MILK FAT CONSUMPTION AND WEIGHT STATUS OF CHILDREN AND ADOLESCENTS

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ABSTRACT OF THESIS

OBJECTIVE: To critically analyze the current research on milk fats to determine if the current guidelines in the NSLP are evidence-based in terms of maintaining weight status in children and adolescents.

DESIGN: Academy of Nutrition and Dietetics (AND) Evidence Analysis Library (EAL) Project.

METHODS: AND's EAL, which incorporates systematically reviewed scientific evidence. The steps included in the evidence analysis process are, 1) Formulate the Evidence Analysis Question, 2) Gather and Classify the Evidence, 3) Critically Appraise Each Article, 4) Summarize the Evidence, and 5) Write and Grade the Conclusion Statement.

RESULTS: Nine studies were analyzed using the PubMed Database. From the search, 25 were identified relating beverage consumption in children and adolescents. Studies excluded analyzed energy intake, sugar-sweetened beverage consumption and juice consumption only, perceptions of beverages, tools to measure consumption, and efficacy of programs. Of the nine studies chosen for review, six were longitudinal cohorts and three were cross-sectional studies. All nine studies assessed children and adolescents 18 years of age and younger, which is consistent with the age groups involved in the National School Lunch Program (NSLP). All specifically assessed milk and/or dairy intake and adiposity in children and adolescents, showing an inverse relationship or no association between higher-fat milk or dairy intake and weight status, according to BMI.

CONCLUSION: The current guidelines restricting students to only low-fat or fat-free milk and dairy products are not consistent with the research, which shows that consumption of higher-fat milk or dairy is not a predictor of overweight and obesity. Perhaps the low-fat and fat-free dairy product restriction for the NSLP should be reconsidered. This conclusion was graded *Fair, II.*

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CHAPTER 1: INTRODUCTION

The Centers for Disease Control (CDC) states that childhood obesity has more than doubled in children and quadrupled in adolescents in the past 30 years (CDC, 2015). Obesity leads to both immediate and long-term consequences on health and well-being. Immediate health problems include high cholesterol and high blood pressure, pre-diabetes, bone and joint problems, sleep apnea, and social and physiological concerns including poor self-esteem. Long-term effects include a higher prevalence of obesity later in life and development of heart disease, type 2 diabetes, and risk for stroke, several types of cancer, osteoarthritis, and cardiovascular disease. To combat the issue of childhood overweight and obesity, and to help prevent long-term negative outcomes, those schools participating in the National School Lunch Program (NSLP) must follow specific dietary guidelines set forth by the United States Department of Agriculture (USDA).

School-aged children and adolescents who have access to nutritious meals are more likely to succeed academically and have lifelong healthy eating habits (CDC, 2014). The NSLP strives to incorporate a healthy diet into a child's everyday life, allowing access to healthier food options with calorie, fat, saturated fat, and sodium limits. Over time this will hopefully contribute to the decline in the incidence of overweight and obesity in childhood. The Healthy Meals for Healthy Americans Act requires that federally subsidized meal programs conform to the Dietary Guidelines for Americans (Ralston, 2008). In addition to this, the Healthy Hunger-Free Kids Act of 2010 authorizes funding and sets policy for USDA's child nutrition programs, to improve child nutrition. Meal patterns in the NSLP are designed to reflect these guidelines. Compared to the previous regulations, there is now more focus on whole grains, fresh fruits and

vegetables, lower sodium in meals, limits on fat, saturated fat, and calories, and elimination of trans-fats in all products served to students, since this type of meal pattern is associated with positive health outcomes (Thornton, 2013). One of the focuses of the NSLP is offering students low-fat and/or fat-free milk as part of a reimbursable meal, since the calcium and protein content of the milk are important nutrients for normal growth in children.

In the 2012 Federal Register report on the nutritional standards in the NSLP, one proposed rule was to offer plain or flavored fat-free milk and unflavored low-fat milk (1% fat or less), which reflects milk varieties that are consistent with the 2015-2020 Dietary Guidelines for Americans. The document stated parents and health advocates were in favor of this rule to limit flavor to fat-free milk because they believed the saturated fat and sugar in a child's diet could be reduced by restricting the fat in milk (FNS, 2012). Within the same document, other parents stated that flavored low-fat milk *should* be allowed and that the extra calories in 1% flavored milk is not significant enough and yet may encourage milk intake (FNS, 2012). The requirements dictate that meals served in the NSLP contain no more than 10% of calories coming from saturated fat. Restricting schools to provide only lower-fat and fat-free milks help schools to remain within the saturated fat guidelines.

The American Heart Association (AHA) recommends adults and children over the age of two consume lower-fat dairy products to prevent long-term health issues. Low-fat milk products include fortified fat-free (skim or non-fat) milk, fortified non-fat milk powder, and ½ percent and 1 percent low-fat milk. These recommendations are made based on the saturated fat content in higher-fat dairy products. The AHA recommends

low-fat items because saturated fats tend to raise the cholesterol level in the blood, which is a risk factor for heart disease (AHA, 2016).

In a push for low-fat food options, saturated fat is being taken out of products and being replaced with refined carbohydrates, or in most cases, sugar. This can have a bigger health impact, raising the glycemic response of an individual, which may lead to diabetes or insulin resistance (Hu, 2010). Replacing products with carbohydrates versus other fats can have worsening effects on one's cardiovascular health, specifically a higher risk for ischemic heart disease (Jakobsen et al, 2010). Because of current regulations, milks served in the NSLP have lower-fat contents, which mean less satiation than higher-fat milks, possibly leading to overeating of other less nutritious foods.

Milk also contains fatty acids that are essential for growth and development. Milk fat contains about 400 fatty acids, 65-70% of which are saturated, 27-33% monounsaturated, and 3.5-5% polyunsaturated (IDF, 2008). Saturated fatty acids, although controversial, are essential to the development of a child's brain and are also a source of energy (IDF, 2008). The unsaturated fatty acids in milk, specifically oleic acid, which comprises about 30% of total fatty acids, is used as a source of energy and helps with the structure of brain tissue (IDF, 2008). Although there is a small percentage of polyunsaturated fatty acid in milk, they are essential, meaning humans need to retrieve them from food. These essential acids, linoleic acid and alpha-linoleic acid, help with immune and reproductive functions, development of the retina and brain as well as the nervous system and prevention of cardiovascular disease (IDF, 2008). In low-fat and fat-free type milks, these fats (saturated, monounsaturated, and polyunsaturated) are in lower amounts.

Therefore, the question remains; are the guidelines set by the USDA too strict in limiting fat in a child's diet by restricting schools from offering certain types of milk? Should young children who are continuing to develop be limited to only low-fat and fat-free milks, or is this creating other issues like overconsumption of refined carbohydrates, lack of essential fatty acids, or decreased absorption of fat-soluble vitamins?

An evidence analysis was conducted to determine if current NSLP guidelines on milk type restrictions are evidence-based in terms of maintaining weight status and preventing weight gain in pre-school and school-aged children. The results will allow for a better understanding of which types of milk promote the most positive health outcomes for school-aged children. The results of this study could potentially influence the regulations the USDA sets forth for the NSLP based on the dietary guidelines and ultimately the health and proper development of the school-aged children that participate in the NSLP.

Research Questions

1. Should preschoolers and school-aged children consume low-fat and fat-free dairy products rather than full-fat?
2. Are the current NSLP guidelines on milk types evidence-based in terms of maintaining and preventing weight gain in pre-school and school-aged children?

