participation in the past year. We treated each indicator of household composition as an independent variable and analyzed it in separate multivariate models. We used R to perform all analyses and considered 5% as the significance level.

3. Results

3.1. Sample Description

A total of 85 caretakers completed the survey. Participants were mainly < age 40 (n = 67, 79%), female (n = 80, 94%), Hispanic (n = 65, 77%), and preferred to speak Spanish (n = 48, 57%) (Table 1). They predominantly resided in very low or low food security households (n = 77, 91%) and received SNAP benefits in the past year (n = 68, 80%). The median household size (IQR) was 5 (3-5) with 2 (2-3) adults and 2 (1-3) children ≤ age 10. Children included 1 (1-2) ≤ age 5, 1 (0-1) aged 6-10, and 1 (1-2) participating in a school lunch program.

Table 1. Descriptive information of participants in terms of demographic characteristics, household food security, SNAP participation, and indicators of household composition.

Factor	Sample size (%)	Median (IQR)
Demographic		
Age	85 (100)	
18-29	27 (31.8)	
30-39	40 (47.1)	
40 or older	18 (21.2)	
Gender, female	80 (94.1)	
Race/ethnicity	84 (100)	
African American	14 (16.7)	
Hispanic	65 (77.4)	
Multiracial	3 (3.6)	
American Indian/Alaska Native, Asian American, Asian Indian/Asian Chinese/Asian Filipino/Asian Korean/Asian Vietnamese, other Asian, Middle Eastern/North African, Native Hawaiian/other Pacific Islander, White/Caucasian, another ethnicity not listed (as an open-ended question), or do not know	2 (2.4)	
Preferred language	85 (100)	
English	37 (43.5)	
Spanish	48 (56.5)	
		4 (2-6)
High or marginal food security (0-1)	8 (9.5)	
Low food security (2-4)	38 (44.7)	
Very low food security (5-6)	39 (45.9)	
SNAP Participation		
Received SNAP benefits in the past year	68 (80)	

 doi:10.20944/preprints202603.2493.v1

Indicators of Household Composition		
Household size		5 (3-5)
Two	9 (10.6)	
Three	13 (15.3)	
Four	20 (23.5)	
Five	28 (32.9)	
Six or more	15 (17.7)	
		2 (1-3)
One	31 (36.9)	
Two	28 (33.3)	
Three or more	25 (29.8)	
		1 (1-2)
None	7 (8.4)	
One	54 (65.1)	
Two or more	22 (26.5)	
		1 (0-1)
None	38 (45.8)	
One	32 (38.6)	
Two or more	13 (15.6)	
		1 (1-2)
One	42 (56)	
Two	26 (34.7)	
Three or more	7 (9.3)	
		2 (2-3)
None	4 (4.8)	
One	14 (16.7)	
Two	33 (39.3)	
Three	15 (17.9)	
Four or more	18 (21.5)	

SNAP Supplemental Nutrition Assistance Program, IQR interquartile range

3.2. Caretakers' FV Intake

Most caretakers did not meet the DGA recommendations for FV intake (n = 54, 63.5%).

They reported consuming 1.13 (0.5-2.21) servings/day of fruits and 1.96 (1.18-2.98) servings/day of vegetables (Table 2). Caretakers who met the FV recommendation (n = 42, 49%) reported consuming 3.46 (2.36-5.27) FV servings/day.

Table 2. Descriptive information of participants in terms of FV intake and adherence to DGA 2020-2025 recommendations.

Factor	Sample size (%)	Median (IQR)
Fruit intake (servings/day)	31 (36.5)	1.13 (0.5-2.21)
Vegetable intake (servings/day)	31 (36.5)	1.96 (1.18-2.98)
FV intake (servings/day)	42 (49.4)	3.46 (2.36-5.27)

FV fruit and vegetable, *DGA* Dietary Guidelines for Americans, *IQR* interquartile range

3.3. Association Between Indicators of Household Composition and Caretakers' FV Intake

Our results of log-binomial regression models (Table 3) demonstrated that there was a 40-50% greater likelihood of caretakers meeting the DGA's vegetable recommendation for each additional child in the household (relative risk [RR] 1.44; 95% confidence interval [CI] 1.11-1.86) and each additional child participating in a school lunch program (RR 1.52; 95% CI 1.03-2.24), independently

 doi:10.20944/preprints202603.2493.v1

of covariates. Similarly, caretakers who lived with more children (RR 1.36; 95% CI 1.15-1.59), reported living with a higher ratio of younger (≤ age 5) to older children (ages 6-10) (RR 1.22; 95% CI 1.07-1.39) or had more children participating in a school lunch program (RR 1.47; 95% CI 1.16-1.85) were more likely to adhere to the FV recommendation. Conversely, for each additional adult per child in the household, there was an 18% lower likelihood of meeting the FV recommendation (RR 0.82; 95% CI 0.68-0.99).

