



LUND UNIVERSITY
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**Impact of Competitive Foods in Public Schools on
Child Nutrition: Effects on Adolescent Obesity in
The United States
An Integrative Systematic Literature Review**

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Author
Kirsten E. Sildén

Supervisor
Dr. Lina Magnusson
University lecturer Global Health and Rehabilitation, PhD.
Lund University

Abstract

Objective: To identify and analyse literature on the effects of competitive foods in public schools on adolescent weight (BMI), and possible impacts they may have on adolescent obesity in the United States.

Methods: An integrative systematic review of literature was conducted. The literature was collected in CINAHL, Medline and EMBASE databases. Refined keyword search is further detailed in the report. Year restrictions were 2006-2017 from peer reviewed journals and published in English, with age parameters of adolescents 13-18 years in middle or high schools in the United States. Criteria for inclusion targeted at least one of 1) sugar-sweetened beverages (SSB), 2) competitive foods, 3) commercial foods, 4) vending machines, 5) *al a carte* venues, and 6) school stores, examining their associations with weight/Body Mass Index (BMI), using either BMI measurements or caloric intake analysis.

Results: The total of 164 articles were detected with 89 full abstracts examined and assessed, for a final analysis of 34 full text articles based on the inclusion criteria for this literature review. Twenty-six articles met the inclusion criteria. Many of the articles addressed multiple areas of interest within their study. Aspects of interest most commonly found involved BMI/Obesity/Weight in 19 (73%) articles, 15 (58%) articles examined Calorie (Kcal) density or consumption, 20 (77%) articles discussed the Availability of competitive foods in schools, 14 (54%) articles included analysis of competitive food and beverage and nutrition policies, and 18 (69%) addressed Other effects (socio-economic status (SES), race, ethnicity, and sex).

Conclusion: This systematic literature review found that although there is substantial evidence that competitive foods (foods sold to students which are not part of the regular school lunch programs) are highly available in middle, and especially high schools, there is still a lack of strong evidence that it is causal in increasing BMI/weight in adolescents. However, there is enough corroboration in the research which shows that higher caloric intake, as well as SES, race, ethnicity and sex are factors worthy of studying further and more in depth to determine how to better combat adolescent obesity in the United States. Additional longitudinal and higher quality research still needs to be done in this regard.

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Abbreviations

(BMI) Body Mass Index

(CDC) Center for Disease Control and Prevention

(CLASS) The National Cancer Institute's Classification of Laws Associated with School Students

(CINAHL) Cumulative Index to Nursing & Allied Health Literature

(ECLS-K) Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999

(FMNV) Foods of Minimal Nutritional Value

(FRPL) Free or Reduced-Price Lunch

(FSN) Food Service and Nutrition

(Kcal) Kilo Calories

(MTF) Monitoring the Future

(MECIR) Methodological Expectations of Cochrane Intervention Reviews

(NCES) The National Center for Education Statistics

(NHANES) The National Health and Nutrition Examination Survey

(NLSY97) The National Longitudinal Survey of Youth 1997

(NSCH) The National Survey of Children's Health

(NSLP) National School Lunch Program

(NYPANS) National Youth Physical Activity and Nutrition Study

(PERSPCS) Physical Education-Related State Policy Classification System

(RDI) Reference Daily Intake

(SBP) School Breakfast Program

(SES) Socio Economic Status

(SHPPS) The School Health Policies and Practices Study

(SNDA-III) The School Nutrition Dietary Assessment Study – III

(SSB) Sugar sweetened beverages

(STOPP T2D) The Studies to Treat or Prevent Pediatric Type 2 Diabetes

(U.S., or US) United States

(USDA) United States Department of Agriculture

(YPANS) Florida Youth Physical Activity and Nutrition Survey

(YES) US, and Youth, Education & Society

1 Introduction

Obesity is currently considered a public health epidemic in the United States (U.S.), with more than one third of adolescents (aged 13-18) in the U.S. currently weighing in as overweight or even obese (Rosenkoetter et al., 2015). Body Mass Index (BMI) is used as the tool for defining overweight, with BMI's of \geq 85th percentiles being overweight, and \geq 95th percentiles as being obese (Larson & Story, 2010). It is projected that as the population becomes older, both public health and economic burdens from obesity will grow along with it (Tabor et al., 2012). The Center for Disease Control and Prevention (CDC) reported concerning adolescent obesity, the risks for children due to obesity include: stroke, coronary heart disease, sleep apnea and respiratory problems, Osteoarthritis, hypertension, Dyslipidemia, Type 2 diabetes, gallbladder disease, and some cancers. Even further, there are many complications which are linked to Type 2 diabetes, including stroke, diabetic neuropathy, gastroparesis, heart disease, blindness, and even depression (DeBarr, 2006). It is because of these increasing public health concerns that we turn our sights to the youth of America to discover why obesity is growing so rapidly and what can be done to reduce it.

1.1 Background

In recent years, the realization of the weight problem within the country has been exposed, and policy initiatives have become realities throughout the U.S., with the federal government, policymakers, and even national medical organizations stepping forward and calling for bold initiatives to be put in place (Tabor et al., 2012). Adolescents receive more than forty percent of their daily caloric intake while in school, therefore, the influence of what foods and beverages they are consuming is so critical (Larson & Story, 2010). However, even with initiatives such as The Healthy, Hunger-Free Kids Act of 2010, which sets standards on competitive foods which are allowed to be sold throughout the school day for students, and the National School Lunch Program (NSLP), which includes nutritional guidelines for the foods which are served and available in schools (Long et al., 2013), there is still an undeniable need for further research to determine why we are still seeing a concerning increase in weight and BMI in the youth across the country.

There are many contributors to the obesity problem, with a significant amount of research on the marketing of unhealthy food towards youth and children (Graff, 2008; Story, 2004; Dority, 2010; Rossen, 2012; Mello, 2010; Harris and Graff, 2011; Calvert, 2008). Other factors include increased portion sizes, and the multitudinous snack food options offered (Sharma et al., 2010). Studies on commercial and competitive foods which, according to the United States Department of Agriculture (USDA), are foods available to be purchased by students which are not part of the regular school lunch programs (Rosenkoetter & Loman, 2015) have been ongoing (Anderson & Butcher, 2005; Price et al., 2006; Van Hook and Altman, 2012; Cunningham and Zavodny, 2011; Larson and Story, 2010; Fox et al., 2005; Rovner et al., 2010; Kubik et al., 2010; Terry-McElrath et al., 2014; Brownell and Warner, 2009; Park et al., 2010; Woodward-Lopez et al., 2010; Bullock et al., 2010; Hennessy et al., 2014; Ohri-Vachaspati et al., 2012; Merlo, et al., 2014), with research thus far examining the fact that youth in schools which serve *a la carte* meals eat fewer healthy options, and in a school setting where soft drinks and junk foods are sold, are more likely to be obese (Cvjetan, et al., 2014). Influences in an eating environment may directly affect food intake that could lead to overeating as well as increased risks of obesity (Privitera & Zuraikat, 2014). The concern of the obesity pandemic is enough to warrant significant changes in how the U.S. addresses issues such as ‘population-wide education, training, and motivation concerning obesity’ (Tillotson, 2004, p. 620).

Further, it is worthy to examine Foods of Minimal Nutritional Value (FMNV), and how food choices most often available in venues of competitive food sources (*a la carte*, vending, and school stores) are predominately FMNV (Cisse-Egbuonye et al., 2016). “FMNV, including sodas, “water ices,” and certain candies, provide “empty calories”—calories that are not accompanied by other nutritional benefits, such as amino acids, fiber, vitamins, or minerals,” (Molnar et al., 2008, p. 504). Current research also proposes that some types of carbohydrates, particularly fructose, might play a significant role in increased adiposity (Riera-Crichton, and Tefft, 2014).

1.2 Purpose

Hennessy et al. (2014) concluded that competitive food and beverage laws within schools deserve to gain more attention as we look to addressing the obesity epidemic currently facing our nation. According to a review performed by Jaime & Lock (2009, p. 52), ‘there are

currently few studies which have measured the impact of school food policies on BMI'. Although adolescent obesity has been researched and discussed extensively, to my knowledge research examining the association between availability of competitive foods in school settings and adolescent weight (BMI) has not been systematically reviewed. The purpose of this systematic literature review is to make known the literature on research which has addressed commercial foods in schools and adolescent weight (BMI), and synthesize the data to explore recommendations for further research, increase the potential for stronger health policies, and hopefully provide insight into how to better protect our youth and combat the health crisis of obesity which America is currently facing.

1.3 Theory

When looking at commercial food sources in schools in the United States, it is worthwhile to turn to the utilitarian vs. libertarian framework (Nuffield Council on Bioethics, 2007) which states that utilitarian approaches may allow the well-being or interests of some of the population to be forfeited if the overarching solution were to lead to an increase in total welfare for the population (Ibid.). Alternately, the libertarian framework follows the affirmations of "what are classically regarded as the 'natural' rights of man: life, liberty and property" (Ibid., p. 13), and the authority of the government in these natural rights is restricted to merely guaranteeing that people in the population can enjoy these natural rights with no intrusion from other individuals or the state itself (Ibid.).

It is proposed in this thesis that with consideration of the epidemic of obesity in the United States, the utilitarian framework should be considered, where the comforts and enjoyment of competitive foods, which have been defined as primarily FMNV and often high in sugar and fat content, including sugar sweetened beverages (SSB), often sold in school stores, *a la carte*, and vending machines on the school campuses (Cisse-Egbuonye et al., 2016; Molnar et al., 2008; Rosenkoetter & Loman, 2015), should be examined further for the impact they might hold with regards to the obesity crisis currently facing the youth of the United States.

1.4 Aim

The main aim of this thesis is to summarize the research on the effects of competitive foods in public schools on adolescent weight (BMI), and possible impact it may have on adolescent obesity in the United States.

Research Question:

In what ways are the weight (BMI) of adolescents impacted by competitive foods in schools?

2 Methods

To accomplish this aim, this integrative systematic review will attempt to classify quantitative peer reviewed studies on nutrition policies in public schools which specifically address (1) competitive foods in schools and (2) the impact competitive food sources may have on adolescent weight (BMI). The methodology used in this study is an integrative systematic literature review. The characteristics of an integrative systematic review, according to Gough et al. (2012), are to identify and describe the pertinent research, critically appraise these research reports in a systematic method, and synthesize the findings. Data was collected through a systematic literature search. An integrative systematic literature analysis examines ‘new or emerging topics that would benefit from a holistic conceptualization and synthesis of the literature to date’ (Torraco, 2005, p. 357). This type of analysis holds a critical role in motivating additional research on the topic of discussion (Ibid).

This review will attempt to identify school based nutrition policies of school settings in students aged 13 to 18 which allow for competitive foods (Cisse-Egbuonye et al., 2016; Molnar et al., 2008; Rosenkoetter & Loman, 2015). The participants in the primary studies that will be included in this integrative systematic review will be schools (public and private) in the United States (Middle and High Schools) whose student population is between 13 and 18 years of age. In this review, competitive foods, often FMNV, include foods which offer less than 5% of the Reference Daily Intake (RDI) for 8 selected nutrients in each serving (Fleischhacker, 2007), and will include SSB’s, commercial foods, vending machines, *al a carte* venues, and school stores.

Quantitative studies (human, cross-sectional, longitudinal, Quasi-experimental, cohort, comparative analysis, nonexperimental design) that have examined school based nutrition policies which include or allow for competitive foods in school settings and discuss weight (BMI) and/or ways in which weight (BMI) is impacted by competitive foods in schools, were considered.

2.1 Literature Search

Cumulative Index to Nursing & Allied Health Literature (CINAHL); MEDLINE; and EMBASE databases were searched. Additional sources were examined, including bibliographies of applicable articles and relevant literature reviews, per the Methodological Expectations of Cochrane Intervention Reviews (MECIR), which advises to “check reference lists in included studies and any relevant systematic reviews identified” (Higgins et al., 2016, p. 16).

The screening process included scanning titles and brief abstracts initially, then full abstracts for relevance per inclusion criteria. The criteria for inclusion was: (1) studies from peer reviewed journals; (2) published between 2006-2017; (3) publication in English; (4) adolescents 13-18 years of age in middle or high schools; and (5) geographic restriction to the United States (U.S.). Criteria for inclusion also included at least *one* of the following measures: Sugar-Sweetened Beverages (SSB), competitive foods, commercial foods, vending machines, *al a carte* venues, school stores, and their associations with weight (BMI) for adolescents in school settings. This included either actual BMI calculation, and/or caloric intake analysis. Only peer-reviewed journal articles were indexed in MEDLINE, CINHAL, and EMBASE databases. Keyword used in the review are listed in Tables 2.1 and 2.2.