Sub-problems

The sub-problems presented with this research question include amounts of milk consumed, age of consumption, and other types of milk on the market. Questions arise such as, do higher milk fat percentages (2%, whole milk) have positive or negative impacts on the weight status of pre-school and school-aged children? Do other factors influence weight status of children who consume low-fat milk and/or fat-free milk, such

as over-eating other unhealthy food options due to decreased satiety? What role does flavored milk have in weight status of children? What are the harmful effects and/or health benefits of higher-fat milks? What are the harmful effects and/or health benefits of lower-fat milks?

Limitations

Limitations include availability of research conducted on types of milk consumed in pre-school and school-aged children. Because the AHA recommendations on milk consumption are set for children and adolescents aged two and older, pre-school and school-aged children 2-18 years of age were the population of focus. There was limited availability of studies on children in a certain age group within that age frame. Recently conducted or longitudinal studies analyzing weight status over time were difficult to find. Many studies included observational, self-reported data which limits the strength of conclusions.

Delimitations

Delimitations have been set for the review of literature. These include studies that analyze milk consumption of pre-school and school-aged children (aged 2-18), studies that analyze types of milk fat and consumption by pre-school and school-aged children, and studies that analyze the health benefits or health issues on preschool and school-aged children that are associated with different types of milk fat consumption. This evidence analysis is limited to reviewing milk fat percentages in regular cow's milk.

Assumptions

All studies included in the literature review are assumed to contain accurate and sound information.

Definitions

American Heart Association (AHA): places efforts to reduce death caused by heart disease and stroke.

Centers for Disease Control (CDC): conducts critical science and provides health information to protect the nation against expensive and dangerous health threats, and responds when these arise.

Dietary Guidelines for Americans: published every 5 years for public health professionals and reflects the current body of nutrition science.

National School Lunch Program (NSLP): federally assisted meal program that operates in public and non-profit private schools and residential child care institutions.

Healthy Hunger Free Kids Act of 2010 (HHFKA): authorizes funding and sets policy for USDA's child nutrition programs.

The Healthy Meals for Healthy Americans Act: requires that federally-subsidized meal programs conform to the Dietary Guidelines for Americans.

United States Department of Agriculture (USDA): provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on public policy, the best available science, and effective management.

CHAPTER 2: LITERATURE REVIEW

Introduction

The importance of schools serving nutritious meals to school-aged children and adolescents is to facilitate learning and create lifelong healthy eating habits. The National School Lunch Program (NSLP) helps achieve this as a measure of national security, to safeguard the health and well-being of the Nation's children (FRAC, 2014). Being the largest food and nutrition program in the United States, NSLP nutrition guidelines are followed to ensure school-aged children are receiving the best, most updated nutrition recommendations. The NSLP includes children ages 4-18 years in school settings. Those in daycare under the age of 4 years participate in the Child and Adult Care Food Program (CACFP), which has a specific set of milk requirements. Infants are required breastmilk or formula, children 1 year of age are recommended whole or 2% milk, and children 2 and up are required low-fat or fat-free milk (DPI, 2016).

One regulation in the NSLP is that the only allowable reimbursable milk options for both breakfast and lunch are fat-free flavored or unflavored, low-fat (1%) unflavored only, or fat-free or low-fat lactose-reduced or lactose-free milk. Because of the saturated fat requirements, restricting schools to lower-fat and fat-free milks helps schools stay under the saturated fat limit and improves school-aged children and adolescents' health and wellbeing. However, there is some controversy around these guidelines: are the guidelines set by the USDA too strict in limiting fat in a child's diet by restricting schools from offering certain types of milk? Should young children who are continuing to grow and develop be limited to only low-fat and fat-free milks, or are there benefits of fuller-fat milks that should be considered?

This review of the literature analyzes the research to determine whether there is sound evidence to support the current school nutrition guidelines on milk type restrictions in terms of maintaining weight status in school-aged children and adolescents. The review looks at studies on milk fats, types of milk including flavored and plain, weight status, and milk consumption behaviors among children and adolescents.

Background

The American Heart Association (AHA) recommends adults and children over the age of two to consume lower-fat dairy products, including fortified fat-free (skim or non-fat) milk, fortified non-fat milk powder, and ½ percent and 1 percent low-fat milk. These recommendations are based on the saturated fat content in higher-fat dairy products. Saturated fats tend to raise the cholesterol level in the blood, and high blood cholesterol is a risk factor for heart disease that cannot be reversed (AHA, 2016). When discussing different milk types, it is important to analyze the nutritional content of non-fat, low-fat, and reduced-fat milk. Below are a comparison of fat-free white milk, low-fat white milk, reduced-fat white milk, and whole white milk and their nutrient profiles using the USDA's National Nutrient Database for Standard Reference.

Table 1: Nutritionals for non-fat, low-fat, reduced-fat, and whole milk

	Milk, non-fat, fluid, with added vitamin A and vitamin D, 1 cup (# 01085)	Milk, low-fat, fluid, 1% milkfat, with added vitamin A and vitamin D, 1 cup (# 01082)	Milk, reduced-fat, fluid, 2% milkfat, with added vitamin A and vitamin D, 1 cup (# 01079)	Milk, whole, 3.25% milkfat, with added Vitamin D, 1 cup (# 01077)
Calories	83 kcal	102 kcal	122 kcal	149 kcal
Total Fat	0.20g	2.37g	4.83g	7.93g
Saturated	0.14g	1.48g	3.07g	4.55g
Monounsaturated	0.05g	0.68g	1.37g	1.98g
Polyunsaturated	0.007g	0.09g	0.18g	0.48g
Sugar	12.47g	12.69g	12.35g	12.32g
Protein	8.26g	8.22g	8.05g	7.69g
Calcium	299mg	305mg	293mg	276mg
Vitamin A, IU	500IU	478IU	464IU	365IU
Vitamin D, IU	115IU	117IU	120IU	124IU

(USDA National Nutrient Database for Standard Reference, 2016)

Although the whole white milk is highest in calories, fat, and saturated fat, it contains comparable amounts of other essential nutrients as the skim white milk, the 1% white milk, and the 2% white milk including calcium and vitamin D. Whole, white milk contains the highest amounts of the essential fatty acids: monounsaturated and polyunsaturated fatty acids. There is a 66 calorie difference between whole milk and skim milk, which may or may not make a significant difference in a child or adolescent's weight status.

The Dietary Guidelines for Americans, which is released once every five years, reflects the latest body of evidence-based nutrition science. It coincides with AHA's recommendations of following a healthy eating pattern, which includes fat-free or low-fat dairy products. This serves as a tool for policymakers and health professionals that have guidelines and recommendations to help Americans eat a healthier diet (ODPHP, 2016). The recently released guidelines recommend cup-equivalencies based on age; 2-cup equivalents of dairy per day for children ages 2-3 years, 2 ½ cup-equivalents per day for

children ages 4-8 years, and 3 cup-equivalents per day for ages 9 and up. Key nutrients in dairy include calcium, phosphorus, vitamins A and D, riboflavin, vitamin B12, protein, potassium, zinc, choline, magnesium and selenium (ODPHP, 2016). When the NSLP began in 1946, higher-fat milk was allowed. Lunches were designed by Type A, Type B, and Type C. Type A lunches were set to meet one-third to one-half of the minimum nutritional requirements of a child 10-12 years of age (Gunderson, 2014). Type B lunches were devised to provide a supplementary lunch in schools where Type A lunches could not be made. Type C lunches consisted of a half pint of whole milk. Since then, The Healthy Meals for Healthy Americans Act requires that federally subsidized meal programs conform to the dietary guidelines for Americans (Ralston, 2008). There is also the Healthy Hunger-Free Kids Act of 2010, which authorizes funding and sets policy for USDA's child nutrition programs, with the ultimate goal to improve child nutrition. Because of these legislations, meal patterns in the NSLP are designed to reflect the latest nutritional guidelines. There is now more focus on whole grains, fresh fruits and vegetables, lowering sodium, limiting fat, saturated fat, and calories, and eliminating trans-fats in all products served to students. One of the main focuses is on lower-fat dairy options served to students, specifically milk. Recent evidence suggests that lower-fat dairy may not be necessary, however, as saturated fat may not be contributing to obesity, coronary heart disease, or cardiovascular disease (De Souza et al, 2016). Perhaps the milk fat restrictions in child nutrition programs are no longer warranted and elimination of them could result in increased consumption of milk.

