

Factors Influencing Fluid Milk Waste in a *Breakfast in the Classroom School Breakfast Program*

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ABSTRACT

Objective: To determine predictors of fluid milk waste in a *Breakfast in the Classroom School Breakfast Program*.

Design: Cross-sectional with 3 repeated measures/classroom.

Setting: Elementary schools in a medium-sized, low-income, urban school district.

Participants: Twenty third- through fourth-grade classrooms across 6 schools.

Main Outcomes: Dependent variables include percentage of total and served milk wasted. Independent variables included observed daily menu offerings, program factors, and teacher and student behavior.

Analysis: Descriptive statistics were used to characterize variables across classrooms and schools. Multi-level mixed-effects models were used to test associations between predictors and outcomes of interest. $P \leq .05$ was considered statistically significant.

Results: Total milk waste increased 12% when juice was offered and 3% for each additional carton of unserved milk. Teacher encouragement to take and/or consume breakfast was associated with a 5% and 9% increase in total and served milk waste, respectively. When students were engaged in other activities in addition to eating breakfast, total milk waste decreased 10%.

Conclusions and Implications: Beverage offerings were predictive of greater total milk waste. Teacher and student behavior also appeared to influence milk consumption. Findings suggest that specific changes to *School Breakfast Program* implementation policies and practices could have an important role in waste mitigation.

Key Words: breakfast, school, food waste, juice, milk, school breakfast program (*J Nutr Educ Behav.* 2018;■■■■-■■■.)

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INTRODUCTION

Reducing food waste in the US *Child Nutrition Programs* is a national priority,^{1,2} and fluid milk waste has been targeted in previous research because of its unique contribution to children's nutrient intake.³⁻⁸

While most school-age children (8–14 years) fail to consume the rec-

ommended 2.5–3 cups/d of low-fat or nonfat dairy,⁹⁻¹¹ participation in school meal programs is associated with increased dairy intake.¹² *National School Lunch Program* (NSLP) and *School Breakfast Program* (SBP) participants achieve higher scores on the milk component of the modified Healthy Eating Index-2005¹³ and are more likely to drink milk at breakfast or lunch.¹² Con-

sequently, NSLP participant lunches provide significantly greater amounts of protein, vitamin A, vitamin B12, riboflavin, calcium, phosphorus, and potassium than do lunches of nonparticipants.¹⁴ Nonetheless, the National Academies of Sciences, Engineering, and Medicine recognized fluid milk as a meal component commonly declined by students under the offer-vs-serve system.¹⁵ Moreover, the Third School Nutrition Dietary Assessment Study suggested that refusing individual food items can affect the nutrient content of a student's meal, and that refusing milk, in particular, results in a meal with <80% of the target amounts for calcium and phosphorus as well as potential deficits in vitamin D, potassium, magnesium, and riboflavin.^{14,15} Although health outcomes associated with dairy and milk intake are generally mixed, milk consumption is consistently associated with improved nutrient intake.¹⁶⁻¹⁸ As a result of associations between

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dairy consumption and essential nutrient intake, efforts to encourage milk consumption have been made throughout the programs' history. At the same time, updated nutrition recommendations have resulted in changes to allowable offerings (eg, flavored added sugar, fat content). Hence, previous studies have focused primarily on the impact of flavored milk offerings and/or Healthy, Hunger-Free Kids Act–updated nutrition standards on milk selection and/or consumption within the NSLP.^{3,19-22}

These studies shed some light on factors that influence milk waste in the NSLP, but literature on the SBP is lacking, and milk waste is of particular concern in the *Breakfast in the Classroom* (BIC) delivery model of the SBP owing to its perishable nature and the requirement that it be offered at every meal.^{23,24} Whereas qualitative research identified several explanatory factors, including food-related, child-related, and program-related variables,²³ to the authors' knowledge, no peer-reviewed studies to date have quantitatively investigated correlates of plate waste in a BIC SBP. The objective of this study was to determine whether factors at the school, program, classroom, and/or participant level predict the amount of milk wasted.