Table 2.1 MEDLINE and CINAHL Search: 125 Results Before Screening for Duplicates with Other Databases: 2/27/2017

Search Terms	Keywords	Results	Relevant to aim after screening abstracts
S1	school OR schools	3,155,522	
S2	united states OR U.S. OR US OR united states of America	1,885,884	
S3	'food' OR 'food preferences' OR 'food habits' OR 'health behavior' OR 'feeding behavior' OR 'child nutrition'	1,114,267	
S4	'weight gain' OR 'overweight' OR 'BMI' OR 'Body Mass Index' OR 'Body Composition' OR 'Obesity' OR 'Adolescent Obesity' OR 'Pediatric Obesity' OR 'body weight'	927,091	
S5	'nutrition policy' OR 'health promotion' OR 'health policy' OR 'school health policy'	442,801	
S6	'food services' OR 'competitive food' OR 'competitive foods' OR 'commercial food' OR 'beverages' OR 'carbonated beverages' OR 'sugar-sweetened beverages' OR 'vending machines' OR 'food dispensers' OR 'food dispensers, automatic' OR 'foods of minimal nutritional value' OR 'FMNV'	91,114	
S7	S1 AND S2 AND S3 AND S4 AND S5 AND S6	366	
	S1 AND S2 AND S3 AND S4 AND S5 AND S6 sorted with Limiters: (Publication date, source type of academic journal, subject age (adolescent 13-18), English language, geography (United states, USA, Texas, Baltimore, California, Illinois, Los Angeles, Midwestern United States, Alaska, Appalachian region, Colorado, Michigan, mid-Atlantic region, New York City, Washington)	125	73

A search was performed in EMBASE of 6 aspects; once terms were narrowed down by the inclusion criteria in the database (publication dates, age, type of disease ‘obesity’, type of publication ‘articles’, and geography), resulting in 66 articles. A quick-screening through the brief abstract of articles was completed; if a study did not include any type of competitive food, nutrition policies in schools, adolescent obesity, or not in a school setting it was excluded. This resulted in 39 possible articles (66-27=39).

Table 2.2 EMBASE Database Search: 39 Results Before Screening for Duplicates with Other Databases: 03/02/2017

Search Terms	Keywords	Results	Relevant to aim
#1 EMBASE aspect #1 obesity terms 2017-03-022017-03-021193364	'weight gain'/exp OR 'weight gain' OR 'overweight'/exp OR 'overweight' OR 'bmi'/exp OR 'bmi' OR 'body mass index'/exp OR 'body mass index' OR 'body composition'/exp OR 'body composition' OR 'obesity'/exp OR 'obesity' OR 'adolescent obesity'/exp OR 'adolescent obesity' OR 'pediatric obesity'/exp OR 'pediatric obesity' OR 'body weight'/exp OR 'body weight'	1,193,364	
#2 EMBASE aspect #1 obesity terms 2017-03-022017-03-0215	AND [adolescent]/lim AND 'childhood obesity'/de AND 'adolescent disease'/de AND ('abdominal obesity'/de OR 'adolescent obesity'/de OR 'obesity'/de) AND (2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py) AND 'Article'/it	15	
#3 EMBASE aspect #2 ' food' terms 2017-03-022017-03-021748981	'food'/exp OR 'food' OR 'food preferences'/exp OR 'food preferences' OR 'food habits'/exp OR 'food habits' OR 'health behavior'/exp OR 'health behavior' OR 'feeding behavior'/exp OR 'feeding behavior' OR 'child nutrition'/exp OR 'child nutrition'	1,748,981	
#4 and #3 EMBASE aspect #2 ' food' terms 2017-03-022017-03-023896	AND 'obesity'/de AND [adolescent]/lim AND 'Article'/it AND (2006:py OR 2007:py OR 2008:py OR 2009:py OR 2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py)	3,896	
#5 EMBASE aspect #3 ' US" terms 2017-03-022017-03-021541184	united AND states OR 'u.s. '/exp OR u.s. OR us OR united AND states AND of AND ('America'/exp OR America)	1,541,184	
# 5 and #6 EMBASE aspect #3 ' US" terms 2017-03-022017-03-021761	AND 'obesity'/de AND 'Article'/it AND [adolescent]/lim AND (2006:py OR 2007:py OR 2008:py OR 2009:py OR 2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py)	1,761	
#7 EMBASE aspect #4 ' school' terms 2017-03-022017-03-024727654	'school'/exp OR school OR 'schools'/exp OR schools	4,727,654	
#8 and #7 EMBASE aspect #4 ' school' terms 2017-03-022017-03-028174	AND 'obesity'/de AND [adolescent]/lim AND 'Article'/it AND (2006:py OR 2007:py OR 2008:py OR 2009:py OR 2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py)	8,174	
#9 EMBASE aspect #5 ' nutrition policy' terms 2017-03-022017-03-02316924	'nutrition policy'/exp OR 'nutrition policy' OR 'health promotion'/exp OR 'health promotion' OR 'health policy'/exp OR 'health policy' OR 'school health policy'	316,924	
#10 and #9 EMBASE aspect #5 ' nutrition policy' terms 2017-03-022017-03-021187	AND 'obesity'/de AND [adolescent]/lim AND 'Article'/it AND (2006:py OR 2007:py OR 2008:py OR 2009:py OR 2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py)	1,187	
#11 EMBASE aspect #6 ' competitive food' terms 2017-03-022017-03-02279682	'food services'/exp OR 'food services' OR 'competitive food' OR 'competitive foods' OR 'commercial food' OR 'beverages'/exp OR 'beverages' OR 'carbonated beverages'/exp OR 'carbonated beverages' OR 'sugar-sweetened beverages' OR 'vending machines' OR 'food dispensers' OR 'food dispensers, automatic'/exp OR 'food dispensers, automatic' OR 'foods of minimal nutritional value' OR 'fmmv'	279,682	

Search Terms	Keywords	Results	Relevant to aim
#12 and #11 EMBASE aspect #6 ' competitive food' terms2017-03-022017-03-02652	AND 'obesity'/de AND [adolescent]/lim AND 'Article'/it AND (2006:py OR 2007:py OR 2008:py OR 2009:py OR 2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py)	652	
Aspects #1-#6 combined with limitations:	Search with limitations: Disease (obesity), Age (adolescent), Publication types (article), Publication years (2006-2017)	39	17

Similarly, a search was performed in EBSCO which allowed the combination of both MEDLINE and CINAHL databases to be searched simultaneously, resulting in 125 articles, after limitations were narrowed down (publication date, source type of academic journal, subject age (adolescent 13-18), English language, and geography). Combining EMBASE results (39) with those from MEDLINE and CINAHL (39 + 125= 164), gave a total of 164, prior to checking for duplicates.

2.2 Screening of Abstracts

Following a quick screening of the 125 articles in MEDLINE and CINAHL, 52 articles which were either duplicates or non-relevant to the inclusion criteria were removed (125-52=73). Then EMBASE (39), MEDLINE and CINAHL (73) were combined (39 + 73= 132) to screen for duplications across all databases. After comparing EMBASE and MEDLINE and CINAHL for duplicate articles, EMBASE ended up with 16 articles for a second screening via abstracts; MEDLINE and CINAHL remained at 73, (16 + 73 = 89) for a total sum of (89) article abstracts to screen. The (89) articles identified in the systematic database search were categorized, detailing both included and excluded articles, using Excel (see Table 2.3).

Table 2.3 Excel Sample of Systematic Database Article Search (89 articles found before full abstract filtering for relevance)

Author, and Title	Year	Source	Aim	Methods/Data	Findings	Include/ Exclude
Briefel, R. R., Ander Wilson, A., Charlotte Cabili, C., Dodd, A. H., "Reducing Calories and Added Sugars..."	2013	J Acad Nutr Diet. 2013; 113:269-275	The objective of this study was to estimate the mean calories from added sugars potentially saved by healthier beverage selections at both home and school.	Simulation analyses used 24-hour dietary recall data from the third School Nutrition Dietary Assessment Study (n2,314), a 2005 national cross-sectional study of schools and students participating in the National School Lunch Program, to estimate changes in mean calories from added sugars both at and away from school.	205 calories or a 10% savings in energy intake across all students (11% in middle and high schools). 80% of the daily savings were attributed to beverages consumed away from school, with results consistent across school level, sex, race/ethnicity, and weight status. Children's consumption of SSB's at home contributed the	Include Directly discusses caloric intake in SSB's in school settings

Author, and Title	Year	Source	Aim	Methods/Data	Findings	Include/ Exclude
					greatest share of empty calories from added sugars.	
Schneider, L.M., Schermbek, R.M., Chriqui, J.F., Chaloupka, F.J., "The Extent to Which School District..."	2013	J Acad Nutr Diet. 2012; 112:892-896.	To examine the extent to which district competitive food and beverage policies had specific and required limits aligned with 2010 DGA recommendations ...	Competitive food and beverage policies were compiled for the 2009-2010 school year from a nationally representative sample of 622 districts. recommendations Descriptive statistics were computed, clustered to account for the sample design, and weighted to account for districts nationwide	Nationwide, 5% of districts met or exceeded all of the previously mentioned nutrient requirements examined. Fat and sugar content of foods and soda availability were more commonly addressed. Areas that require attention include stronger nutrition standards at the secondary level.	Exclude because the study does not answer the question on weight/BMI association with competitive foods.

After the initial abstract screening of the 89 articles from all three databases was performed, 24 articles were accepted, prior to quality check. Bibliographies were scrutinized to determine if anything more needed to be included, based on MECIR, and (10) additional articles were included (24 + 10 = 34). Additionally, according to the MECIR, "a PRISMA flow chart and a table of 'Characteristics of excluded studies' will need to be completed in the final review." (Higgins et al., 2016, p. 13). Therefore, Appendix 1 demonstrates the flow of information gathering and reduction for this review in a PRISMA flow chart, and Table 2.4 details the characteristics of the articles which were excluded.

Further in-depth examination using a data extraction method, inspired by Urzi, 2005 (Souza et al., 2010), (see Appendix 2) was utilized in narrowing down the search further. The data extracted in the studies was evaluated based on this prepared instrument, which was "able to assure collection of all relevant data, to minimize the risk of errors in transcription, to guarantee precision when checking information and to serve as a record. The data should include definition of the subjects, methodology, size of the sample, measuring variables, method of analysis and concepts used as bases" (Ibid., p. 104).

2.3 Data Extraction

Inclusion criteria which target the aim of the research question were examined in each relevant study, as well as probing if the ‘study participants, interventions, and settings are relevant to the Key Question’ (Treadwell et al., 2011). A pilot test of the data extraction instrument was conducted by two reviewers, and deemed appropriate. Due to conflict in time and feasibility, after the pilot test was performed, the remaining 33 articles were tested by one reviewer. After utilizing the data extraction system, and cross checking that probative information was addressed, (8) more articles were excluded with reasons (see Table 2.4). This left 26 articles which met inclusion criteria. Intra-rater reliability was insured through re-analysis of all data.

Table 2.4 Excluded Articles with Reasons

References:	Reasons for Exclusion from Review:
Cisse-Egbuonye, N., Liles, S., Schmitz, K. E., Kassem, N., Irvin, V. L., Hovell, M. F., 'Availability of Vending Machines and School Stores in California Schools' 2016, <i>J Sch Health.</i> ; Vol. 86: 48-53.	Study identified the types of foods sold in vending machines and school stores in schools, discussed the availability and consumption associated with student purchase, but does not address weight/BMI/or caloric intake.
Gordon AR; Cohen R; Crepinsek MK; Fox MK; Hall J; Zeidman E, "The third School Nutrition Dietary Assessment study: background and study design." 2009, <i>Journal of the American Dietetic Association (J AM DIET ASSOC)</i> , Supplement; 109(s): S20-30.	Discusses availability of competitive foods in schools, school meal programs, in the prevalence of overweight and obesity. Does not address calories, BMI, or overall weight differences due to competitive foods in schools directly. Consumption, and availability, not weight.
Hawkes AP, Weinberg SL, Janusz R, Demont-Heinrich C, Vogt RL "An Innovative Method of Measuring Changes in Access to Healthful Foods in School Lunch Programs: Findings from a Pilot Evaluation", 2016, <i>PLoS ONE</i> , Vol. 11(1):. e0146875.doi:10.1371: 10.1371/journal.pone.0146875	Evaluates district policies addressing student wellness, developed an approach to determine best changes in policy to access to health food/drink in school cafeteria lunches. Does not address weight/BMI/caloric intake.
Kristensen, Alyson H; Flottesmesch, Thomas J; Maciosek, Michael V; Jenson, Jennifer; Barclay, Gillian; Ashe, Marice; Sanchez, Eduardo J; Story, Mary; Teutsch, Steven M; Brownson, Ross C "Reducing Childhood Obesity through U.S. Federal Policy: A Microsimulation Analysis", 2014, <i>American Journal of Preventive Medicine (AM J PREV MED)</i> , Vol. 47(5): 604-612.	Discusses SSB taxes and impact on BMI in adolescents, but does not directly address this in school settings specifically.
Kubik, M. Y., Wall, M., Shen, L., Nanney, M. S., Nelson, T. F., Laska, M. N., Story, M., "State but not District Nutrition Policies Are Associated with Less Junk Food in Vending Machines and School Stores in US Public Schools", 2010, <i>J Am Diet Assoc.</i> , Vol. 110: 1043-1048.	Discusses junk food in school vending machines and school stores and school nutrition policies, however does not address weight/BMI/caloric intake specifically. Consumption, not weight.
Schwartz MB; Novak SA, Fiore SS, "The impact of removing snacks of low nutritional value from middle schools." 2009, <i>Health Education & Behavior: The Official Publication of The Society for Public Health Education [Health Educ Behav]</i> , Vol. 36 (6), pp. 999-1011.	Discusses perceptions of weight and diet with regards to consumption of snack foods sold in schools, but actual weight, BMI, or calories were not measured or evaluated. Consumption, not weight.
Thompson, O.M., Yaroch, A.L., Moser, R.P., Finney Rutten, L.J., Agurs-Collins, T., "School Vending Machine Purchasing Behavior: Results From the 2005 YouthStyles Survey", 2010, <i>J Sch Health</i> , Vol. 80, 225-232.	Primary purpose was to examine purchasing behaviors with school policy. Calculated purchasing behavior and dietary consumption, but did not address the research question on weight/BMI/or caloric intake.
Wordell, D., Daratha, K., Mandal, B., Bindler, R., Butkus, S. N., "Changes in a Middle School Food Environment Affect Food Behavior and Food Choices", 2012, <i>J Acad Nutr Diet.</i> , Vol. 112: 137-141.	Study discusses school food environments, healthier school policies, and consumption and choice making of competitive foods. Does not address weight/BMI/caloric intake specifically. Consumption, not weight.