Milk Consumption Behaviors among Children and Adolescents

Patterns of milk consumption by children and adolescents at home and at school have changed over the last several decades. According to the 2015 scientific report from the Dietary Guidelines for Americans, more than 60% of young boys and girls ages 1-3 meet or exceed the recommended intake of 2 cup equivalents per day, mainly in the form of milk (ODPHP, 2016). In older children, about 30% of boys and girls are meeting or exceeding the recommended 2.5 cup equivalents per day for those ages 4-8, and 3 cup equivalents per day for those ages 9-13 years. The report goes on to explain an age-related decline in dairy intake appearing to be in adolescents and continues to be low among adult females, and overall, 80% of the entire U.S. population does not meet the daily dairy intake recommendation (ODPHS, 2016).

A possible cause in the rise of childhood and adolescent obesity is the increased consumption of sugar-sweetened beverages (SSBs). Many of these beverages contain "empty calories", or calories that contain no nutritional value beyond energy. The Dietary Guidelines for Americans 2015-2020 recommends consuming less than 10% of calories per day from added sugars (ODPHP, 2016). Some studies consider flavored milk to be in the SSB category. With the current regulations, only skim flavored milk is allowed, to decrease the fat and calories consumed by children and adolescents with this popular menu option.

One study estimated the calories from added sugars potentially saved by healthier beverage selections at home and school, with less added sugar (Briefel et al., 2013). The hypothesis was that calories saved would be greater for SSBs than flavored milks, and that away-from-school savings would be greater than at-school savings. Data from the

School Nutrition Dietary Assessment Study (SNDA-III) was used, which was a cross-sectional sample of students in US public schools, participating in the NSLP in the school year 2004-05. The sample included 2,314 students ages 6-18 years. Of the sample, 62% participated in the NSLP and 18% participated in the SBP on a typical school day. A 24-hour dietary recall assessed the intake of calories and teaspoons of added sugar. This analysis focused on two beverage categories that provide empty calories from added sugars: SSBs (soda, fruit-flavored drinks, energy and sport drinks with added sugar, and sweetened teas and coffees) and flavored milks (including milkshakes). BMI for each child was taken and compared to the CDC growth charts. About 40% of children were classified as overweight or obese. To determine the amount of calories from beverages that could be saved, the choice of beverage was altered and replaced with a matched amount of unflavored low-fat milk, up to 1 cup. Any SSB that was consumed with a snack or non-meal was replaced with water.

SSBs accounted for an average of 159 daily calories and 9 teaspoons of added sugar for a typical day. Those consuming SSBs were mainly doing so at home rather than at school or another away location. A higher percentage of middle school students who were not overweight or obese consumed flavored milk at home compared with those who were overweight (7% versus 1%). On average, replacing SSBs and flavored milk with unflavored low-fat milk (at meals) or water (at non-meals) translated to an estimated daily savings of 205 calories per student (or 235 if they were removed). Improved beverage selections resulted in an estimated savings of 10% of total daily calories and 10.5 teaspoons of daily added sugars. This study suggests that one way to combat childhood obesity is to decrease or eliminate sugar-sweetened beverages, including

flavored milk, and provide only unflavored, low-fat milks, and water in schools and at home. This may decrease caloric intake and lower BMIs in school-aged children. This study used a 24-hour recall, which is not representative of an overall diet, and it only assessed students on a school day, not taking into account weekend beverage consumption habits. Although the data are from 2005 and regulations in school nutrition programs have changed since then, this study is a good representation of school-aged children's beverage consumption habits and patterns. It also aligns with the current guidelines of restricting schools to serving only low-fat white, skim white, or skim chocolate milk. However, this study grouped SSB's with flavored milk, which have vastly different nutrient profiles; flavored milk being a more nutritious option.

Although children are restricted to certain types of milk at school, it is important to know milk consumption behaviors at home. The National Center for Health Statistics (NCHS) examined data from the National Health and Nutrition Examination Survey (NHANES) from 2007-2008. A cross-sectional survey was conducted on low-fat milk consumption among children and adolescents in the United States. In-house surveys were conducted to present information on the frequency and types of milk consumed by youth in the US. Milk consumption among girls was lower than boys, ages 2-19 (67.4% and 77.7% respectively). Of those surveyed, 20.2% reported drinking low-fat milk, 45.4% reported drinking 2% milk, and 32.4% reported drinking whole milk. Children in the older age groups reported consuming low-fat milk more often than children in younger age groups. Of the age group 2-5, 13% reported drinking low-fat milk, of the age groups 6-11 and 12-19, 21.1% and 23.3% respectively reported drinking low-fat milk. Children in the highest income category reported drinking low-fat milk more frequently than the

low-income group. Although this data does not relate milk fat consumption and weight status, it does show milk consumption behaviors among children and adolescents in a nationally-represented data set, showing the majority of children and adolescents are drinking 2% and whole milk versus low-fat milk.

Beverages, including 100% fruit juice, soda, other sweetened drinks, and milk, are becoming a source of extra and excessive calorie intake. Dietary eating and drinking habits develop early in life, and can have long-term effects on health and wellness. One study looked at whether beverage intake at age 5 predicted adiposity from age 5 to 15 years (Fiorito et al., 2009). They predicted that sweetened beverage intake at age 5, but not milk or fruit juice intake, would be a significant and positive indicator of adiposity in childhood and adolescence. Further, they hypothesized that a higher intake of sweetened beverage at age 5 would predict higher 24-hour energy intake, adiposity, and weight status from age 5 to 15 years. All participants were young girls living in central Pennsylvania, which included 197, 5-year-old girls and their parents. Percentage of body fat and waist circumference were measured every 2 years up to the age of 15 and a final sample of 166 girls was included. At each 2-year increment, three 24-hour recalls were conducted and averaged to produce one 24-hour recall. Beverage consumption was assessed and grouped into three categories: milk, fruit juice, and sweetened beverage. Milk included whole and reduced-fat (plain or flavored) and fruit juice was 100%. Analyses assessed 1) whether girls who consumed greater than or equal to 2 servings of sweetened beverage at age 5 were more likely to be overweight compared with girls with lower intakes and 2) whether the proportion of participants who were overweight increased from age 5 to 15 years.