METHODS

Study Design, Participants, and Recruitment

This study employed a cross-sectional study design with repeated observations within each classroom (3 days) to account for day-to-day variability in milk waste. A total of 20 third- and fourth-grade classrooms across 6 elementary schools were recruited from a medium-sized urban school district in the US, where an offer-vs-serve universal-free BIC SBP was in its third year of operation (spring, 2015). All elementary schools in the district were eligible to participate. Schools were initially contacted by district administration via e-mail. Study staff followed up via phone and e-mail and enrolled schools on a first-come basis. The sample size was determined based on the number of schools needed to estimate the percentage of milk wasted within a 5% margin of error assuming an intraclass

correlation of 0.01 using previous estimates of milk waste in the NSLP.²⁵ Teachers who agreed to participate received a \$50 gift card for classroom school supplies. Tufts University's Institutional Review Board approved this study under expedited review, and all research staff involved in data collection completed a state background check before data collection.

Procedures

Data were collected on 3 days in each classroom, with the entire data collection period spanning 6 weeks in May and June, 2015. Research staff arrived at the school before the start of the school day. One research assistant (RA) was assigned to each participating classroom; whenever possible, RAs were assigned to the same classroom across days. School food service staff delivered breakfast daily in coolers left outside each classroom prior to students' arrival. RAs counted and recorded the number of milk cartons delivered. The coolers were brought into the classroom by students and/or teachers upon arrival.

After entering the classroom, RAs stood in place of the classroom's usual trash can location with a 3-tiered rolling cart. The cart shelves were labeled to indicate where boys' and girls' milk cartons were to be placed. Students were instructed to place all breakfast trash on the appropriate shelf cart according to their usual trash disposal routine. RAs recorded classroom observations on a standardized data collection form during the breakfast period, noting any spillage. After all students' trash was collected, RAs rolled the carts to a designated processing location (eg, cafeteria or teachers' lounge); upon arrival, the temperature of 1 milk carton from each classroom was taken in triplicate. Milk cartons were counted and emptied into clear plastic, 4-qt buckets by gender, milk type, and classroom. The buckets were then weighed to the nearest gram. If cereal was served, a rice press lined with cheesecloth was clamped firmly 1 time to separate the cereal and milk.

Instruments and Measures

Classroom observations were made using a standardized form ([Supplementary](#)

[Data](#)) consisting of a list of questions pertaining to attendance and participation by gender; student and teacher behavior; classroom environment; and daily menu offerings.

Data Analysis

All data were double-entered using the Research Electronic Data Capture program hosted at Tufts University and analyzed using Stata statistical software (release 14, College Station, TX, 2015).^{25,26} The milk temperature measurement was adjusted for the time it was taken (minutes since the start of the school day) by modeling the rate of temperature increase at room temperature and using the resulting equation to predict the temperature at the start of the school day; measuring temperature at the start of the program was logistically infeasible. Descriptive statistics were used to characterize dependent variables and main outcomes (percent total milk wasted and percent served milk wasted) across classrooms and schools. The percentage of total milk wasted was quantified as the volume of all milk offered that was discarded (ie, milk made available to students but ultimately not consumed). The percentage of served milk wasted was quantified as the volume of milk that students selected that was discarded (ie, milk that was served but not consumed). Because unobservable factors influencing milk waste may be correlated at the school and classroom levels, the researchers used multilevel mixed-effects models accounting for such clustering at the school and classroom level to test bivariate and multivariable associations between predictors and outcomes of interest. Bivariate models were run separately for each predictor and outcome variable. Correlates of milk waste found to be statistically significant in the bivariate associations were retained in multivariable regression models. $P \leq .05$ was considered statistically significant.

RESULTS

Sample Demographics

Participating schools were representative of the district on key socioeconomic characteristics ([Table 1](#)), with size reported as approximate values to

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