3 Results

This paper confines itself to summarizing the results in an integrative analysis as the heterogeneity of the studies investigated in this review are not suitable for a meta-analysis. Based on Haidich's (2010), article on meta-analysis, he states that typically, one would use a meta-analysis when the study is based on 'randomized, controlled clinical trials' (p. 30). Haidich (2010) continues by stating that systematic reviews may not need to contain a meta-analysis as there may be occasions where it is not possible or even appropriate.

The following summary of data aims to answer the objective of what impacts there are upon child weight (BMI), and/or caloric intake related to obesity when competitive foods are sold in schools, and it is the purpose of this thesis to investigate and identify any recommendations for further research as well as promote the strengthening of public health policy. It is significant to mention using an integrative systematic review affects not only the development of policies, procedures and protocols, but can also be essential in critical assessment (Souza et al., 2010).

3.1 Assessment of Study Quality

Based on the model presented by Ackley et al., (2008), seven levels of evidence were described. Each study was evaluated based on this model, and breaking down the levels of evidence reveals that seven studies (27%) were of Evidence Level III, which include non-randomized, well-designed controlled trials such as Quasi-experimental studies; and 19 studies (73%) were Level IV, which are defined as being well-designed case-control or cohort studies, including cross-sectional designs. According to Detsky et al., (1992), who evaluated quality strength of criteria for assigning grades of evidence, seven studies (27%) were Moderate quality, with 19 studies (73%) being of Low Quality (see Table 3.2).

3.2 Eligible Articles

The final analysis included 26 articles. The most common study designs, cross-sectional designs, were composed of 19 (73%) studies, followed by six (23%) quasi-experimental designs, and finally, one (4%) experimental study. Four interventions were accepted into the review, Craddock et al. (2011), Hartstein et al. (2008), Smith & Holloman (2014), and Snelling et al. (2007). The range of dates included were 2006-2017, to try to capture the most recent literature available at the time this review was completed.

All studies included adolescent age group 13-18, including Middle and High School students. Some studies included ages 6-12, and data was then extrapolated which focused on the age of inclusion for this review. The size of sample varied anywhere between 186 students involved in a high school intervention (Smith & Holloman, 2014), to U.S. student population age 10-17 across 50 states in the U.S. (Nanney et al., 2010).

3.3 Synthesized Presentation of Research

The research synthesized is presented in Tables 3.1, which summarizes the aspects examined most frequently within the studies. Based on Whittemore and Knafl (2005), regarding methodology within integrative literature reviews, the first step in data analysis should be data reduction. In this stage, literature that contained the inclusion criteria were classified into five subgroups based on the factors that were most frequently addressed with regards to competitive foods in school settings and any effects or associations that had on adolescent BMI/weight. The themes most frequently appearing in the studies utilized were those examining elements of BMI/Weight/Obesity, Calorie (Kcal) Consumption, Availability of Competitive Foods in Schools, Strength of Policy, and Other Effects: SES/ Race/ Ethnicity/Sex. There were 19 (73%) articles which examined BMI/Obesity/Weight as a main aspect. Articles which observed Calorie (Kcal) density or consumption as an important aspect came out to 15 (58%). Twenty (77%) articles discussed the Availability of competitive foods in schools as being important to their study findings. Fourteen (54%) articles included analysis of competitive food and beverage and nutrition policies in school settings and their association with weight or obesity. Of the 26 articles included in this review, 18 (69%) addressed Other Effects, such as socio economic status (SES), race, ethnicity, and sex as possible factors of interest in their study findings.

Table 3.1 Summary of Aspects Examined in Literature for Review

Articles	BMI/ Obesity/ Weight	Kcalories Consumed or measured	Availability of competitive foods in schools	Analysis of Policy	Other effects: SES/ Race/ Ethnicity/ Sex
Anderson & Butcher, 2006	Yes	No	Yes	Yes	No
Bauhoff, S., 2014	Yes	Yes	No	Yes	Yes
Briefel et al., 2009b	No	Yes	Yes	No	Yes
Briefel et al., 2009a	No	Yes	Yes	No	Yes
Briefel et al., 2013	No	Yes	Yes	Yes	Yes
Cradock et al., 2011	Yes	Yes	Yes	Yes	Yes
Fletcher et al., 2010	Yes	Yes	Yes	Yes	No
Fox et al., 2009a	Yes	Yes	Yes	No	No

Articles	BMI/ Obesity/ Weight	Kcalories Consumed or measured	Availability of competitive foods in schools	Analysis of Policy	Other effects: SES/ Race/ Ethnicity/ Sex
Fox et al., 2009b	Yes	Yes	Yes	No	No
Hartstein et al., 2008	No	Yes	No	No	Yes
Hennessey et al., 2014	Yes	No	Yes	Yes	Yes
Kakarala et al., 2010	Yes	Yes	Yes	No	Yes
Levy & Friend, 2013	No	Yes	Yes	Yes	No
Mendoza et al., 2010	Yes	Yes	No	Yes	Yes
Nanney et al., 2010	Yes	No	Yes	Yes	No
Park et al., 2010	Yes	No	Yes	No	Yes
Riis et al., 2012	Yes	No	Yes	Yes	No
Sanchez-Vaznaugh et al., 2010	Yes	No	No	Yes	Yes
Smith & Holloman, 2014	Yes	No	Yes	No	Yes
Snelling et al., 2007	No	Yes	Yes	No	No
Taber et al., 2012a	Yes	No	Yes	Yes	Yes
Taber et al., 2013	Yes	No	Yes	Yes	Yes
Taber et al., 2012b	No	Yes	No	Yes	Yes
Terry-McElrath et al., 2009	Yes	No	Yes	No	Yes
Van Hook & Altman, 2012	Yes	No	No	No	Yes
Wiecha et al., 2006	Yes	Yes	Yes	No	Yes
Total	19	15	20	14	18

Table 3.2 breaks down the literature components which were significant in the summary of each article accepted for this review. The breakdown consists of aim and objective, design of study, methods and data used in each study, evaluation measures, and level of evidence.

3.4 Summary of Aspects

The following is the summary of the five aspects most frequently used in the 26 articles for this review.

3.4.1 BMI/Obesity/Weight

Nineteen out of the twenty-six articles included in the review addressed competitive foods in schools based on Body Mass Index (BMI), Obesity, or Weight as indicators. While the studies were diverse, several examined the associations between competitive food sources in the schools and adolescents weight (Fox et al., 2009a; Terry-McElrath et al. 2009; Van Hook & Altman, 2012). Some studies explored the prevalence of childhood overweight trends before and after policies were implemented, as well as implementation and adherence to nutrition laws in schools (Bauhoff, S., 2014; Hennessey et al., 2014; Riis et al., 2012; Sanchez-Vaznaugh et al., 2010; Taber et al., 2012a, 2013), while others examined the

interaction on junk food sold in schools and genetic components to weight (Anderson & Butcher, 2006). Wiecha et al., (2006) debated whether there was an association between BMI and grade with intake of sugar-sweetened beverages (SSB).

Several studies discussed the prevalence of competitive food and beverages in schools and the potential there was an increase in BMI and weight for adolescents (Cradock et al., 2011; Kakarala et al., 2010; Park et al., 2010). A study analysis by Mendoza et al., (2010), and Smith & Holloman (2014), explored reductions in Kcal consumption by decreasing the energy density in foods and SSB's sold in schools and possible associations with long-term weight loss and maintenance. Whereas Fox et al. (2009b) discussed reductions in daily calories from consumption of energy-dense foods and beverages in school and associations to weight of adolescents. Nanney et al. (2010) discusses the varying levels of obesity across the country in various states and regions and the potential relevance in nutrition and physical activity and education policies within schools. Fletcher et al. (2010) examines the effects of soft drink taxes on weight among children, change in BMI, obesity prevalence, or soft drink calorie consumption.

3.4.2 Kcalories Consumed or Measured

Articles which discussed weight through consumption of kilocalories or kilocalorie density were in 58% or 15 of the articles reviewed. Interventions assessed by Hartstein et al. (2008),

Table 3.2 Summary of the 26 articles in this Review

Reference	Aim/ Objective	Design	Methods/ Data 1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis	Eval. Meas. Wt. BMI Kcal	Level of Evidence ^{1*} and Quality**
Anderson & Butcher, 2006	“We examine whether schools under financial pressure tend to adopt potentially unhealthy food policies and whether students' Body Mass Index (BMI) is higher where they are more likely to be exposed to these food policies”	Non-experimental design: Observational; cross sectional	1. grades 1-12 2. 451 public middle and high schools 3. Two-sample methodology. ‘We use school food policy information from the representative sample of public schools surveyed in the SHPPS to create our proxy variable.’ 4. three different policies: junk food availability in schools, whether schools have "pouring rights" contracts, and whether soda and snack food advertisements are allowed at schools or school events 5. Statistical analysis; ‘our approach uses an auxiliary regression to predict exposure to a food policy, which is unobservable in the data. Standard errors were adjusted for arbitrary correlation within the state.’	BMI	Level IV; Low Quality
Bauhoff, S., 2014	“This paper evaluates the impact of an early nutrition policy, Los Angeles Unified School District’s food-and-beverage standards of 2004, using two large datasets on food intake and physical measures.”	Non-experimental design: Observational: cohort and cross-section	1. 12-13 and 14-15 2. Middle school (206,718), High School (198,262) 3. ‘a data-driven approach was used to construct a “synthetic” control group that closely resembles the treatment unit in the pre-intervention period. Then generated the synthetic control group as a preprocessing step and then estimate a two-period difference-in-difference with additional individual and school level controls. The synthetic districts are constructed in three steps that were applied separately for the two datasets because of their different geographic coverage.’ 4. ‘estimate the treatment effect using these four cohort and cross-section synthetic control groups, one for each the PFT and CHKS data, and for the cohort and cross-section samples. Since the Los Angeles beverage policy starts in January 2004, data was compared from Spring 2003 and Spring 2005.’ 5. Descriptive Statistical Analysis used.	Kcal	Level IV: Low Quality
Briefel et al., 2009a	“To describe patterns of consumption of “empty calories”—low-nutrient, energy-dense foods, including sugar-sweetened beverages—by eating location among National School Lunch Program (NSLP) participants and nonparticipants.”	Non-experimental design: Observational; Cross-sectional	1. grades 1 - 12 2. 2,314 children, including 1,386 NSLP participants. 3. Twenty-four-hour dietary recalls, child surveys, and parent surveys were collected for each selected child 4. One 24-hour recall was collected for each child and a second day’s intake on a subsample using the USDA Automated Multiple Pass Method software 5. Descriptive Statistical Analysis used. ‘Comparisons, using t tests , of the proportion of children consuming low-nutrient, energy dense foods and beverages, mean daily energy and energy from low-nutrient, energy-dense foods, and energy density by NSLP participation status.’	Kcal	Level IV: Low Quality
Briefel et al., 2009b	“To estimate the effects of school food environments and practices, characterized by access to competitive foods and beverages, school lunches, and nutrition promotion, on children’s consumption of sugar-sweetened beverages, low-nutrient	Non-experimental design: Cross-sectional	1. 287 schools (in 94 districts) with child-level dietary recall data; 2,314 children, grades 1-12 2. children aged 6 to 18 years 3. ‘Based on the questionnaire, checklist, and menu data, we created 20 binary variables that indicated the presence of a healthful school food policy, practice, or environmental characteristic and grouped them into three domains: wellness policies and nutrition promotion practices of the district or school, competitive foods and beverages and related school practices, and characteristics of USDA lunches offered and practices	Kcal	Level IV: Low Quality

¹ based on: *Ackley, B. J., Swan, B. A., Ladwig, G., & Tucker, S. (2008). *Evidence-based nursing care guidelines: Medical-surgical interventions*. (p. 7). St. Louis, MO: Mosby Elsevier.