Only sweetened beverage intake at age 5 was a significant predictor of adiposity at each age from 5-15 years. Sweetened beverage intake at age 5 years significantly explained 9%, 7%, 9%, 5%, 3%, and 3% of the variation in the prediction of participants' percentage body fat at each time point assessed (age 5, 7, 9, 11, and 15 respectively). The proportion of girls classified as overweight increased significantly from age 5 to 15 years. The association of sweetened beverages with milk ($r = -0.20$, $P<0.01$) and sweetened beverages and fruit juice ($r = -0.19$, $P<0.05$) intake was negative, whereas milk and fruit juice were not significantly associated. Girls with parents of lower income drank greater than or equal to 2 servings of SSB. Also, fathers of girls drinking greater than or equal to 2 servings daily of sweetened beverages had significantly higher BMI's than fathers of girls consuming less than or equal to one serving daily at age 5 ($P<0.05$). This study showed neither milk nor fruit juice intake were related to girls' adiposity or weight status, but sweetened beverages consumed at age 5 years did. This suggests early consumption of sweetened beverages, and not milk or fruit juice, predicted higher adiposity during childhood and adolescence. However, within this small sample size, only one gender was represented and all participants were from central Pennsylvania, which is not nationally-representative of the US population. Intake of water was also not assessed and specific servings of milk per day were not measured. Data was self-reported, which may result in misclassification, however this longitudinal study had a high number of measurements over a 10 year period. The results showed those that consumed more servings of sweetened beverages at age 5 had parents with lower incomes, levels of education, and higher paternal BMI's. Although this study focused mainly on sweetened beverages, it indicated that the overweight and obesity issue may be due to the high fructose levels in

sweetened beverages and not milk and 100% fruit juice consumption. Therefore, the current guidelines that restrict milks above 1% may not be necessary.

Flavored Milk versus Plain Milk Consumption

Both plain milk and flavored milk are among the options at breakfast and lunch in schools. Because flavored milk, like chocolate, is a popular choice among school-aged children, there is a concern for added sugars and weight gain. A significant relationship has been shown between added sugar consumption and increased risk for cardiovascular mortality (Yang et al., 2014). Do the benefits of flavored milk, including nutrients similar to unflavored milk, outweigh the negative effects, like weight gain and risk for CVD mortality? One review looked at studies analyzing the effect of flavored milk versus plain milk on total milk intake and nutrient provision among children (Fayet-Moore, 2015). This review suggested that availability of flavored milk at school may drive its consumption. Families that bought chocolate milk had increased overall milk consumption than those that bought only plain milk, adding calories to the diet. They noted in another study that children had similar likings of chocolate milk and plain milk, but that they consumed chocolate milk for longer periods of time, bringing to light the question of plain milk or flavored milk and weight gain. However, through the review of literature they concluded that flavored milk is still a viable option as it is low-cost and provides children with their nutrient and calcium needs in a vital time of growth and development.

Yon et al., 2012 compared school-children's acceptance of the fat-free flavored milk after the updated 2011 regulations to the school meal patterns. This rule mandated that schools serve only low-fat white, skim white, or skim chocolate milk at breakfast and

lunch. They hypothesized that lower-calorie flavored milk (< 150 kcal) consumption would be the same as the higher-calorie flavored milk (> 150 kcal). A sample of four diverse public school districts was used with different geographical locations around the United States. They were enrolled in a quasi-experimental plate waste study. Four other districts were used as the controls in which they offered standard flavored milk (160-170 kcal/8oz, 1% milk fat, 25-27g sugar). The reformulated schools (n=4) served fat-free or 1% white milk (150kcal/8oz, 22-27g sugar).

A total of 798 containers of flavored milk were collected from grades 3-5 and 793 cartons were used for testing. Of these, 67 were unopened. Comparing the control to the experimental group, more were unopened in the experimental (12.5%) than the control (6%). Two schools within the control group required all students to take all meal components including the milk, whereas the other schools did not require that all meals served include milk. Those in the experimental group (n=296) consumed an average of 4.92oz whereas those in the control group consuming the standard, higher-fat milk (n=497) had an average milk intake of 5.88oz. This suggests that the there is more likeability with the higher-fat, higher-sugar milks. The cafeteria environment was a factor in milk consumption, since consumption decreased as the milk temperature increased. After accounting for age, sex, and geographical location, children drinking the lower-calorie flavored milk were as likely to consume above 7oz of milk as those drinking the standard milk (p=0.29).

Limitations in this study include the sample not being nationally representative of all school children in the US and some of the schools used Offer Versus Serve and others did not. Offer Versus Serve is a structure in the NSLP and SBP that allows students the

ability to decline some of the food offered. The hope is to reduce food waste and provide autonomy to students. This study does show a good representation of the amount of flavored milk consumed by a sample of elementary students. It also provides some insight into reformulating products and acceptance by students. Because there was slightly more likeability with the higher-fat milk, there may be more of these types consumed, which adds calories to the diet, but also beneficial nutrients like calcium, vitamin D, and protein. Because overweight and obesity is a concern, the current guidelines restricting these kinds of milks in the NSLP and SBP may be justified as a means of obesity prevention.

Milk Consumption and Weight Status

With obesity becoming a greater issue among young children, guidelines recommend lower-fat and fat-free products to reduce the prevalence of weight gain. According to the Centers for Disease Control and Prevention (CDC), Body Mass Index (BMI) is used to determine overweight and obesity in children and adolescents. The CDC defines the following percentiles: less than the 5th percentile as underweight, the 5th to the 85th percentile as normal weight, the 85th to the 95th percentile as overweight, and above the 95th percentile considered obese. Although BMI does not measure body fat directly, it is correlated with the most direct measure of body fat (CDC, 2015).

One longitudinal study evaluated types of milk consumed and its effect on weight status in preschoolers. Scharf and DeBoer (2013) predicted that consumption of low-fat milk was associated with a lower BMI and less weight gain over time. The sample size included 14,000 randomly sampled birth certificates. Longitudinal examinations were conducted at 9 months, and 2, 4, and 5 years. Data from the 2 and 4 year olds only were

used and parents completed computer-assisted interviews. Questions at age 2 years included types of milk their child consumed; whole milk, 2%, 1%, skim, soy, or other. Questions at 4 years included more detailed information like frequency, types of milk, use of a glass or a cup, carton or with cereal. Height and weight measurements were obtained twice and categorized to mirror CDC growth charts. Cross-sectional and longitudinal analyses were conducted on the 2 and 4 year old BMI z-scores on milk type categories. Researchers chose 2 and 4 year olds who reported consuming 1%/skim and 2 year olds and 4 year olds who reported 2%/whole milk. Of the included sample size, 7,900 at 4 years had complete information and were milk drinkers and 7,450 at 2 years had complete information and were milk drinkers.

Overweight and obesity were prevalent with both groups (30.1% in 2 year olds, 32.2% in 4 year olds). Consumption of 1%/skim milk was higher among overweight and obese children (14% in 2 year olds, 16% in 4 year olds) versus normal weight (9% in 2 year olds, 13% in 4 year olds; $p<0.01$) at both years. Mean BMI z-scores varied significantly across milk types with lower among 2%/whole milk drinkers compared to 1%/skim, which was consistent with both age groups and socioeconomic status. Consumption of higher-fat content in milk was associated with lower BMI z-score ($p<0.0001$). Preschoolers drinking 1%/skim versus 2%/whole had higher odds of being overweight or obese. Children with higher BMI's, who drank 1%/skim, at both ages were more at risk for being overweight or obese than those drinking 2%/whole. However, there was no significant difference between lower-fat and higher-fat milk drinkers in change in BMI over time ($p=0.06$). Children who were not overweight or obese at baseline who drank 1%/skim were more likely to be overweight or obese between ages 2-4 years. This

study suggests that lower-fat milk consumption does not necessarily maintain weight status over time nor does high-fat milk consumption contribute to weight gain. Limitations include: other food consumption was not taken into consideration, data were self-reported by parents, and no physical activity was recorded. Because this study included ages where transitioning to a lower-fat milk is common, there are possibilities of misclassification. The large sample size and nationally-representative population are strengths of this study. The findings do not support the guidelines or rationales set by the USDA, but do support the consumption of full-fat milks among children. This study only assessed 2-4 year olds, suggesting that maybe this is the age range that requires higher-fat milks.