We found no statistically significant associations between indicators of household composition and the caretakers' fruit intake. Similarly, there were no significant associations between either ratio variable (adult-children or younger-older children) and the caretakers' vegetable intake and between household size and caretakers' fruit, vegetable, and FV intake.

Table 3. Log-binomial regression model of the association between indicators of household composition and caretakers' FV[a] intake adherence to the DGA[b] 2020-2025.

Indicators of Household	Fruit Intake			Vegetable Intake			FV Intake		
	RR[c]	*95% CI*[d]	*p-value*	*RR*	*95% CI*	*p-value*	*RR*	*95% CI*	*p-value*
Household size	1	0.86-1.17	0.997	0.97	0.79-1.18	0.759	0.98	0.85-1.14	0.806
Number of children	1.19	0.95-1.50	0.13	1.44	1.11-1.86	0.005**	1.36	1.15-1.59	<0.001***
The ratio of younger children (< age 5) to older children (age 6-10)	0.98	0.60-1.59	0.925	0.93	0.59-1.46	0.746	1.22	1.07-1.39	0.003**
Number of children participating in a school lunch program	1.25	0.94-1.66	0.133	1.52	1.03-2.24	0.035*	1.47	1.16-1.85	0.001**
The ratio of adults to children	0.84	0.65-1.09	0.191	0.79	0.60-1.05	0.101	0.82	0.68-0.99	0.049*

[a] fruit and vegetable [b] Dietary Guidelines for Americans [c] *RR* relative risk [d] *CI* confidence interval model adjusted on the caregiver's sex, race/ethnicity, preferred language, household food security, and SNAP participation in. the past year. We treated each indicator of household composition as an independent variable and analyzed it in separate models. *p-value <0.05 **p-value <0.01 ***p-value <0.001.

4. Discussion

The number of children, children's age, their participation in a school lunch program, or the number of adults were associated with caretakers' adherence to DGA's FV recommendations among those eligible for SNAP with a child(ren) in the Bronx, NYC. Our results highlight the importance of further examining the role of indicators of household composition in FV intake and elucidate their possible contribution to disparities of FV intake among urban populations of low-income.

When specifying the number of children as an indicator of household composition, we found a positive association with the caretakers' vegetable and FV adherence to DGA recommendations. Our results challenged previous studies that found unhealthier dietary patterns among caretakers with children than those without [21], [22], [23], [24], [25]. Possible explanations for the discordance are that previous studies compared parents versus non-parents [21], [22], [23], [24], [25], while our study had a more homogenous sample of adults with children. Furthermore, the scope of one of the studies limited participants' eligibility to parents of children ≤ age 5 [21], while our study included a wider age range of ≤ age 10.

Concurrently, we found that caretakers living with a greater ratio of younger (≤ age 5) to older children (6-10) were more likely to meet the DGA's FV recommendation, consistent with the implications of multiple studies [27], [28], [31], [32]. We suspect this is because more younger children in Head Start centers participated in food assistance programs than older children. Although we did

 doi:10.20944/preprints202603.2493.v1

not collect information regarding participation in other food assistance programs besides SNAP, according to a report about child and family characteristics of Head Start centers' participants across the U.S., 55% of participants participated in SNAP, 56% participated in the Special Supplemental Nutrition Program for Women, Infants, and Children Program (WIC), 13% participated in the Temporary Assistance for Needy Families (TANF), and 7% participated in the Supplemental Security Income (SSI) [41]. Considering that all aforementioned programs have enrollment eligibility requirements that include children who are younger, households with younger children may be able to purchase and consume more FVs compared to households with older children because of the ability to enroll in more food assistance programs.