** Detsky AS, Naylor CD, O'Rourke K, McGeer AJ, L'Abbe KA. Incorporating variations in the quality of individual randomized trials into meta-analysis. *J Clin Epidemiol*. 1992; 45:255–65.

Reference	Aim/ Objective	Design	Methods/ Data 1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis	Eval. Meas. Wt. BMI Kcal	Level of Evidence^{1*} and Quality**
	energy-dense foods, and fruits/ vegetables at school.”		related to school meals.’ 4. Food and nutrient consumption for this analysis was based on a single 24-hour dietary recall collected using the USDA Automated Multiple Pass Method software 5. ‘Ordinary least squares regression was used to identify the association between school food environments and practices and dietary outcomes, controlling for other school and child/ family characteristics. To examine whether school food environments and practices were associated with children’s dietary outcomes at school, binary and multivariate analyses were conducted. Descriptive analysis was conducted to estimate the prevalence of individual school food policies and practices by school type and boys’ and girls’ consumption of beverages, low-nutrient, energy-dense foods, and fruits and vegetables. Multivariate analysis was conducted to identify the relationship between school food environments and practices and dietary outcomes.’		
Briefel et al., 2013	“The objective of this study was to estimate the mean calories from added sugars potentially saved by healthier beverage selections at both home and school. The study tested the hypothesis that calories saved would be greater for SSB’s than flavored milks, and that away-from-school savings would be greater than at-school savings.”	Non-experimental design: cross-sectional	1. grades 1-12 2. 2,314 students in grades 1 through 12 (ages 6 to 18 years), distributed among 287 schools at the elementary (n732), middle (n787), and high school (n795) 3. 24-hour dietary recalls, child/parent surveys on demographics, school meal program participation, and family eating habits were collected for each selected child in spring of 2005. 4. Descriptive analyses of calories and added sugars from SSB’s and flavored milks by location and replacement simulation were completed using SAS, incorporating appropriate sampling weights for schoolchildren and design effects caused by the SNDA-III complex sample design. 5. Descriptive analyses used. ‘ A t test of mean differences between population subgroups was conducted to determine which groups would benefit most from beverage changes.’	Kcal	Level IV: Low Quality
Cradock et al., 2011	“The Boston Public Schools passed a policy restricting sale of sugar-sweetened beverages in Boston schools in June 2004. The objective of this study was to determine whether high school students’ consumption of sugar-sweetened beverages declined after this new policy was implemented.”	Quasi-experimental design:	1. students in grades 9 through 12 (15-19) 2. 2004, 1,079 students from 17 H.S. participated; in 2006, 1,233 students from 18 H.S.’s 3. used data on consumption of SSB’s by H.S. students who participated in the Boston Youth Survey during February - April 2004 and February - April 2006 (N = 2,033). ‘We compared the observed change with national trends by using data from the 2003-2004 and 2005-2006 Health and Nutrition Examination adjusted for student demographics. We obtained dietary recall data from adolescents 15 - 19 years surveyed during the NHANES 2003-2004 and 2005-2006 periods. For analysis of national trends in consumption of SSB’s, we used the 24-hour recall interview component of the NHANES survey that documented the type, quantity, and location of each beverage consumed, researchers coded beverage items according to the (USDA) Food and Nutrient Database.’ 4. The outcome measure of per capita total k/cal consumed per day SSB’s included consumption of soda, sport drinks, fruit drinks and punches, low-calorie drinks, sweetened tea, and other sweetened beverages. 5. Descriptive Statistical Analysis . ‘We used linear regression analysis to examine changes in mean servings per day of SSB’s between 2004 and 2006, adjusting for potential differences in student composition.’	Kcal	Level III: Mod. Quality

Reference	Aim/ Objective	Design	Methods/ Data 1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis	Eval. Meas. Wt. BMI Kcal	Level of Evidence^{1*} and Quality^{**}
Fletcher et al., 2010	<p>“In this paper, we outline important concepts related to these policies. We present new empirical evidence of the likely effectiveness of school vending machine restrictions and increasing taxes on soft drinks on reducing obesity rates in children. We conclude by discussing how the effectiveness of these policies might be increased.”</p>	Non-experimental design: Observational; Cross Sectional	1. 5th (2004) -8th grades (2007) 2. None provided 3. ‘Using data on soft drink consumption and vending machine restrictions from the nationally representative ECLS-K. We focused on the 5th grade (2004) and 8th grade (2007) survey waves, to measure soft drink consumption and accessing data from (NHANES) III (1988–1994) and IV (1999– 2006). Individual foods and beverages from the dietary recall were coded and classified using the USDA’s Survey Nutrient Databases. We examined the effects of soft drink taxes on soft drink consumption and weight among children and adolescents using data from (NHANES) III (1988–1994) and IV (1999– 2006).’ 4. soft drink consumption and accessing data; Indiv. foods and beverages were coded and classified; soft drink consumption and weight were examined. 5. Descriptive Statistical Analysis used. Comparisons used for BMI levels across ages and sexes.	BMI	Level IV: Low Quality
Fox et al., 2009a	<p>“To examine the association between school food environments and practices and children’s body mass index (BMI; calculated as kg/m²). In this article, we examine associations between school food environments and practices and children’s weight status, as measured using BML.”</p>	Non-experimental design: Observational: cross sectional	1. grades 1-12 2. 287 schools and 2,228 children 3. 287 schools (in 94 school food authorities) in which site visits were completed to inventory competitive food sources and collect child-level data, and 2,228 children who had valid height and weight data; Foodservice managers completed a menu survey that provided information about the foods offered in school meals each day during a specified “target week.” 4. Students and parents completed brief interviews that collected data on sociodemographic characteristics of the child’s household, as well as information about the child’s level of physical activity, the amount of time the child spent watching television or videos, using the computer, or playing video games, recent dieting behavior, and parental perceptions about how the child’s usual food intake and activity level compared to other children of the same age and sex. Sampled children were measured and weighed. 5. Descriptive Statistical Analysis used. ‘ Ordinary least squares regression was used to estimate the associations between school food environments and practices and BMI z scores and logistic regression was used to estimate associations between school food environments and practices and the likelihood of obesity.’	BMI	Level IV: Low Quality
Fox et al., 2009b	<p>“To describe the availability of competitive foods in US public schools, consumption of competitive foods by children, and contributions of competitive foods to energy intakes.”</p>	Non-experimental design: Observational: cross-sectional	1. grades 1-12 2. 287 schools and 2,314 children 3. SNDA-III data were collected between January and June 2005. Food service managers in each sampled school completed a menu survey that provided information about the foods offered in school meals each day during a specified “target week. Trained field interviewers completed observation checklists that documented the competitive food sources available in each school and the specific types of food that were offered. Three separate checklists were completed to document competitive foods available in each school from three major sources: foods available for à la carte purchase in the cafeteria; vending machines; and other on-campus food sources. Observations were conducted on one randomly selected day during the time interviewers were at the school to collect 24-hour dietary recalls from children. Interviewers also identified all of the specific locations within the school where children could obtain foods and beverages and assigned a separate code to each location. Interviewers used information provided by the food service manager to	Kcal	Level IV: Low Quality

Reference	Aim/ Objective	Design	<p style="text-align: center;">Methods/ Data</p> <p style="text-align: center;">1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis</p>	<p style="text-align: center;">Eval. Meas. Wt. BMI Kcal</p>	<p style="text-align: center;">Level of Evidence^{1*} and Quality^{**}</p>
			<p>rank each location on the relative availability of competitive foods. Rankings indicated that all, most, about half, a small amount, or none of the foods sold/served at the location were part of subsidized school meals. Sampled children were interviewed in person.</p> <p>4. foods available for à la carte purchase in the cafeteria; vending machines; and other on-campus food sources; location of food sources; 24-hour recall interviews.</p> <p>5. Descriptive Statistical Analysis used. ‘Most analyses were limited to estimation of means and proportions. Two-tailed t tests were used to test the significance of differences between children who did and did not eat a school lunch.’</p>		
Hartstein et al., 2008	“Document whether a 6-week snack bar/ <i>la carte</i> line intervention improved kilocalories, macronutrients, and food offerings purchased per student and per item sold (nutrient density) compared to baseline.”	Non-Experimental Design: Observational; Cross-sectional	<ol style="list-style-type: none"> 1. students grades 6-8 2. 6,248 students 3. Reducing all reg. chips serv. size bags to <1.5 oz., increase lower-fat chip offerings by 25%; offer bottled water in a 20-oz. size, and limit all sweetened beverages to < 12 oz. 4. To assess if nutrient density of items sold was improved by the intervention, kilocalories, fat, and % fat from items sold per day were divided by the total number of items sold that day. 5. Statistical analyses used. ‘Mixed models, accounting for the clustering of observations within schools, were used to analyze changes between baseline and week 6 for two models.’ 	Kcal	Level IV Low Quality
Hennessy et al., 2014	“This study attempted to determine whether state laws regulating low nutrient, high energy-dense foods and beverages sold outside of the reimbursable school meals program (referred to as “competitive foods”) are associated with children’s weight status.”	Non-experimental design: Observational; cross-sectional	<ol style="list-style-type: none"> 1. 11-14 2. 16,271 interviews 3. ‘The National Cancer Institute’s Classification of Laws Associated with School Students (CLASS) database was used to evaluate the stringency of codified school nutrition laws for each of the 50 states and the District of Columbia. Competitive food laws were scored in relation to the Institute of Medicine standards.’ 4. Independent variable: a composite score of competitive food and beverage laws for middle schools. Dependent variable: overweight and obesity weight status defined as (BMI) 5. Descriptive Statistical Analysis used. Bivariate and multivariate logistic analyses performed. 	BMI	Level IV: Low Quality
Kakarala et al., 2010	“Excluding à la carte items from competitive foods, the objectives were to: (1) assess competitive food use by gender, ethnicity, eligibility for free or reduced-price meals, and participation in school meals programs, (2) determine differences between grade levels in energy intakes obtained from food sources, (3) determine the nutrient intake derived from competitive foods for students who consumed them, and (4) determine	Non-experimental design: Observational; Cross-sectional	<ol style="list-style-type: none"> 1. grades 1-12 2. 2309 students 3. ‘Competitive foods/beverages use, excluding à la carte items, was examined using the third School Nutrition Dietary Assessment Study (SNDA III), a nationally representative sample of 2309 schoolchildren in grades 1 to 12. Trained interviewers administered questionnaires to obtain 24-hour food recall data on a school day. All students of middle schools and high schools self-reported their dietary intakes.’ 4. (SNDA III). Data on food source, Competitive foods/beverages use, dietary interview data were collected, reported food items to food composition data; gender (male, female), ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other), income eligibility for NSLP/SBP (eligible for free meals, eligible for reduce-price meals, not eligible), and participation in NSLP/SBP 	Kcal	Level IV: Low Quality

Reference	Aim/ Objective	Design	<p style="text-align: center;">Methods/ Data</p> <p style="text-align: center;">1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis</p>	<p style="text-align: center;">Eval. Meas. Wt. BMI Kcal</p>	<p style="text-align: center;">Level of Evidence^{1*} and Quality**</p>
	energy-adjusted differences in 24-hour nutrient intakes of protein, calcium, iron, & other selected nutrients betwn compet. food consumer and non-consumers.”		5. Descriptive statistical analysis used. Analysis of variance techniques were employed to test significance of differences between groups while controlling for covariates.		
Levy & Friend, 2013	“In this paper, we develop a simulation model of the pathways of policy effects of school-based access to nutrition, school-based education and SSB tax policies on the consumption of SSB’s by youth, and the resulting effects on caloric intake. The model will embody a systematic approach that considers the effect of various school nutrition policies on the number of SSB calories consumed inside and outside of school, and how changes in SSB consumption affect the consumption of other foods (more specifically, their associated caloric intake).”	Experimental design: virtual experiment	<ol style="list-style-type: none"> 1. review of literature and policies 2. None provided 3. ‘We reviewed the literature on the direct effects of school nutrition policies on SSB consumption, the effect of price on SSB consumption (with a focus on youth), the effects of reduced consumption of SSB’s in school on the consumption of other foods in school (LNEDs or otherwise), the effects of SSB consumption in school on the consumption of SSB’s and other foods outside of school, and the effects of SSB consumption on caloric intake (both through direct reductions in the amount consumed and the effect on the consumption of other foods).’ 4. ‘We apply those estimates where feasible in our current modeling approach and incorporate new studies conducted since that review. We limit the analysis to the effect of SSB policies on overall caloric intake.’ 5. Statistical Descriptive Analysis used. 	Kcal	Level II-III; Mod. Quality
Mendoza et al., 2010	“The study’s objective was to assess the impact of the Texas Public School Nutrition Policy on children’s energy density by using a pre- and post-policy evaluation. Specifically, the research objectives were to examine the changes in energy density after the policy, determine whether socioeconomic status moderated the impact of the policy on energy density, identify changes in the contribution of individual food groups to energy intake after the policy was implemented, and determine whether socioeconomic status mod. changes by individual food groups to energy intake.”	Non-experimental design: Observational; Cross Sectional	<ol style="list-style-type: none"> 1. 6-8th grade students 2. 2,616 students 2001-2002; 10,172 students 2005-2006 3. 6-8th grade students completed anonymous lunch food records immediately after lunch in the cafeteria. ‘On each school day during the week, research assistants selected either one or two tables of students at each lunch period and asked students to complete a food record for lunch consumption only. Lunch tables were selected starting at one side of the cafeteria and then on subsequent days, tables closer to the opposite side of the cafeteria were selected until all tables had been sampled. This process was then repeated throughout the entire school year, September through May. Research staff did not collect data on refusals.’ 4. ‘Graphic data were collected in year 1. From the food records, data were entered into the Nutrition Data System to obtain average daily lunch intake of calories and the average gram weight of food at lunch.’ 5. Analysis of variance (ANOVA) was used to address the study objectives. Two-way ANOVAs, with year and (SES) as factors, were used to identify differences in energy density between academic years and school SES. To control for inflated type I errors caused by multiple testing, the Bonferroni correction was used and the significance level was set to 0.0167. 	Kcal	Level IV: Low Quality