Another study explored the association between milk fat percentage and both BMI z-score and venous 25-hydroxyvitamin D [25(OH)D] (Vanderhout et al., 2016). Secondly, they assessed whether milk volume consumption altered this relation. This cross-sectional study included 5,301 children ages 1-6 years from The Applied Research Group for Kids (TARGet Kids!) collaboration in Toronto, Canada; spanning September 2008 to August 2014. Of those recruited, 2,745 children were included in the final sample. Exclusions included: growth-altering disorders like failure to thrive; chronic conditions like asthma; or substantial developmental impairments. Parents answered questions about their child and anthropometrics were taken as well as the collection of venous blood. The primary exposure was the percentage of milk fat consumed and was measured as a continuous variable. Consumption of milk (skim, 1%, 2%, or whole) over the past three days was assessed and mean taken for those consuming more than one type of milk. Confounding variables included age, sex, vitamin D supplementation, minutes

per day of outdoor free play and screen time, daily consumption of milk volume (in 250 ml cups), maternal BMI, skin pigmentation, after-tax median neighborhood family income, maternal ethnicity, and date of serum collection. Multivariable linear regression was used as the statistical analysis.

The mean age of participants was 2.8 years; 53% of which were boys and 47% girls. Milk percentage was averaged for those consuming more than one kind of milk (n=122). Of those included, 21% were overweight and 5% were obese. Serum vitamin D levels were <75 nmol/L in 38% of participants and <50 nmol/L in 5.9%. There was a positive relation between milk fat percentage and 25(OH)D (P=0.006) and a negative relation between milk-fat percentage and BMI z-score (P<0.001). Median 25(OH)D was 1.67 nmol/L (95% CI: 1.01, 3.05) higher with every 1% increase in milk fat consumption. The average child who drank whole milk had a median 25(OH)D concentration of 5.43 nmol/L (95% CI: 4.32, 6.54) higher than a child who drank 1%. Children had a 2.25-fold lower odds (95% CI: 1.28, 3.99) of 25(OH)D <50 nmol/L if they drank whole milk compared to those who drank 1%. Higher volumes of milk consumption and vitamin D supplementation taken daily both positively related to 25(OH)D concentrations (P=0.0001). A 0.22 (95% CI: 0.18, 0.26) lower BMI z-score was associated with each 1% higher milk fat consumption. Those who drank whole milk had a 2.43-fold (95% CI: 1.69, 3.49) lower odds of overweight and had 3.21-fold (95% CI: 1.76, 5.88) lower odds of obesity than participants who drank 1% milk. Children who consumed 1 cup of whole milk had a 25(OH)D that was comparable to those who consumed 2.9 cups of 1% milk daily (95% CI: 2.85, 3.04) but had a BMI z-score of 0.79 U (95% CI: 0.64, 0.94 U) lower. Whole milk drinkers had higher mean vitamin D levels than 1% milk drinkers,

which was a similar change in serum vitamin D that equates to about 1 cup per day. Whole milk drinkers had lower BMI z-scores than 1% milk drinkers.

Recommendations to consume 2 servings per day of low-fat milk may be decreasing vitamin D concentrations and increasing adiposity in children. Because vitamin D is a fat-soluble vitamin, lower-fat milks may be contributing to its decreased absorption. The heightened satiety with whole milk may decrease the caloric intake of other foods, while low-fat milks may increase the caloric intake of other foods. One thing to note is the classification of milk drinkers may be due to overweight children transitioning to lower-fat milks to control weight gain. This study included a broad, healthy, culturally diverse, large population of children with data on milk consumption, serum vitamin D levels, and adiposity. Limitations of this study include the cross-sectional design, where causality and direction cannot be established between exposure and outcomes. Also, other sources of vitamin D were not accounted for. The authors concluded that children may benefit from higher-fat milks for healthy serum vitamin D levels and adiposity.

Metabolic Syndrome

Metabolic syndrome has previously been seen only in adults, but with today's overweight and obesity problems occurring younger, it is commonly seen in children and adolescents. According to the International Diabetes Federation (IDF), metabolic syndrome can be diagnosed with abdominal obesity and two or more of the following clinical features: elevated triglycerides, low HDL-cholesterol, high blood pressure, and increased plasma (IDF, 2007). This definition only applies to children ages 10-16, as metabolic syndrome should not be diagnosed in anyone younger due to insufficient data

and those older than 16 should use adult criteria (IDF, 2007). These risks can all be controlled with diet, exercise and an overall healthy lifestyle. The 2015-2020 Dietary Guidelines for Americans has specific dietary recommendations to prevent obesity among children and adolescents (USDA, 2015). However, each food group has different effects on the body whether it is satiety, health impact, energy content, or volumetric differences. These factors may influence weight status among children and adolescents.

One study using the 1988-1994 NHANES data explored the relationship between mean food group intake and anthropometric measures of central obesity in children (aged 5–11 years) and adolescents (aged 12–16 years) (Bradlee et al., 2009). The final sample size of 3,761 children aged 5–11 years and 1,803 adolescents aged 12-16 years was assessed using a 24-hour dietary recall and analyzed for nutrient composition. Waist circumference and skinfold thickness measurements were taken to assess weight status.

Among 12- to 16-year-old male and female adolescents, intakes of dairy were inversely associated with both measures of body fat. Those with the lowest waist circumference consumed half a serving more of dairy daily than those with the highest waist circumference ($p<0.01$ for boys, $p<0.015$ for girls). Adolescents with central obesity consumed less dairy and had lower intakes of total fruit and vegetables ($P=0.0002$, $P=0.0001$). The majority of the dairy consumed was in the form of milk. Both milk ($P=0.004$) and cheese intakes ($P=0.020$) were inversely associated with central obesity in NHANES III while only the association with milk consumption was significantly different ($P=0.0008$). In their observations, overweight children and adolescents more often consumed low-fat dairy products than those who were of normal weight. The results suggest intake of dairy and grains, as well as fruit and vegetables may

be associated with lower levels of central body fat particularly among adolescents. This study may also suggest that higher levels of dairy intake are associated with lower levels of body fat, and that those consuming lower-fat milks had higher body fat percentages. However, because this is a cross-sectional study using a 24-hour recall to assess diet, these findings cannot make causal associations. This study had a large sample size that was nationally representative. It analyzed the five food groups (fruit, vegetables, meat, grain, and dairy), which mirrors the five components used in the NSLP. At the time of data collection, the USDA modeled dietary patterns using the food pyramid (USDA, 1992) whereas now they have adopted MyPlate (USDA, 2016) to visually show recommended eating patterns. This study did not specify which milk types were consumed. The results of this study suggest that more dairy consumption yields appropriate weight status in children, which justifies the current guidelines to offer 1 cup of milk daily with both the NSLP and SBP. This study was a good overall representation of dietary patterns among children and adolescents and sets up future studies to further examine specific food groups.

Another study determined whether the quantity and type of milk (whole, reduced fat or 1%/non-fat) consumed at age 2 years is associated with adiposity at age 3 years (Huh et al., 2010). From April 1999 to July 2002, participants were enrolled in Project Viva, a longitudinal pre-birth cohort in the Boston, MA area. Recruitment was conducted at eight obstetric practices within Harvard Vanguard Medical Associates. Milk and dairy intake were assessed at age 2 years with food frequency questionnaires completed by mothers. Primary outcomes were BMI z-score and overweight at age 3 years.