Another possible reason for the negative association between children's age and caretakers' FV adherence is that multiple studies have found that children who are older consume fewer FVs, especially fruits, than their younger counterparts [27], [28], [31]. One explanation for the decrease in FV intake among children who are older may be that they have more independence and are more likely to consume foods outside the home. As a result, caretakers with children who are older may purchase fewer FVs, reducing their availability in the home and subsequently decreasing other household members' FV intake [42], [43]. Our study found no significant association between children's age and caretakers' fruit intake alone. Most of the participants identified as Hispanic who, according to the latest data, have the highest prevalence (16.4%) of meeting the fruit intake recommendation compared to the other ethnicities [9].

Regarding the number of children participating in a school lunch program, we found apositive association between this indicator of household composition and the caretakers' FV adherence to the DGA recommendation. Our result is consistent with the implications of previous literature that found participation in a school lunch program increased food security among families of low-income with children by providing nutritional resources for children and consequently creating opportunities to reallocate food to other household members [29], [30].

Lastly, we found that having a greater adult-children ratio reduced the chance of caretakers adhering to DGA's FV recommendation. Our results contradict the implications of two studies that found healthier dietary habits among adults living with other adults than adults living with children [22], [23]. A possible explanation for the discrepancy is that the composition of adults in the household (i.e., spouse/partner or other adults who are not spouse/partner) may play a role in the FV intake of other members in the household [24]. For instance, a study found that men have healthier dietary patterns when living with a spouse compared to another adult who was not a spouse [44]. Our study did not explore such information. In addition, our study did not inquire about the number of adults in the household. We estimated the total number of adults as household members > age 10 by subtracting the number of children ≤ age 10 from the household size. Considering adults as household members > age 10 may be spurious, as some who we considered adults may share more similar dietary habits to children than adults. For instance, according to a report about the Healthy Eating Index (HEI) score of children and adolescents, individuals ages 5-10 and ages 11-18 have a similar HEI score ranging from 51-55 [32].

Our study has several limitations, some of which are its cross-sectional design that does not allow causal inference and the use of a small sample size of caretakers. Moreover, the use of online surveys may have introduced selection bias towards participants who have access to the Internet. To address this bias, we had tablets available during recruitment to allow interested participants to answer the online survey. Lastly, residual confounding may still be possible regardless of statistical adjustment on several covariates. We did not ask about the number of adults in the household, participation in other food assistance programs besides SNAP, or whether the caretakers resided in a household with a single parent which could potentially be important additional information of the household composition.

 doi:10.20944/preprints202603.2493.v1

5. Conclusions

Our results challenge the understanding that having fewer children or more adults living in a household increases the likelihood of caretakers' healthier dietary habits. We attribute the discordance to different methodological approaches, study settings, and population characteristics. Conversely, our results confirm the implications of existing literature that having more children who are younger or more children participating in a school lunch program living in a household are protective factors to FV intake among caretakers, especially those of Hispanic families eligible for SNAP. Our results have implications that may benefit not only caretakers with children but also their children, as caretakers' diets can influence a child's food choices throughout life (Savage, Fisher, and Birch 2007). Lastly, our study urges future studies to move beyond the children's presence as the only indicator of household composition when considering the caretakers' FV intake and highlights the importance of parsing apart the characteristics of who lives in the household to support the investigation of social, cultural, and gender dynamics that may influence intrahousehold food distribution and intake.

Author Contributions: SMW, ACBT, KAM, and PER were involved in the study's conception and design. SMW, ACBT, and ZNR conducted the data collection and management. SMW and ACBT performed the data analysis. SMW wrote the first draft of the manuscript and all authors commented on previous versions. All authors read and approved the final manuscript.

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Institutional Review Board Statement: Our study was conducted in accordance with the Declaration of Helsinki and approved by the New York University Institutional Review Board (IRB-FY2022-6623). All individual participants provided written informed consent virtually.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data that support the findings of our study are available from the corresponding author, KAM, upon reasonable request.

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Conflicts of Interest: The authors report there are no conflicts of interests to declare.

Abbreviations

The following abbreviations are used in this manuscript:

FV	Fruit and vegetable
DGA	Dietary Guidelines for Americans
SNAP	Supplemental Nutrition Assistance Program

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