Reference	Aim/ Objective	Design	Methods/ Data 1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis	Eval. Meas. Wt. BMI Kcal	Level of Evidence^{1*} and Quality^{**}
Nanney et al., 2010	“The primary aim of this paper was to develop a comprehensive evaluation approach to describe the policy environment related to school-based obesity prevention efforts in each of the 50 U.S. states. A secondary aim was to examine the cross-sectional associations between current state policy environments and youth obesity prevalence.”	Non-experimental design: cross sectional; This study used qualitative and quantitative methods	1. ages 10 –17 2. US student populations 10-17 across 50 states in the US 3. ‘Using 2006 (SHPPS) state data, qualitative and quantitative methods were used (2008 –2009) to construct domains of state-level school obesity prevention policies and practices, establish the validity and reliability of the domain scales, and examine their associations with state-level obesity prevalence among youth aged 10 –17 years from the 2003 National Survey of Children’s Health’ 4. used state-level data from SHPPS 2006. scaled scores were developed for all state-level obesity-related policies and practices, for areas of FSN, PAD, and WA. 5. Statistical Analysis. To manage the extensive SHPPS policy data set, investigators used principal component analysis (PCA) to create an initial set of policy clusters .	Wt.	Level IV: Low Quality
Park et al., (2010)	“This cross-sectional study examined the prevalence of students buying snacks or beverages from school vending machines instead of buying school lunch and predictors of this behavior. the purpose of this study was to examine the prevalence and behavioral predictors of students in middle school who purchase items from school vending machines instead of purchasing a traditional cafeteria lunch.”	Non-experimental design: Observational, cross sectional	1. grades 6-8 2. 4,322 students 3. Students were asked, “During the previous five school days, how many days did you buy a snack or beverage from the vending machine instead of buying lunch?” 4. Analyses were based on the 2003 YPANS using a representative sample of 4,322 students in grades 6-8 in 73 Florida public middle schools. Student and school characteristics were examined. Data were weighted by sex, grade, and region to represent all Florida public middle school students in grades 6-8. Outcome measure was buying a snack or beverage from vending machines 2 or more days during the previous 5 days instead of buying lunch. 5. Statistical Analyses included Chi-Squared tests and logistic regression . Descriptive statistics were expressed as proportions. Chi-Squared tests were used to examine differences within categories. Odds ratios and 95% confidence intervals (CIs) for risk factors for buying lunch from vending machines were calculated using multivariable logistic regression . Interactions between exposure variables were also examined.	BMI	Level IV: Low Quality
Riis et al., 2012	“The objective of this study was to examine relations between state-level school policies and childhood obesity for youth ages 10–17 years.”	Non-experimental design: Observational; Cross Sectional	1. students grade 5-12 2. children aged 10-17 3. Wilcoxon signed rank sum tests were used to examine the extent of change in state nutrition and PE policies from 2003 to the most recent assessment (2006 for nutrition and 2007 for PE policies). Tests were also used to compare the comprehensiveness of the most recent nutrition and PE policy domain scores across school-type (ES, MS and HS) 4. 11 nutrition and 5 physical education (PE) domains were examined for elementary (ES), middle (MS), and high school (HS) children. 5. Bivariate logistic regression examined the relations of each independent variable, including individual, family and neighborhood factors, with the odds of being obese.	BMI	Level IV: Low Quality

Reference	Aim/ Objective	Design	Methods/ Data 1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis	Eval. Meas. Wt. BMI Kcal	Level of Evidence^{1*} and Quality**
Sanchez-Vaznaugh et al., 2010	“This is one of the first studies examining the postulated population-level influence of recently implemented policies aimed at sales of competitive foods and beverages in schools.”	Non-experimental design: Observational; cross sectional	1. fifth and seventh graders 2. 475,389 (2001); 602,567 (2008) 3. ‘The Fitnessgram database includes information on children’s (BMI) age, sex, race and ethnicity, grade, and physical fitness test results. To account for school- and district-level characteristics, we merged 2001–2008 Fitnessgram data with school and district data from the California Department of Education’s databases and 2000 census data.’ 4. BMI values were compared to the (CDC’s) 2000 growth charts. ‘Student-level explanatory variables included age, race and ethnicity, and physical fitness. characteristics of the students, schools, and districts, overall and by year, for the LA Unified School District and the rest of California were measured separately.’ 5. ‘We estimated the characteristics of the students, schools, and districts, overall and by year, for the LA Unified School District and the rest of California separately, using means and standard deviations or frequencies as appropriate. We estimated adjusted overweight prevalence for each study year and the rate of change, or trend, of overweight prevalence using multilevel multiple logistic regression models. ’	BMI	Level IV; Low Quality
Smith & Holloman 2014	“The purpose of the project was to examine school-based purchasing patterns of SSB and explore the impact of a school-based and student-led intervention aimed at limiting short-term and longer-term SSB consumption. To understand SSB consumption patterns, both daily servings and the numbers of days per week that SSB were consumed were examined.”	Quasi-Experimental design: piloted intervention	1. grades 9-12 2. 186 3. The piloted intervention consisted of the creation of a TAC at each of 2 high schools to design specific components of the intervention: a “Sodabriety” 30-day challenge. Each TAC consisted of 12 members overall: 2 teachers and at least 2 students from each grade in school (grades 9-12). To gather baseline data, pre-intervention an assessment of school vending machine beverage choices was completed. Data was collected at 3 time-points: pre-intervention, immediately post-intervention, and at 30 days’ post-intervention. Recruitment for the “Sodabriety” project occurred in 2 phases. (1) focused on recruitment of members to serve on each TAC; (2) focused on recruitment of students attending each school to participate 4. Demographic survey. A Vending Machine Survey was designed and completed by study personnel prior to implementation of the intervention. A 10-item beverage survey was completed by each participant at 3 times: preintervention, immediately post-intervention, and 30 days’ post-intervention. Each participant was provided a beverage log to complete during the 30-day intervention. 5. Descriptive variables were collected by self-report during the pre-intervention data collection. Data were analyzed using both descriptive and inferential methods. Descriptive data were analyzed by calculating frequency, means, standard deviations, and ranges of values. Paired t tests were conducted.	Kcal	Level III: Mod. Quality
Snelling et al., 2007	“The aim of this study was to compare the NSLP and competitive food offerings with the food purchased at 3 public high schools, collectively.”	Non-experimental design: Observational; quasi-experimental	1. High School students (grades 9-12) 2. 5249 3. ‘Over a 4-week cycle, daily food purchases were gathered and the proportions of green, yellow, and red foods offered and purchased was compared. Competitive food items were coded according to nutrient information obtained from the food label. Purchasing data for both competitive and NSLP food items was collected each day by the food service staff at 3 public high schools.’ 4. The food items were coded by a system based on the Stoplight Diet for analysis, placing food in 3	Kcal	Level III: Mod. Quality

Reference	Aim/ Objective	Design	Methods/ Data 1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis	Eval. Meas. Wt. BMI Kcal	Level of Evidence^{1*} and Quality^{**}
			categories: green, yellow, or red. 5. Statistical Descriptive Analysis		
Taber et al., 2012b	“To determine whether nutrient intake is healthier among high school students in California, which regulates the nutrition content of competitive foods sold in high schools, than among students in states with no such standards.”	Non-experimental design: Observational: cross sectional	1. grades 9-12 2. 680 high school students 3. State laws governing fat, sugar, and nutritional content of competitive foods sold in vending machines, school stores, and à la carte venues were studied. Student data on nutrient intake were obtained from the (NYPANS), conducted by the (CDC) 4. Estimated differences in (1) total caloric intake, overall and stratified by location of consumption; (2) proportions of total calories consumed in the forms of protein, carbohydrates, and different types of fat, and (3) total intake of macronutrients and micronutrients. 5. General linear models were used to estimate differences in average dietary intake between students in California and states that did not have laws regarding the nutrition content of competitive foods.	Kcal	Level IV; Low Quality
Taber et al., 2012a	“To determine if state laws regulating nutrition content of foods and beverages sold outside of federal school meal programs (“competitive foods”) are associated with lower adolescent weight gain.”	Quasi-experimental design: longitudinal study	1. Middle school’s grades 5th and -8th 2. 6300 students 3. The Westlaw legal database identified state competitive food laws that were scored by using the (CLASS) criteria. States were classified as having strong, weak, or no competitive food laws in 2003 and 2006 based on law strength and comprehensiveness. Objective height and weight data were obtained from 6300 students in 40 states in 5 and 8th grade (2004 and 2007) 4. ECLS-K used. General linear models estimated the association between baseline state laws (2003) and within-student changes in BMI, overweight status, and obesity status. Identity measures were examined: gender, age, race/ethnicity (non-Hispanic white, non Hispanic black, Hispanic, non-Hispanic other), socioeconomic status (SES) 5. ‘Fixed-effect models estimated the association between law changes during follow-up (2003–2006) and within-student changes in BMI and weight status. A robust SE was used to account for within-state clustering. ’	BMI Kcal	Level III; Mod. Quality

Reference	Aim/ Objective	Design	Methods/ Data 1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis	Eval. Meas. Wt. BMI Kcal	Level of Evidence^{1*} and Quality**
Taber et al., 2013	“To determine if state laws with stricter school meal nutrition standards are inversely associated with adolescent weight status, while controlling for unmeasured state-level confounders.”	Quasi-experimental design: observational study	1. 8th grade students in 40 states 2. 4,870 students 3. ‘Codified state statutory and administrative laws governing school meals were collected as part of the Bridging the Gap research program.’ Student data from the (ECLS-K). Other ECLS-K data in this study was gotten from interviews with parents/guardians and questionnaires done by students 4. Independent variable: Type of School Lunch they usually obtained. Dependent variable: primary outcomes of interest were (BMI) percentile and obesity status. Control group: Students who do not obtain lunch at school 5. Statistical Analysis. ‘All analyses used generalized estimating equations with an exchangeable correlation matrix and identity link to control for state-level clustering ’.	BMI	Level III: Mod. Quality
Terry-McElrath et al., 2009	“Identify trends in the availability of various food choices in United States’ middle and high schools from 2004 to 2007, and examines the potential associations between such food availability and students’ self-reported eating habits and body mass index (BMI)–related outcomes.”	Non-experimental design Observational; cross-sectional	1. students 8th, 10th, and 12th grades 2. 45,000 students interviewed each year/ 2004 to 2007 3. Report uses data from two studies: Monitoring the Future (MTF), and Youth, Education, and Society (YES). 4. Independent variables were all measured at the school level, and included: types of foods offered, locations such foods could be obtained, if the school provided breakfast, and school start time. 5. Trend analyses were conducted at the school level using the Mantel-Haenszel c2 test for significance. Multivariate analyses were conducted to assess the association between the school food environment and student food consumption, with correction for design effects resulting from clustered sampling using the survey logistic procedure.	BMI	Level IV Low Quality
Van Hook & Altman, 2012	“We use longitudinal data to estimate the association between the introduction of competitive food sales in children’s schools and weight gain from fifth grade to eighth grade, and we exploit variation in the timing of the transition from elementary to middle school to estimate exposure to competitive foods in middle school environments. Second, we assess whether the estimated associations of competitive foods with weight gain vary significantly by gender, race/ethnicity, and family socioeconomic status (SES).”	Quasi-experimental design: a longitudinal research design	1. fifth and eighth grades 2. 19,450 children who attended school in the same county in both fifth and eighth grades 3. ‘In the 5th and 8th-grade waves of data collection, school administrators were asked a series of questions about the availability of competitive foods for students to purchase. Children were also asked the types of food available for purchase at school. For both 5th and 8th grades, we created a dichotomous measure of competitive food sales for schools that sold food through at least one competitive food venue (i.e., vending machines, snack bars, or a` la carte). We conducted supplementary analyses of the types of food sold, using two competitive food scales.’ 4. ‘Height and weight measures were collected from the children during the spring and fall of kindergarten and 1st grade and during the spring of 3rd, 5th, and 8th grades, which were converted to percentile BMI in accordance with CDC guidelines. We used data from the of (ECLS-K) 1998- 1999.’ 5. Used estimate fixed effects models , which model changes in children's weight as a function of changes in competitive foods. Descriptive statistical analysis used.	BMI	Level III- Level IV; Mod. Quality

Reference	Aim/ Objective	Design	<p style="text-align: center;">Methods/ Data</p> <p style="text-align: center;">1. Definition of the subjects 2. Size of the sample 3. Methodology 4. Measuring variables 5. Method of analysis</p>	<p style="text-align: center;">Eval. Meas. Wt. BMI Kcal</p>	<p style="text-align: center;">Level of Evidence^{1*} and Quality^{**}</p>
Wiecha et al., 2006	“To examine associations between use of school vending machines and fast-food restaurants and youth intake of sugar-sweetened beverages.”	Non-experimental design: Observational; cross-sectional analysis	<p>1. Middle School grade 6-7</p> <p>2. 1,474 students</p> <p>3. ‘From a group randomized obesity intervention, we analyzed baseline data from 1,474 students in 10 Massachusetts middle schools with vending machines that sold soda and/or other sweetened drinks. Students completed a self-report survey of 83 questions during a single class period in Fall 2002 administered by trained study staff. Vending machine presence, availability to students, and contents were determined in Spring 2003 by study staff using a standardized data collection instrument.’</p> <p>4. ‘Daily SSB consumption (regular soda, fruit drinks, and iced tea), purchases from school vending machines, and visits to fast-food restaurants in the preceding 7 days were estimated by self-report. Heights and weights were obtained by school nurses standardized in measurement techniques by study staff. BMI was generated using an age- and sex-specific algorithm from the CDC.’</p> <p>5. Statistical analyses performed and nonparametric tests were performed on unadjusted data; multivariable models adjusted for sex, grade, body mass index, and race/ ethnicity, and accounted for clustering within schools.</p>	BMI	Level IV: Low Quality

evaluated mean daily nutrient sales per student, per item in competitive food venues such as a la cart and snack bars in schools. Cradock et al. (2011), assessed data on consumption of SSB's by high school students before and after policy change implementation, noting the mean per capita daily calorie consumption for students who consume SSB's. Snelling et al. (2007) compared the National School Lunch Program (NSLP) and competitive food offerings and purchases in students in 3 high schools, and Smith & Holloman (2014) examined the impact of SSB consumption among adolescents in high school settings and the Kcalorie implications it held.

Similarly, other studies which examined adolescent Kcalorie consumption of SSB's in school settings were also performed by Briefel et al. (2009a, 2013), and Wiecha et al. (2006), including a pilot simulation by Levy & Friend (2013) who assessed SSB calories consumed inside and outside of school settings, and the possible effects on an SSB tax. Kakarala et al. (2010) explored the mean energy intake from competitive food sources other than *a la carte* in schoolchildren. Briefel et al. (2009b) set out to test the hypothesis that children would compensate for eating fewer SSB's and low-nutrient, energy dense foods at school by consuming more of these items outside of school. Other cross-sectional analyses examined data on Kcalorie consumption of competitive foods in schools before and after policy implementation or beverage tax imposed (Bauhoff, S., 2014; Fletcher et al., 2010; Mendoza et al., 2010;). Fox et al. (2009a, 2009b) examined associations between adolescent's weight status and school food environments, and amount of Kcalories consumed by students from low-nutrient, energy-dense foods attained in school.

3.4.3 Availability of Competitive Foods in Schools

There were twenty articles (77%) which addressed the aspect of availability of competitive foods in schools and how that related to calorie consumption or weight in adolescents. Studies which correlated associations between availability, consumption patterns, and student's BMI-related outcomes were performed by Anderson & Butcher (2006), Briefel et al. (2009a); Fletcher et al. (2010), Fox et al. (2009a); Hennessy et al. (2014), and Terry-McElrath et al. (2009). Whereas other studies considered the associations between a variety of competitive food sources (vending machines, *a la carte*, school store, snack bars) in schools with adolescent consumption of low nutrient, energy-dense foods (Briefel et al., 2009b; Fox et al., 2009b; Kakarala et al., 2010; Park et al., 2010; Wiecha et al., 2006;). Briefel et al. (2013), Cradock et al. (2011), Levy & Friend (2013), Riis et al. (2009), and Taber et al. (2012a, 2013) explored change in consumption and weight status when policies

or interventions implemented restricting the sale of SSB's and and competitive food offerings on school grounds.

Snelling et al. (2007) sought to compare the National School Lunch Program (NSLP) and competitive food offerings and the impact availability and type of competitive foods had on adolescent consumption and purchasing behaviors. Nanney et al. (2010) examined cross-sectional associations to discover if youth obesity prevalence and comprehensive school-based obesity prevention policies, especially related to food service and nutrition, were linked. Smith & Holloman (2104) analyzed the purchasing patterns of SSB consumption when restrictions on availability were implemented in school settings.

3.4.4 Analysis of Policy

Fourteen studies (54%) discussed elements involving competitive food and beverage, nutrition, and physical education policies. Addressing over-weight prevalence before and after initiation of competitive food and beverage policies was observed in several studies (Bauhoff, S., 2014; Mendoza et al., 2010; Sanchez-Vaznaugh et al., 2010). Studies examined comparisons between states with competitive food and beverage policies in place versus those states with less stringent or no policies in place (Anderson & Butcher, 2006; Briefel et al., 2009; Cradock et al., 2011; Hennessy et al., 2014; Taber et al., 2012a, 2012b).

Evaluating different competitive food and beverage policies within schools around the country and their association with adolescent obesity were also examined (Levy & Friend 2013; Nanney et al. 2010), whereas, Nanney et al., (2010), and Riis et al. (2012) add analysis on physical education policies in addition to school nutrition policies. Taber et al. (2013) analyzes state school meal laws and their associations with weight status in adolescents. Fletcher et al. (2010), and Levy & Friend (2013), also considered effects on adding SSB taxes to predict daily Kcal reduction in adolescents, which could be associated with weight loss.

3.4.5 Other Effects: SES/Race/Ethnicity/Sex

Eighteen articles (69%) addressed the element of other effects involved, including Socio Economic Status (SES), Race, Ethnicity, and Sex as factors of interest to the studies analyzed. Fourteen (78%) of the 18 articles which addressed other effects examined effects of being in an ethnic minority group (Briefel et al., 2009b, 2013; Cradock et al., 2011; Hartstein

et al., 2008; Hennessy et al., 2014; Mendoza et al., 2010; Park et al., 2010; Sanchez-Vaznaugh, 2010; Taber et al., 2012a, 2012b, 2013; Van Hook & Altman, 2012; Wiecha et al., 2006).

Eleven (61%) of the 18 articles were addressing socio economic status (SES) in some capacity as being an interesting variable in the study (Briefel et al., 2009; Cradock et al., 2011; Hennessy et al., 2014; Kakarala et al., 2010; Mendoza et al., 2010; Sanchez-Vaznaugh et al., 2010; Taber et al., 2012a, 2012b, 2013; Terry-McElrath, 2009; Van Hook & Altman, 2012). Association with sex/gender was examined in nine (50%) out of the 18 articles which looked at other effects (Anderson & Butcher, 2006; Bauhoff, S., 2014; Briefel et al., 2009b; Cradock et al., 2011; Hennessy et al., 2014; Mendoza et al., 2010; Park et al., 2010; Smith & Holloman, 2014; Van Hook & Altman, 2012).

3.5 Previous Studies Used for analysis in the 26 articles of this Review

Many of the articles used in this review analyzed, used, or evaluated other various studies completed in the U.S. (see Table 3.3).

Table 3.3. *Summary of Articles included in Review using Data Analysis from Previous Studies*

Articles Included in this Review	# of articles	Studies used for Basis of Data Analysis
Anderson & Butcher, (2006)	1	The National Longitudinal Survey of Youth 1997 (NLSY97)
Anderson & Butcher, (2006), Briefel et al., (2009a), and Nanney et al., (2010)	3	The School Health Policies and Practices Study (SHPPS)
Anderson and Butcher (2006)	1	The National Center for Education Statistics (NCES)
Briefel et al., (2009a, 2009b, 2013), Fox et al., (2009a, 2009b) and Kakarala et al., (2010)	6	The School Nutrition Dietary Assessment Study – III (SNDA-III)
Cradock et al. (2011)	1	Boston Youth Survey 2004-2006
Cradock et al., (2011), and Fletcher et al., (2010)	2	The National Health and Nutrition Examination Survey (NHANES)
Fletcher et al. (2010), Taber et al. (2012a, 2013), and Van Hook & Altman (2012)	4	Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K)
Hartstein et al. (2008)	1	The Studies to Treat or Prevent Pediatric Type 2 Diabetes (STOPP T2D)
Hennessy et al. (2014), and Riis et al. (2012)	2	The National Cancer Institute's Classification of Laws Associated with School Students (CLASS)
Hennessy et al. (2014), Nanney et al. (2010) and Riis et al. (2012)	3	The National Survey of Children's Health (NSCH)
Mendoza et al. (2010)	1	The Texas Public School Nutrition Policy
Park et al. (2010)	1	Florida Youth Physical Activity and Nutrition Survey (YPANS)
Riis et al. (2012)	1	Physical Education-Related State Policy Classification System (PERSPCS)
Taber et al., (2012)	1	National Youth Physical Activity and Nutrition Study (NYPANS)
Terry-McElrath et al., 2009	1	US, and Youth, Education & Society (YES)
Terry-McElrath et al., (2009)	1	Monitoring the Future (MTF)

One article (3%) analyzed data from Monitoring the Future (MTF), a continuous study of secondary and college students, and adolescents on their attitudes, behaviors, and values in the US; and Youth, Education & Society (YES), a nationwide study of secondary students and schools in the US (Terry-McElrath et al., 2009). The National Youth Physical Activity and Nutrition Study (NYPANS), was conducted in 2010 by the Centers for Disease Control and Prevention (CDC) to make available nationally representative data on behaviors and determinants related to physical activity and nutrition among U.S. high school students, was used in one article (3%), Taber et al., (2012).

Four articles (15%), Fletcher et al. (2010), Taber et al. (2012a, 2013), and Van Hook & Altman (2012) utilized data taken from a study (starting with Kindergarten through middle school) on wide range of school, community, family, and individual influences related to school performance in the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K). The School Health Policies and Practices Study (SHPPS), a national survey periodically done to analysis and measure school health policies and practices at different levels in state, district, school, and the classroom, was used in three articles (12%) by Anderson & Butcher, (2006), Briefel et al., (2009a), and Nanney et al., (2010). The School Nutrition Dietary Assessment Study – III, a study sponsored by the The Food and Nutrition Service (FNS) of the United States Department of Agriculture (USDA) to provide existing information on school meal programs, the school environment affecting the the programs, the nutrient make-up of school meals, and impact of the school meals on school aged student's diets, was analyzed in six studies (23%) by Briefel et al., (2009a, 2009b, 2013), Fox et al., (2009a, 2009b) and Kakarala et al., (2010).

The National Health and Nutrition Examination Survey (NHANES), a unique group of studies designed to evaluate the health and nutritional standing of adults and children in the U.S. by combining both interviews along with physical examinations, was included in two articles (8%) by Cradock et al., (2011), and Fletcher et al., (2010). Two articles (8%), Hennessy et al. (2014), and Riis et al. (2012), utilized The National Cancer Institute's Classification of Laws Associated with School Students (CLASS), which uses current public health research and national standards and recommendations regarding physical education (PE) and nutrition in schools to be able to score state-level codified laws for PE and nutrition. Hennessy et al. (2014), Nanney et al. (2010) and Riis et al. (2012), were three studies (12%)

that used The National Survey of Children's Health (NSCH), providing thick data on multiple aspects of children's physical and mental health as well as access to quality health care.

One article (3%), Riis et al. (2012) also evaluated the Physical Education-Related State Policy Classification System (PERSPCS), which is a classification system which assesses Physical Education (PE), curriculum, staffing, and health-related fitness. One study (3%), Hartstein et al. (2008), assessed The Studies to Treat or Prevent Pediatric Type 2 Diabetes (STOPP T2D), a primary prevention trial conducted to examine risk factors for type 2 diabetes in adolescents. Cradock et al. (2011), was one study (3%) who assessed the Boston Youth Survey 2004-2006, Boston's most comprehensive overview of their youth.

One article (3%) by Mendoza et al. (2010), assessed the Texas Public School Nutrition Policy, which promotes Nutrition Guidelines for Public Schools Participating in Child Nutrition Programs. Park et al. (2010), was one article (3%) which used the Florida Youth Physical Activity and Nutrition Survey (YPANS), a statewide, school-based, self-reported survey of middle school students in Florida on attitude, knowledge of nutrition and physical activity, and health behaviors. The National Center for Education Statistics (NCES), a primary federal unit which collects and analyses data related to education in the U.S., was used in one article (3%) by Anderson and Butcher (2006). The National Longitudinal Survey of Youth 1997 (NLSY97), a longitudinal project which follows a sample (8,984) of American youth born between 1980-84, was evaluated in one article (3%) by Anderson & Butcher (2006).