At age 2 years, mean milk intake was 2.6 servings per day. A higher intake of whole milk at age 2, but not reduced-fat milk, was associated with a slightly lower BMI z-score (0.09 unit per daily serving [95% confidence interval: 0.16 to 0.01]) at age 3 years; when restricted to children with a normal BMI (5th to 85th percentile) at age 2 years, the association was null (0.05 unit per daily serving [95% confidence interval: 0.13 to 0.02]). Intake of milk at age 2 years, whether full-fat or reduced-fat, was not associated with risk of incident overweight at age 3 years. Neither total milk nor total dairy intake at age 2 years were associated with BMI z-score or incident overweight at age 3 years. Neither consuming more dairy products, nor switching from whole milk to reduced-fat milk at age 2 years, appears likely to prevent overweight in early childhood.

These findings suggest that a higher intake of milk, whether full or reduced-fat, is unlikely to prevent the development of obesity among preschool-aged children. This study provided prospective dietary data collection and detailed information regarding potential biological, social, and environmental confounders. There may have been misclassification from using a single estimate of intake during a 1-month period at age 2 years. Self-reported data by the mother may have resulted in misclassification of intake as well as possible underreporting of energy intake by mothers of overweight children. Milk intake, however, may offer other health benefits, including provision of calcium, vitamin D, and other nutrients (Huh et al., 2010).

Bigornia et al. (2014) determined the effects of total and full- and reduced-fat dairy intake in children at 10 years of age on risk of excess total body fat mass (TBFM) and overweight at age 13 years. Those eligible to participate were pregnant mothers with expected due dates between April 1991 and December 1992, residing in southwest

England. Of those eligible, 14,541 enrolled. From the children that were born and included, n=2455, anthropometric measurements were taken at ages 10, 11, and 13. A 3-day dietary recall was completed before both the 10 year and 13 year visit. Included in the dietary recall were dairy products, categorized as white milk (cow, sheep, and goat), flavored milk, cheese, yogurt, ice cream, and other desserts like pudding. They were then grouped based on their fat content; full-fat or reduced-fat. The outcomes of this study were overweight and excess fat mass at age 13 years. Of the participants, 20.7% were overweight at age 10 years and 19.7% were overweight at 13 years. Three different dietary exposures were tested: intakes of total and full- and reduced-fat dairy. There was a low prevalence of reduced-fat consumption, therefore those in the bottom 36% of reduced-fat dairy intake were categorized in the lowest category (C1). All others were grouped in C2, C3, or C4.

At baseline, or 10 years of age, mean BMI and prevalence of overweight were similar across dairy-intake categories. Interestingly, of those in the reduced-fat category, 25% reported dieting at age 13. However, those dieting decreased with increased intakes of total and full-fat dairy. Perhaps parents turn to reduced-fat dairy as a means to slow their child's weight gain. Children in the top category for total dairy intake compared to those in the bottom category had a 33% lower risk for excess fat mass (P=0.10). Children in the top category for full-fat dairy compared to those in the bottom category had a 37% lower risk of excess fat mass at the age of 13 (p=0.03). Children who consumed the most dairy tended to have smaller increases in BMI compared to those who consumed the least amount of dairy (P<0.1). There was statistical significance for smaller increases in BMI among those with higher consumption of total dairy (P<0.05).

The results of this study show that total and full- and reduced-fat dairy intake during childhood and preadolescence was not associated with excess fat accumulation during adolescence. Although many of the results do not reach statistical significance, they did show trends related to lower gains in BMI with higher intakes of fuller-fat dairy. Strengths of this study include a large sample size and longitudinal data reflecting childhood and adolescence, which are the life stages related to the age/grade groups in the NSLP. This study also collected data on physical activity, which is an important consideration when discussing weight status. However, it did not include dairy from mixed dishes like cheese on pizza. This study brings up the topic of weight maintenance in children. Is it appropriate to switch to lower-fat dairy products in hopes of reducing a child's weight, or do other routes need to be considered first, like physical activity and overall diet quality? Because higher dairy consumption did not affect weight status in this study, perhaps the regulations restricting certain types of milk fats in child nutrition programs are not warranted.

In a study with Spanish girls and boys, the impact of beverage consumption pattern on diet quality and anthropometric measures for abdominal adiposity were assessed (Schroder et al, 2014). Participants were a part of the enKid study, which discussed nutritional status and food habits, conducted between 1998 and 2000. Individual caloric beverages were put in three groups according to their energy value and nutrient properties: (a) 100% juice, including commercial and natural fruit and vegetable juice; (b) low-fat milk, including skim, and reduced-fat (2 %) milk; (c) whole-fat milk (4 % fat); and (d) soft drinks, including carbonated and non-carbonated sugar sweetened

beverages (SSB). Dietary assessment was conducted using a 24-hour recall. Height, weight, and waist circumference were measured.

Of the 3,534 adolescents aged 10-18 years, 1,149 were included in the final sample. For boys there were whole-fat milk (4% fat), low-fat milk (skim and reduced-fat milk) and "soft drinks" clusters. For girls there were whole-fat milk, low-fat milk and juice clusters. For boys, the average intake in the whole-fat milk cluster was 301 ml/day, the low-fat milk cluster was 357 ml/day, and the soft drink cluster was 530 ml/day. For girls in the whole-fat milk cluster the average intake was 244 ml/day, in the low-fat milk cluster was 321 ml/day, and in the juice cluster was 248 ml/day. Boys from the soft drinks cluster had the highest amount of energy intake and girls in the juice cluster had the highest energy intake compared to the other clusters. Waist circumference was 74cm, 75.6cm, and 76.6cm for the boy's whole-fat milk cluster, low-fat milk cluster, and soft drinks cluster respectively; those in the soft drinks cluster having the largest. Waist circumference was 68.7cm, 69cm, and 68.5cm for girls in the whole-fat milk cluster, low-fat milk cluster, and juice cluster respectively; those in the low-fat milk cluster having the highest. BMI was similar amongst the boy clusters showing 21.1, 21.9, and 21.9 for the whole-fat milk, low-fat milk, and soft drinks respectively. BMI was similar amongst the girl clusters showing 20.6, 20.8, and 20.6 for the whole-fat milk, low-fat milk, and juice respectively. The findings in this study show boys in the soft drinks cluster had an increased risk of higher BMI z-scores, WC and waist to hip ratio in comparison to those in the whole-milk cluster. Boys in the whole-fat milk cluster had a lower mean weight than those in the low-fat milk and the soft drink cluster (57.2kg; 59.8kg; and 61.7 kg respectively). Girls in the whole-fat milk cluster had a lower mean weight than those in

the low-fat milk cluster (52.8kg and 54.1kg respectively), but not the juice cluster (52.5kg). This study showed beverage consumption behaviors amongst adolescents. However, it was a cross-sectional study and cannot show causal relationships. It also grouped skim milk with low-fat milk, which is not consistent with how they are grouped in the United States and NSLP. It used one 24-hour recall, which is not a full reflection of one's overall diet. This study showed lower weights for those in the whole-milk category versus those in the low-fat category, suggesting that intake of whole-fat milk may not be associated with weight status.

Another study by Lin et al (2012) examined the association of milk or other dairy product consumption with adolescent obesity. Participants were from the Hong Kong "Children of 1997" birth cohort from April 1st, 1997 to May 31st, 1997. Primary exposures included frequency of non-milk dairy product consumption and milk consumption frequency at around 11 years. The primary outcome was adiposity at around 13 years. Questions on activity level, developmental progress, as well as a food frequency questionnaire were included in a survey.

Of the 8,327 participants, 3,679 were included in the final sample. Only 65.7% regularly consumed milk and 72.4% consumed other dairy products. Milk and other dairy product consumption was positively associated with socioeconomic status, but not BMI z-score or waist to hip ratio (WHR), with or without adjustment for sex, mother's birthplace, parental education, physical activity and other food consumption. Neither non-milk dairy products nor milk consumption at 11 years was associated with BMI z-score at about 13 years. Of those who reported waist and hip circumference, neither non-milk dairy products nor milk consumption at about 11 years was associated with WHR.

This study showed a lack of association between milk and other dairy product consumption and adiposity in adolescents. Waist and hip circumference were self-reported by participants, which may lead to missclassification. This study viewed milk consumption in the last week, which may not be a full reflection of dietary habits. It also did not specify the types of milk, milk fat percentages, dairy, or dairy fat percentages, which makes it difficult to assess the relationship between milk fat types and adiposity.

Nutrient Intake and Milk Consumption

Because milk is a source of essential nutrients required for growth and development, it is highly encouraged that school-aged children consume this instead of other sugar-sweetened beverages. But are flavored milks, with their added sugars, contributing to the weight gain of children and adolescents? One study compared the nutrient intakes of children and adolescents consuming flavored milk, those drinking only plain milk, and those drinking little or no milk. BMI was then compared to milk drinking statuses (Murphy, 2008). Data collected were from the 1999-2000 and 2001-2002 NHANES. A total of 8,603 children and adolescents, aged 2-18 years were interviewed and a 24-hour recall completed. Participants were grouped according to their age as well as type of milk regularly consumed. This research was conducted to determine if those who included flavored milk in their diets as having an intake of different nutrients or BMI measurements compared to those drinking only plain or no milk. Of the original sample size, 7,557 dietary recalls were collected from children and adolescents. Of the final sample size, 1,265 were categorized as flavored milk drinkers, 3,705 as plain milk drinkers, and 2,587 as non-milk-drinkers. More than 95% of those that classified themselves as flavored milk drinkers reported drinking over a half cup or more on the day

of recall and 92% of those that classified as plain milk drinkers reported drinking at least a ½ cup. Those that drank milk consumed significantly greater calories than non-milk drinkers for all groups except boys aged 6-11 years. Surprisingly, non-milk drinkers aged 2-5 years had higher-fat intakes than milk drinkers and those not drinking milk in the 12-18 category had higher-fat intakes than plain milk drinkers only. Not surprisingly, milk drinkers had higher saturated fat intake than non-milk drinkers. Milk drinkers had significantly higher intakes of calcium, phosphorus, magnesium, potassium, and vitamin A than non-milk drinkers. Also, calcium intakes were greater for flavored milk drinkers than plain milk drinkers. There were no differences in BMI except for males aged 12-18 where non-drinkers had higher BMIs than milk drinkers. This was also true for females, where non-milk drinkers had higher BMIs than plain milk drinkers. In conclusion, flavored as well as plain milk drinkers had similar nutrient intakes and only those that consumed milk were close to reaching the recommended dietary intake for calcium. There was no significant difference in energy intakes between the three milk categories. Nutrient intakes were highest among flavored milk drinkers, suggesting that this is a viable way to ensure children and adolescents receive the nutrition they need in terms of magnesium, phosphorus, vitamin A, potassium, and calcium. It is also worth mentioning that total milk consumption was highest among flavored milk drinkers, perhaps replacing or lowering the total amount of intake of other sugar-sweetened beverages. The consumption of flavored or plain milk has positive influences on nutrient intakes of children and adolescents and should continue to be offered as part of a reimbursable meal.

Summary and Conclusions

Most studies showed no association between weight status and milk fat consumption, rather, there may be an association between SSBs and weight status or overall diet quality and weight status. Some studies showed no change in weight status among children and adolescents when consuming higher-fat milks versus consuming lower-fat milks. Others indicated that the overweight and obesity issue may be due to sweetened beverages and not milk and 100% fruit juice consumption. However, perhaps an overall quality diet contributes to the appropriate weight status for children and adolescents in some of these studies. Therefore, the current guidelines that restrict milks above 1% may not be necessary.

Data on milk consumption behaviors among children and adolescents showed the majority to be 2% and whole milk drinkers versus low-fat and non-fat milk drinkers. Children had similar likings of chocolate milk and plain milk, but consumed chocolate milk for longer periods of time. Perhaps this is another reason why low-fat and fat-free milk options are the only allowable milk types; to try and decrease the caloric intake while at school. However, through the review of literature, flavored milk is still considered a viable option as it is low-cost and provides children with their nutrient and calcium needs in a vital time of growth and development.

Other areas of consideration include restricting certain types of milk based on age and grade groups. Perhaps younger children who are continuing to grow and develop require higher-fat milk and perhaps lower-fat milks are appropriate for older adolescents whose metabolisms are slowing down. More research needs to be conducted on age-specific groups and milk fat consumption as well as the effects of saturated fat intake.

Because milk is a source of essential nutrients required for growth and development, it is highly encouraged that school-aged children consume this instead of other sugar-sweetened beverages. The consumption of flavored or plain milk has positive influences on nutrient intakes of children and adolescents and should continue to be offered as part of a reimbursable meal. Because some of the studies showed positive relationships between full-fat dairy and weight status, perhaps full-fat dairy provide benefits to children and adolescents. Therefore, the restrictions on milk types as well as dairy fat percentages may not be warranted. As Ralston et al. put it: one of the main goals of NSLP is to promote the health and well-being of the Nation's children (2008). However, creating guidelines and regulations within the USDA and NSLP for school meals that contribute to the well-being of school children across the country must be evidence-based. It remains to be seen whether restricting milk fat is beneficial for managing weight and risk for chronic disease in children.

CHAPTER 3: METHODS

The Academy of Nutrition and Dietetics' Evidence Analysis Library (EAL) is a synthesis of the best, most relevant nutritional research on important dietetic practice questions housed within an accessible, online, and user-friendly website. The EAL provides bibliographies, conclusion statements, grades, evidence summaries, worksheets and also includes recommendations, recommendation strength and narrative, algorithms, and links to evidence. The EAL enhances the credibility of the dietetics practice, allowing the field to remain competitive and be more effective and efficient in practice (Academy of Nutrition and Dietetics, 2016). The EAL process follows five steps: 1) Formulate the Evidence Analysis Question, 2) Gather and Classify Evidence, 3) Critically Appraise Each Article, 4) Summarize the Evidence and, 5) Write and Grade the Conclusion Statement (andeal.org, 2016). These steps are described below.

Step One: Formulate the Evidence Analysis Question

This step focuses on a specific question in a defined area of practice and identifies links between factors and outcomes. In this case, do milk fat types have an effect on weight status in children and adolescents? Specifically, I am focusing on the milk component of the school nutrition programs and reviewing the evidence on milk fats to determine if the current guidelines are justifiable in restricting students to only fat-free and low-fat milk. To formulate my specific research question I utilized the PICO format, or the population, intervention, comparison, and outcome format (researchguides.uic.edu, 2016).

Table 2: Evidence Analysis Question using PICO FORMAT

Population (P): Patient or Problem	children, adolescents, and young adults between the ages of 2 and 18
Intervention (I): Cause, treatment, or prognostic factor.	2%, or whole milk consumption
Comparison Intervention (C), if necessary	low-fat, fat-free milk
Outcomes (O)	weight status, overall health

Step Two: Gather and Classify the Evidence

This step involves developing a search plan to conduct a detailed literature search. The inclusion and exclusion criteria are defined as well as key terms and outcomes necessary to conduct a comprehensive search. While gathering and classifying the research, it is important to find evidence that relates to the research question. Classification by differentiating between primary and secondary reports and organizing them into classes A, B, C, D, M, R, and X (Academy of Nutrition and Dietetics Evidence Analysis Library, 2012). Articles found to be appropriate will be included for further evaluation or excluded along with the reason for it.

Table 3: Hierarchy and Classification of Studies

(Academy of Nutrition and Dietetics Evidence Analysis Library, 2012)

Primary Reports		Secondary Reports	
A	Randomized Controlled Trial Cluster Randomized Trial Randomized Crossover Trial	M	Meta-analysis or Systematic review Decision analysis Cost-benefit analysis Cost-effectiveness study
B	Prospective Cohort Study Retrospective Cohort Study		
C	Non-Randomized Controlled Trial Non-Randomized Crossover Trial Case-Control Study Time Series Study Diagnostic, Validity or Reliability Study	R	Narrative review (Review article) Consensus statement Consensus report
D	Non-Controlled Trial Case Study or Case Series Other Descriptive Study Cross-Sectional Study Trend Study Before-After Study	X	Medical opinion

Search Plan & Results

Question:

1. Should preschoolers and school-aged children consume low-fat and fat-free dairy products rather than full-fat?
2. Are the current guidelines set by the USDA valid in restricting schools participating in child nutrition programs to only fat-free and low-fat milk for controlling weight status?

Date of Literature Review: July 2016

Inclusion Criteria:

- Participant Age: children, adolescents, and young adults between the ages of 2 and 18 years
- Setting: school, cafeteria, or home environment
- Nutrition-Related Problem: underweight, normal weight, overweight, or obesity status relating to consumption of different types of milk fat; studies involving cow's milk.
- Study Design: include all study designs
- Size of Study: any study with > 10 individuals
- Year Range: 2000-2016
- Languages: English

Exclusion Criteria:

- Participant Age: less than 2 years of age and greater than 18 years of age

- Nutrition-Related Problem: health issues not related to milk consumption; other types of milk including lactose-free milk, almond milk, soy milk, rice milk, or goat's milk.
- Languages: languages that are not English.
- Size of Study Groups: any study with < 10 individuals
- Year Range: prior to 2000

Search Terms: milk types, milk consumption, milk fat, flavored, school-aged children, obesity, and overweight.

Electronic Databases:

- Database Used: PubMed
- Search Terms:
  - ((((milk consumption) AND milk fat) AND children) AND adolescents) AND weight status
  - ((Milk Intake and Adiposity)) AND (Children and Adolescents)
- Hits: 25
- Total Articles to Review: 9

List of Articles Included from Database:

Bradlee, M., Singer, M., Qureshi, M., & Moore, L. (2009). Food group intake and central obesity among children and adolescents in the Third National Health and Nutrition Examination Survey (NHANES III). *Public Health Nutr.*, *13*(06), 797-805.

Bigornia, S., LaValley, M., Moore, L., Northstone, K., Emmett, P., Ness, A., & Newby, P. (2014). Dairy Intakes at Age 10 Years Do Not Adversely Affect Risk of Excess Adiposity at 13 Years. *Journal of Nutrition*, *144*(7), 1081-1090.

Fiorito, L., Marini, M., Francis, L., Smiciklas-Wright, H., & Birch, L. (2009). Beverage intake of girls at age 5 y predicts adiposity and weight status in childhood and adolescence. *American Journal of Clinical Nutrition*, *90*(4), 935-942.

Huh, S., Rifas-Shiman, S., Rich-Edwards, J., Taveras, E., Gillman, M. (2010). Prospective Association Between Milk Intake and Adiposity in Preschool-Aged Children. *Journal of the American Dietetic Association, 110*(4), 563-570.

Lin SL, Tarrant M, Hui LL, Kwok MK, Lam TH, et al. (2012). The Role of Dairy Products and Milk in Adolescent Obesity: Evidence from Hong Kong's ''Children of 1997'' Birth Cohort. *PLoS ONE 7*(12): e52575.

Murphy, M., Douglass, J., Johnson, R., & Spence, L. (2008). Drinking Flavored or Plain Milk Is Positively Associated with Nutrient Intake and Is Not Associated with Adverse Effects on Weight Status in US Children and Adolescents. *Journal Of The American Dietetic Association, 108*(4), 631-639.

Scharf, R., Demmer, R., & DeBoer, M. (2013). Longitudinal evaluation of milk type consumed and weight status in preschoolers. *Archives of Disease in Childhood, 98*(5), 335-340.

Schroder, H., Mendez, M., Ribas, L., Funtikova, A., Gomez, S., Fito, M., and Serra-Maiem, L. (2014). Caloric beverage drinking patterns are differentially associated with diet quality and adiposity among Spanish girls and boys. *European Journal of Pediatrics, 173*(9), 1169-1177.

Vanderhout, S., Birken, C., Parkin, P., Lebovic, G., Chen, Y., O'Connor, D., and Maguire, J. (2016). Relation between milk-fat percentage, vitamin D, and BMI z score in early childhood. *American Journal of Clinical Nutrition, 104*(5), 1-8. http://dx.doi.org/10.3945/ajcn.116.139675

Articles Excluded with Reason

Ali, H., Ng, S., Zaghloul, S., Harrison, G., Qazaq, H., El Sadig, M., & Yeatts, K. (2013). High proportion of 6 to 18-year-old children and adolescents in the United Arab Emirates are not meeting dietary recommendations. *Nutrition Research, 33*(6), 447-456.

- Analyzed energy intake.

Briefel, R., Wilson, A., Cabili, C., & Hedley Dodd, A. (2013). Reducing Calories and Added Sugars by Improving Children's Beverage Choices. *Journal Of The Academy Of Nutrition And Dietetics, 113*(2), 269-275.

- Analyzed SSBs and not milk fats.

Dodd, A., Briefel, R., Cabili, C., Wilson, A., & Crepinsek, M. (2013). Disparities in Consumption of Sugar-Sweetened and Other Beverages by Race/Ethnicity and Obesity Status among United States Schoolchildren. *Journal of Nutrition Education And Behavior, 45*(3), 240-249.

- Analyzed SSBs.

Dror, D. K. (2014). Dairy consumption and pre-school, school-age and adolescent obesity in developed countries: a systematic review and meta-analysis. *Obesity Reviews,15*(6), 516-527.

- Not primary research.

Fayet-Moore, F. (2015). Effect of flavored milk vs plain milk on total milk intake and nutrient provision in children. *Nutr Rec, 74*(1), 1-17.

- Analyzed intake of flavored milk versus plain milk.

Hendrie, G. & Riley, M. (2013). Performance of Short Food Questions to Assess Aspects of the Dietary Intake of Australian Children. *Nutrients*, *5*(12), 4822-4835.

- Assessed tools used to measure consumption, not the consumption itself.

Mark, S. (2010). Vitamin D status and recommendations to improve vitamin D status in Canadian youth. *Appl. Physiol. Nutr. Metab., 35*(5), 718-718.

- Assessed vitamin D status and not milk consumption.

Noel, S., Ness, A.,Northstone, K., Emmett, P., Newby, P. (2011). