Adaptation of a Modified Diet Quality Index to Quantify Healthfulness of Food-Related Toy Sets

Jacqueline R Poston, BS[1] Rachel E Watkins[2], Stephanie Jilcott Pitts, PhD[3], Virginia C. Stage, PhD, RDN[4], and Suzanne Lazorick, MD, MPH[3]

[1]Brody School of Medicine, [2]Department of Biology, [3]Department of Public Health, [4]Department of Nutrition Science

Jacqueline Poston
Brody School of Medicine
East Carolina University
Greenville, North Carolina 27858
postonja18@students.ecu.edu

Introduction:

- **Pretend play** is necessary to build various skills of development, including creativity, problem-solving, cognitive, and social skills.[1,2]

- **Food-related toy sets** are often seen in settings such as preschools and childcare facilities (**Figure 1**).

- However, the **nutritional quality** represented by food-related toy sets currently on the market is unknown, and it is unclear whether these toy sets support or hinder positive messaging about healthy eating among young children.

- The first step in deepening our understanding is developing a tool capable of **measuring the healthfulness** of the food-related toys currently on the market.

- Therefore, the **OBJECTIVES** of this study were to examine (1) the construct validity of an adapted modified Diet Quality Index (*a*DQI) as a measure of the healthfulness of food-related toy sets for young children (3–8 years) and (2) the healthfulness of food-related toy sets.

- The **modified DQI** is a tool used in US national studies to quantify healthfulness of a child's dietary intake by scoring food and nutrients based on alignment with dietary guidelines.[3]

Figure 1. Children participating in pretend play with food related toy sets[4]

Methods:

Figure 2. Examples of toy sets included and analyzed in this study.[12-14]

- A standardized online search was used to identify toy sets (**n=50**) from 10 online well-known retailers of toys.

- Products included were intended for **pretend play** and contained toy food sets or items intended to **create a meal** ($\geq$ 2 food groups) (**Figure 2**).

- Once selected, toy set contents were **analyzed** to determine the type and quantity (number of servings or portions) of **foods, beverages, and meal preparation items** included. FoodData Central and MyPlate.gov informed assignment of serving size, with recommended portions being those recommended for 4-year-old children.[5-10]

- **Independent variables** included retailer, price, total number of items, number of scored items, number of food categories included, whether food preparation items were included, number of food preparation items, total number of food servings, and number and percentage of total servings of each food category.

- To evaluate the nutritional content, we utilized the **modified DQI**, which includes **10 food group categories** with a score ranging from **0 to 45 points** (higher indicating better nutrition). Eight were scored from 0 to 5 points (dairy, proteins, vegetables, fruits, 100% fruit juices, sugar-sweetened beverages, other added sugars, and salty snacks); two groups were scored from 0 to 2.5 points (whole and refined grains). [11]

- We adapted the modified DQI by renaming the "other added sugars" category to "Desserts, treats and other added sugars," and scoring it as 10 points for 0 servings, 5 for 1 serving, and 0 for $\geq$ 2 servings; for a total possible **aDQI score of 50.**

- Two researchers independently scored each toy set; any discrepancies were resolved to determine the **final score**.

Results:

- There was **no significant difference** in *a*DQI scores between retailers (p=0.7982).

- **Table 1** shows the characteristics of the toy sets and *a*DQI scores. The mean *a*DQI score was 28.7 and price $25.46. The average percent of total servings by food group demonstrated a high prevalence of protein (32%) and refined grains (22%), higher percent vegetables than fruits (19% versus 7%), low percent of desserts (7%), and very low percent sugar-sweetened beverages (0.94%) and whole grains (0.17%).

- **Table 2** shows the parameter estimates, standard errors, and p-values for variables included in the linear regression model of association with the *a*DQI score. Regression analyses demonstrated a **positive association** between *a*DQI score and percentage of dairy, refined grains, protein, vegetables, and fruit and **inverse association** with percentage of desserts, sugar-sweetened beverages, and total number of servings.

Table 1: Characteristics of the Toy Sets and Components of the Adapted Modified Diet Quality Index Score: Means, Standard Deviations, Medians, and Ranges (*N* = 48 Toy Sets)

Variables	Mean	Standard Deviation	Median	Range
Adapted Modified Diet Quality Index Score	28.7	6.1	29.4	15.0 - 37.5
Price	$25.46	7.77	24.99	$10.99 - $49.99
Number of Tools	2.0	2.3	1.0	0.0 – 10.0
Number of items	31.2	26.4	20.5	5.0 – 122.0
Percent Diary	9.1	13.1	4.5	0.0 – 64.0
Percent Whole grain	0.2	1.2	0.0	0.0 - 15.1
Percent Refined grain	21.9	15.1	20.5	0.0 – 57.0
Percent Protein	32.0	23.4	29.0	0.0 – 81.0
Percent Vegetable	18.6	19.2	14.0	0.0- 98.0
Percent Fruit	7.7	10.5	1.0	0.0 – 40.0
Percent Dessert	7.0	12.3	0.0	0.0 – 64.0
Percent Sugar-Sweetened Beverage	0.9	2.5	0.0	0.0 - 11.0
Total number of servings	21.1	21.9	13.6	2.8-109.3

Table 2. Parameter Estimates, Standard Errors, and p-Values for Variables Included in the Linear Regression Model of Association with the Adapted Modified Diet Quality Index Score

Predictor	Parameter Estimate	Standard Error	p-value
Percentage of dairy	0.18509	0.05249	0.001
Percentage of refined grains	0.12629	0.04720	0.01
Percentage of proteins	0.11586	0.04454	0.01
Percentage of vegetables	0.16327	0.04573	0.001
Percentage of fruits	0.27818	0.05806	<0.001
Percentage of desserts	-0.13374	0.06448	0.04
Percentage of sugar-sweetened beverages	-0.44296	0.18193	0.02
Total number of servings	-0.13476	0.01974	<0.001

Discussion:

- Results showed that generally the food-related toy sets **did not** include sugar-sweetened beverages and whole grains but **did** include protein, vegetables, and refined grains.

- When compared with dietary recommendations, the average sets contained **fewer** fruits and **far more** protein than recommended, but the amounts of vegetables and grains in the toy sets were **similar** to federal recommendations.[5]

- When comparing what young children consume, prior literature demonstrates children are **not consuming** as many fruits, vegetables, whole grains, or protein as recommended.[15]

- Toys with higher *a*DQI scores were more likely to contain protein, dairy, refined grains, vegetables, and fruit, and less likely to contain desserts and sugar-sweetened beverages, which indicates the aDQI score demonstrates **construct validity.**

- However, there are limitations to use of the DQI for this purpose, such as the **lack of differentiation** for starchy vegetables, fried vs. grilled proteins, and whole vs. white wheat in addition to the absence of a category for fats.[16]

- There is opportunity for toy manufacturers to make changes to **improve the healthfulness** in toy sets for young children, including switching from refined to whole grains, providing healthier protein choices, including more fruits and fewer desserts, and striving to ensure food-related toy sets are more representative of official dietary recommendations.

- **Future research** can explore the impact of the use of food-related toy sets on child's dietary behaviors.

References:

Publication:

Jacqueline R. Poston, Rachel E. Watkins, Stephanie Jilcott Pitts, Virginia C. Stage, and Suzanne Lazorick. Childhood Obesity.