3.6 Measuring Variables

A variety of different measuring variables were examined and used in each article (see Table 3.2), with some of the more common variables including 13 articles (50%) examining BMI/weight association with exposures to competitive food and beverage policies in schools, six studies (23%) compared students in school districts to those in a control group or other district. Seventeen (65%) of the 26 studies utilized questionnaires, checklists, or menu data for comparative analysis to BMI/weight/Kcal consumption, and 11 articles (42%) looked at outcome measures of per capita total k/cal consumed per day as a measuring variable. Similarly, 11 (42%) of the 26 articles analyzed in this review used comparisons within student's eating patterns as a particularly interesting measuring variable.

3.7 Method of Analysis

Each article included in this review utilized one of four categories of analysis; Factor analyses, Associations, Comparisons, and Descriptive Analyses. (see Tables 3.3, 3.4). Seven (27%) of the 26 studies used Factor Analysis, whereas 11 (42%) of the articles applied an Association Analysis. Eleven studies (42%) employed Comparative Analysis, and lastly, most (16, or 62%) studies relied on Descriptive Analysis.

Table 3.4 Summary of Method of Analysis

Articles	Factor Analysis (Clusters)	Association Analysis (multi-variate; regression; Bi-variate; Odds ratio)	Comparative Analysis (t-tests; Comparisons; Chi-Squared; Correlations; ANOVA)	Descriptive Statistical Analysis
Anderson & Butcher, 2006		X	X	
Bauhoff, S., 2014				X
Briefel et al., 2009b		X		X
Briefel et al., 2013			X	X
Briefel et al., 2009a			X	X
Cradock et al., 2011		X		X
Fletcher et al., 2010			X	X
Fox et al., 2009a		X		X
Fox et al., 2009b			X	X
Hartstein et al., 2008	X			
Hennessy et al., 2014		X		X
Kakarala et al., 2010			X	X
Levy & Friend, 2013				X
Mendoza et al., 2010			X	
Nanney et al., 2010	X			
Park et al., 2010		X	X	X
Riis et al., 2012		X		
Sanchez-Vaznaugh et al., 2010		X		X
Smith & Holloman, 2014			X	X
Snelling et al., 2007				X
Taber et al., 2012b		X		
Taber et al., 2012a	X	X		
Taber et al., 2013	X		X	
Terry-McElrath et al., 2009	X			
Van Hook & Altman, 2012	X			X
Wiecha et al., 2006	X	X	X	
Total:	7	11	11	16

3.8 Ethical Considerations

Ethical considerations are important because as Vergenes et al. (2010) postulated, some studies which could be included in integrative systematic reviews may well be of insufficient quality ethically and, ‘authors of systematic reviews should guarantee a minimum of ethical

assessment and at least provide a brief discursive report of the ethical assessment of original studies' (Ibid., p. 773). This review is comprised of those articles which included ethical principles based on established ethical clearance procured for the research, or if that was not apparent, then the informed consent process was described clearly within their article. However, in *Best Practice Guidelines on Publication Ethics*, "if human participants were involved, manuscripts must be accompanied by a statement that the experiments were undertaken with the understanding and appropriate informed consent of each" (Graf et al., 2007, p. 6), thus implying that the statement of ethical consent need not necessarily be published directly in the article, merely accompanying the submission of the article to prove the ethical quality. Therefore, this review examined and included articles if it was clear that the studies were performed in an ethical manner.

4 Discussion

After examining all 26 articles which met all criteria for this review, it was clear that adolescent obesity is a serious public health concern. The studies analyzed and performed within this review attempted to quantify where the problems lay, with a main assumption being that since adolescents spend an average of six or more hours per day and 180 days out of each year in school settings, the school environment might hold an inimitable influence upon the diets and eating behaviors of U.S. schoolchildren (Fox et al., 2009a). One consistent concern was the pervasiveness of competitive foods, considered food and beverages of minimal nutritional value (FMNV), in U.S. schools (Anderson & Butcher, 2006). Thus far, there has been scant evidence to support the associations between school food environments with the eating behaviors and weight of adolescents (Fox et al., 2009a). It is with a unified consensus therefore, that all studies in this review attempted to dissect this hypothesis, with varying results. Therefore, as "a final step of the data analysis in an integrative review...the synthesis of important elements or conclusions of each subgroup" ...is gathered... "into an integrated summation of the topic or phenomenon," (Whittemore and Knafl, 2005, p. 551), which is represented in the following text.

4.1 No Strong Effect between School Food Environments on BMI /Weight Found Overall

Anderson and Butcher (2006) found a strong literature base which revealed robust correlations regarding a genetic component to weight, that a percentage of the population has

a genetic susceptibility for gaining weight, and under certain circumstances might be more likely to gain weight. They determined in their study that while school food policies have no affect on most students' weight, policies that increase access to junk foods and beverages in school could be a contributing factor for those with a genetic susceptibility to weight gain. Similarly, Bauhoff et al., (2014) determined there were positive effect results for obese students considering they might be more apt to purchase and consume in-school, therefore being more influenced by any nutrition policies, however, no significant statistical results regarding most student's weights and any competitive food policies were found. Van Hook and Altman (2012) also suggest that weight during early adolescence is strongly shaped by how heavy these adolescents were in their younger years.

Fletcher et al., (2010), discovered that 'neither vending machine restrictions nor soft drink taxes will lead to noticeable weight reduction in children' (p. 1064), noting that according to their analysis, adolescents consumed just as many soft drinks in schools with vending machine restrictions as in schools without restrictions. And Hartstein et al. (2008) determined that when all schools in their intervention were included, there were no significant change in number of kilocalories sold per student between week 1 and week 6.

Briefel et al., 2013, found positive results for SSB consumption out-of-school settings versus in-school settings, suggesting that while reducing SSB consumption in schools can be beneficial (8 cal/day), a greater benefit would come from reducing SSB consumption outside of school settings (145 cal/day). And Park et al. (2010) discovered no significant association in daily mean sugar-sweetened beverage consumption from vending machine on BMI status among middle school students in the U.S., with buying lunch from vending machines rather than buying a school lunch as being significantly connected to overweight/obesity or physical activity.

Nanney et al. (2010) found that there was no significant correlation between Weight Assessment (WA) policies and youth obesity prevalence. Results from the analysis by Terry-McElrath et al. (2009) showed that, after inclusion of the percentage of high school students eligible for FRPL (free or reduced-price lunch), all associations between student overweight and obesity and school food environment were not significant. It was also noted that few relationships between overweight or obesity and the school food environment were detected among middle school students.

Van Hook & Altman (2012), similarly discovered that their results demonstrate how changes in competitive foods sales in schools are not associated with changes in children's percentile BMI. Moreover, they uncovered no evidence that greater exposure to competitive foods directly causes an increase in children's weight, with the interaction of competitive food sales with years in middle school as being insignificant. The negative relationship between obesity prevalence and school meal environment policies in high schools was constant across cross-sectional and policy change analyses, as was determined by Riis et al. (2010). Based on the findings from Fox et al., (2009a), no associations between school food environments and practices, BMI z scores, or the likelihood of obesity were significant among high-school students.

4.2 Positive Association Between Competitive Food and Beverage Policies and BMI/Weight

Cradock et al. (2011), found that the decline in consumption of SSB's after the policy change in Boston Public Schools relates to approximately 45 Kcals per day, where a 45 Kcal/day reduction could potentially cut the 25% to 40% of total excess calories, (110 Kcals-165 Kcals/day), which is credited to the increasing average body weight among adolescents in the U.S. According to Briefel et al. (2009a), among students in secondary schools who consumed SSB's at school, their energy intake over their entire day was approximately 229 Kcal higher than students who did not consume SSB's at school. According to Wiecha et al. (2006), the number of items adolescents purchased at school vending machines is directly associated with SSB intake and purchase, with these results suggesting that school vending machines make independent contributions to overall SSB intake which increases with repeated use and exposure.

Fox et al. (2009b) discovered that in middle schools and high schools, students got 171 and 219 calories from low-nutrient, energy-dense competitive foods. This amounted to 8% of total daily energy intakes from low-nutrient, energy-dense competitive foods. Fox et al. (2009a), discovered at the middle school level, the availability of low-nutrient, energy-dense foods in vending machines in or near the foodservice area was positively associated with a higher BMI z score. Findings from their analysis suggested that restricting adolescent's access to low-nutrient, energy-dense foods at school could be one tactic in reducing adolescent's total calorie intake in working to control children's BMI (Fox et al., 2009a). And

Hartstein et al. (2008) noted that two Texas schools in their study showed a reduction in kilocalorie density from 277 to 216, however, other reductions were modest (1 to 12 Kcal per item sold). California students exposed to more stringent school nutrition policies consumed a lower proportion of their calories at school, indeed, consumed less for every measure examined, particularly added sugars, trans fat, monounsaturated fat, sodium, potassium, iron, and vitamin B12, compared with students in other states (Taber et al., 2009b).

Results revealed that energy density significantly declined to $2.1 + 0.78$ Kcal/g in the study by Mendoza et al. (2010), supporting the findings that implementation of the Texas Public School Nutrition Policy was associated with a decrease in total lunchtime energy density of middle school students. Nanney et al. (2010) did find that Food Service and Nutrition (FSN) policy groupings with the strongest associations to youth obesity are policies which pertained to competitive foods and food service standards, and concluded that there was some indication that when addressing both FSN and Physical Activity and Education (PAE) in a reasonably inclusive environment, there is an association with lower adolescent obesity in some states in the U.S. After adjusting for factors (individual, family neighborhood), nutrition and physical education policies addressing competitive foods in other venues, food service director qualifications, BMI screening, and time allowances for recess, remained positively and significantly related to the odds of obesity in children, as revealed by Riis et al. (2012).

Levy and Friend (2013) postulated that a \$0.01 tax per ounce is predicted to reduce SSB consumption by 40.3-54.2 cal/day, thus implying that stricter school lunch policies could have the potential to decrease overall caloric intake by around 30.4 Kcal/day per student purchasing foods and beverages in school. And Taber et al. (2013) found that the unadjusted frequency of obesity was 11% higher in students who received free/reduced price lunches at school compared with students who did not purchase lunch at school, however, the difference in prevalence of obesity and BMI percentile between students who got free/ reduced-price lunches and students who did not obtain their lunch at school was lower in states that exceeded USDA standards. Adolescent students gained 0.44 fewer BMI units when they were exposed to specific, consistent, required competitive food laws from 2003 to 2006 than students who were not exposed to the same requirements, according to Taber et al (2009a).

Concluding the intervention analyzed by Smith & Holloman (2014), students who participated in the intervention both reduced their daily consumption of SSB's as well as the number of days per week they consumed these beverages. The short-term behavioral change implications could equate to a substantial reduction in daily caloric intake from SSB's, with a reduction of nearly 1 serving per day being equivalent to a net reduction of 150 Kcal/day. If this is sustained long term would mean an estimated 12-15 pounds/year could be lost, markedly impacting the incidence of adolescent overweight and obesity. Similarly, an intervention by Snelling et al. (2007) discovered that competitive food menus tend to offer foods which lack in nutrients and have higher energy densities. The study provides evidence that competitive foods are not only offered but also purchased in disproportionate amounts in the high schools in this intervention. Kakarala et al. (2010) found that the total sugar intake was higher amongst students who consumed competitive food/ beverages compared with non-consumers when excluding *a la carte* items.

4.3 Other effects are Significant

Briefel et al., (2013) discovered when accounting for other effects such as age and race/ethnicity, non-Hispanic whites would save more total calories than Hispanic middle school students (234 k/day vs. 184 k/day). Briefel et al. (2009b) also found that being non-Hispanic African American was associated with greater caloric intake of sweetened beverages in high school, by 42 Kcal, and that being Hispanic or non-Hispanic African American was associated with a 47 and 70 Kcal greater intake from low-nutrient, energy-dense foods, than for non-Hispanic whites, whereas females consumed 46 Kcal less from low-nutrient, energy-dense foods.

Bauhoff et al. (2014) discovered that there was a consistent decrease of soda consumption for females, when SSB reductions were put into place. And Wiecha et al. (2006) discovered that boys drank significantly more SSB's than girls did, and that SSB intakes were higher among Hispanics vs non-Hispanics, and African Americans vs non-African Americans. Similarly, Hennessy et al. (2014) noted in their study that adolescents who were overweight/obese were more often younger, have younger parents, non-Hispanic black or Hispanic, male, less vigorously active, have a TV in their bedroom, not live in a 2-parent family, and reside in a poor household. Park et al. (2010) determined that in the proportions of students buying lunch from vending machines, non-Hispanic black race/ethnicity,

Hispanic ethnicity, older age, and smoking were significantly higher. Hispanic ethnicity and smoking revealed an interaction with an odds ratio of buying lunch from vending machines as 4.1 for Hispanic smokers, and 2.5 for Hispanic non-smokers, compared to non-Hispanic white nonsmokers.

Adolescent students in Los Angeles were more likely to be Hispanic than students in the rest of California, although the prevalence of overweight was highest among Hispanics and blacks in the entire data set. Relative to other groups, fifth-grade girls in Los Angeles experienced the largest change in overweight trends, however, in the rest of California, the lower rate of increase in overweight was significant among fifth-grade boys and seventh graders (Sanchez-Vaznaugh et al., 2010). In the study analyzed by Taber et al. (2009b), they also found that the California sample had a greater proportion of Hispanic students (76.6%) than other states that were in the sample (14.7%). These results were very similar when restricting the analysis to Hispanic students on consumption of caloric content of competitive foods.

Mendoza et al. (2010) discussed in their analysis that the reduction in energy density was significantly moderated by SES, and that low-SES schools had a higher proportion of males (66%), and Hispanic students. According to Taber et al. (2009a), in their analysis, states that had no 2003 laws had a relatively low proportion of students who were non-Hispanic black (9.0%) and had a relatively low proportion of students in the lowest SES quintile (15.7%). However, they found that states with weak 2003 laws had a relatively high proportion of students who were Hispanic (28.0%), and who were or in the lowest SES quintile (23.8%). Yet, Kakarala et al. (2010) examined other effects in their studies and determined that competitive food use did not differ significantly between adolescents who qualified for subsidized school meals and those who did not, signifying that the cost of vended items was most likely priced so that children of any income level could buy them.

4.4 Limitations in the literature

According to this review of literature, with 26 articles included in the final analysis, each presented their limitations with regards to robustness in research. As previously stated, nineteen articles (73%) were based on cross-sectional study design, which can be important in determining correlational findings, however, are not able to imply causality. It is also important to note that fifteen of the articles (58%) were based on self-reported data, while

common in these types of research studies on diet and BMI/weight, could potentially alter prevalence within the data due to under or over-reporting of food and beverage consumption and purchase recall or weight/height measurements.

Five of the articles (19%) in this review mentioned that the data they were utilizing was as current as was possible to obtain, however, was still outdated and newer more vigorous research was needed. Two articles (8%) discussed the limitations in data in the pre-intervention and post-intervention phases, which would have benefited the results. Limited data collection across a variety of elements within studies was brought up in 17 of the 26 articles (65%), with most acknowledging the lack of ability to test for every factor possible to attain the strongest most unbiased results possible. And finally, five of the articles (19%) stated that their results were not necessarily applicable to other children, either older or in a different setting.

4.5 Methodological Limitations

There were several limitations with this integrative systematic review, one being that most of the literature available are cross-sectional studies, which are unable to define causality. Another limitation might be that only three databases were searched, therefore data was only obtained from CINAHL, Medline, and EMBASE, and other literature is potentially available which was not found in this review. Generalizability is scattered, with some studies being relevant over the entire adolescent age range, and others merely pertinent to middle school, or high school aged students only. Finally, due to feasibility and time, double measures of cross-checking the data and inclusion criteria was unavailable. A pilot was done with two reviewers, yet only one researcher could complete the rest of the data extraction and analysis for this review. However, intra-rater reliability was ensured through the researcher re-analyzing all selected data.

5 Conclusions

The results were inconclusive, with many studies unable to definitively prove that competitive food sources in the schools are causal towards BMI/weight of adolescents, and much of the

literature revealing that there was indeed, no direct association between competitive foods in schools and BMI/weight. There were studies which did discover associations between weight and competitive foods sold in schools, but they were limited and did not have robust results.

Stronger policies overseeing competitive foods in schools proved to help in some significant ways, revealing that monitoring the sales and availability of foods of minimal nutritional value (FMNV) in schools can only benefit students, considering how only a few calories per day can make a difference long term. The most common theme throughout the literature was how even small fluctuations can create large changes in society, and easy access and availability towards unhealthy foods in schools may not now be obviously impacting our youth in a profound way, however, there needs to be an awareness and forethought towards what will come. It is apparent from the literature that policy makers need to pay extra attention to the more vulnerable groups such as those with a genetic susceptibility, lower socio-economic status, as well as examining more closely minority groups, and gender differences.

It was proposed at the beginning of this study that a utilitarian framework should be applied to the issue of competitive foods in schools, and although the evidence is clearly less robust than what was expected, this study still considers the obesity pandemic great enough that stricter policies must begin in areas where there is structure first, such as school environments. Without proper, sound research, the problem of policy implementation in the U.S. is full of roadblocks and challenges. It is difficult for many to see the difference between governmental involvement as protection, and government involvement as intrusion, with any overarching changes that affect a population possibly being viewed as a threat to their individual independence.

It was the definitive goal of this study to explore the literature currently available to answer the question of what ways competitive foods in school settings impacted adolescents BMI/weight. The hope was to bring to light the importance of how school environments are a strong influence and possibly a factor in the epidemic of adolescent obesity in America today. This literature review attempted to analyze the existing data systematically, thoroughly, and without bias. It is the opinion of this review that this was achieved. The literature which was

examined, as well as the results of the studies analyzed, could very well be generalized to other countries other than just the United States. Replicability of this study is ensured, and detailed throughout this review. Adolescent obesity is a growing epidemic world wide, and a call for stronger research is imperative for this global public health problem.

This review has the potential to enlighten public health policy makers, educators, parents, and the community about the understandings of adolescent obesity and the influence competitive food and school environments have while addressing major concerns related to the need for further rigorous research. What was evident throughout this review was that not enough longitudinal research has been done on this subject, and until this is accomplished, it will be difficult for stricter food and beverage policies to be enacted in schools.

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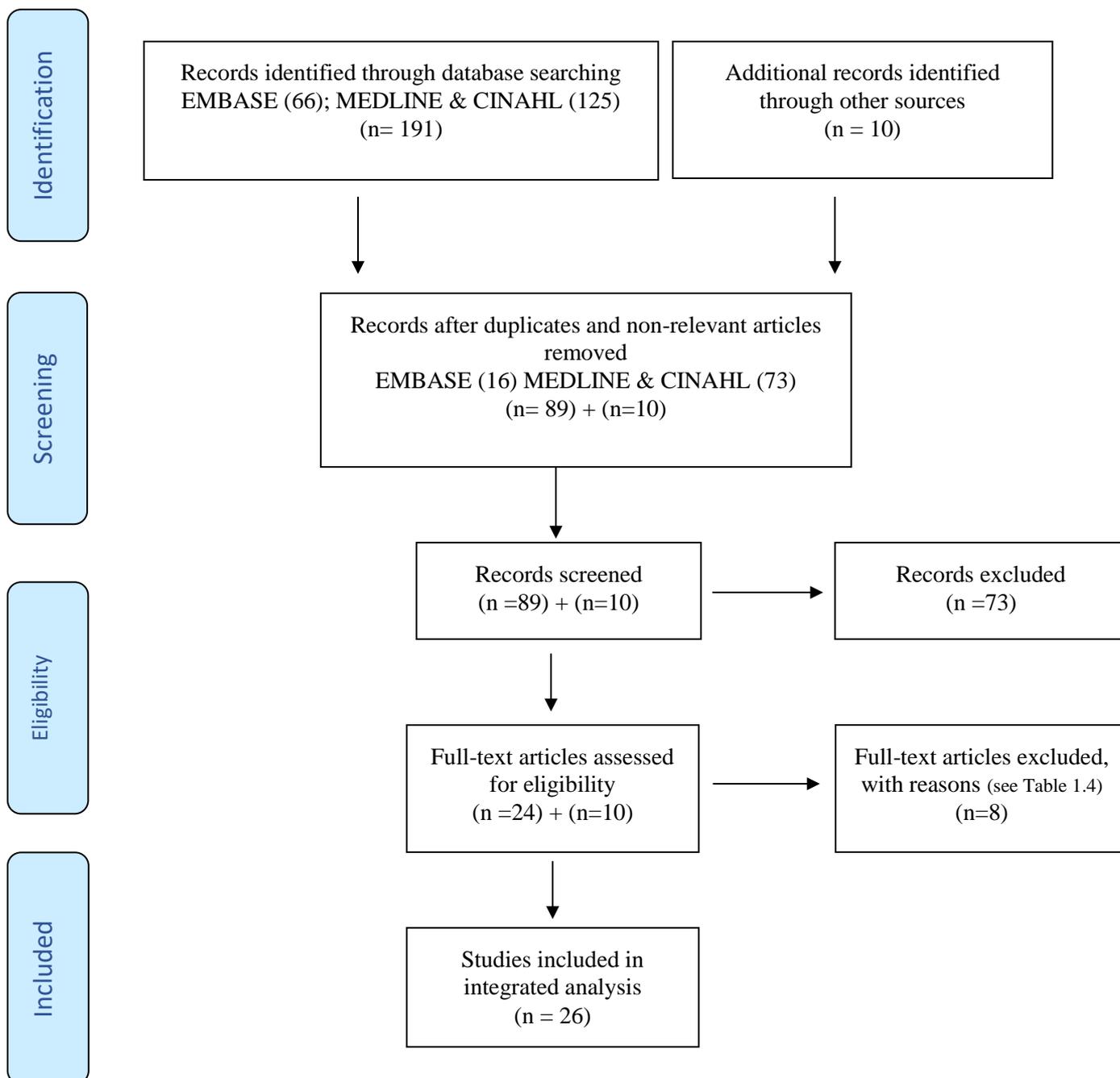
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7 Appendix 1

PRISMA 2009 Flow Diagram



(Moher et al., 2009).

8 Appendix 2

Sample of Variables for Data Collection Table (inspired by Ursi, 2005; Souza et al., 2010).

A. Identification		
Title of the Article		
Title of the Journal		
Authors		
Country	United States	
Language	English	
Year of publication		
B. Type of publication		
Nursing publication		
Medical publication		
Publication in another area of health? Which area?		
C. Methodological characteristics of the study		
1. Type of publication	1.1 Research <input type="checkbox"/> Quantitative approach <input type="checkbox"/> Experimental design <input type="checkbox"/> Quasi-experimental design <input type="checkbox"/> Non-experimental design:	
2. Objective or investigation question/AIM:		
3. Sample	3.1 Selection <input type="checkbox"/> Random <input type="checkbox"/> Convenience <input type="checkbox"/> Other: 3.2 Size (n) <input type="checkbox"/> Initial: <input type="checkbox"/> Final: 3.3 Characteristics Age: Sex: M <input type="checkbox"/> F <input type="checkbox"/> Race _____ 3.4 Inclusion/Exclusion criteria of subjects:	
4. Data Analysis		
5. Interventions performed	5.1 Independent variable: 5.2 Dependent variable: 5.3 Control group: yes <input type="checkbox"/> no <input type="checkbox"/> 5.4 Measurement instrument yes <input type="checkbox"/> no <input type="checkbox"/> 5.5 Duration of the study: 5.6 Methods employed to measure the intervention:	
6. Evidence level, based on:		
*Ackley, B. J., Swan, B. A., Ladwig, G., & Tucker, S. (2008). <i>Evidence-based nursing care guidelines: Medical-surgical interventions</i> . (p. 7). St. Louis, MO: Mosby Elsevier. ** Detsky AS, Naylor CD, O'Rourke K, McGeer AJ, L'Abbe KA. Incorporating variations in the quality of individual randomized trials into meta-analysis. <i>J Clin Epidemiol</i> . 1992; 45:255–65.		

9 Appendix 3 *Popular Science Summary*

‘Weigh in’ on Competitive Foods in Schools

Currently in the United States (U.S.), more than one third of adolescents, children between the ages of 13 and 18, weigh in as either being overweight or obese. It is now projected that as our population grows older, we will see both public health as well as economic burdens increase substantially. The Center for Disease Control and Prevention (CDC) has reported recently that adolescent obesity is a cause for great health concerns, considering the risks associated with obesity are plentiful, including: stroke, coronary heart disease, sleep apnea and respiratory issues, osteoarthritis, hypertension, Type 2 diabetes, and some cancers, just to name a few. It is due to these grave health concerns that we must look at potential causes to why our adolescents are suffering so much from this epidemic.

Consider for a moment the amount of time our young people are spending in school environments. It is assumed that a typical adolescent is in school around six or more hours per day and approximately 180 days out of each year. Therefore, we might assume that the school environment might hold a unique amount of influence upon the diets and eating behaviors of U.S. schoolchildren. Examining this theory, it is important to consider the eating environments within the schools in the U.S., and whether competitive foods, which according to the United States Department of Agriculture (USDA) are defined as being foods that are available for purchase at school which are not part of the regular school lunch programs, are responsible for the increase in obesity in our adolescents.

After extensively reviewing the most current literature on this theory, it is reasonable to say that although there are some results which support the association between competitive foods and weight gain, they are small and lacking in solid research. Interestingly, I noticed in most of the findings in my search, that other factors, such as those with a genetic susceptibility to weight, socio economic factors (SES), race, ethnicity, age, and gender seemed to be affected the strongest by availability of competitive foods in schools. It was surprising that there was less robust research to prove what seems to me to be obvious; if there is junk food available, more kids will purchase it, and therefore, more kids will be eating a higher intake of calories

and thus, gaining more weight. However, what the research has showed so far, is that without further longitudinal and more involved research, instilling stricter food and beverage policies in school settings will be challenging.

Essentially, the bottom line was this: it is critical that we look at all aspects in the lives of our children, from their home situations and environments, economic resources and spending habits, schools, community, availability and consumer influence on purchasing less nutritious foods and beverages, to gender, ethnicity and racial complexities. The task is enormous, yet it is critical that we come to a better understanding of how to attack and conquer this pandemic which is spreading rapidly through our nations youth.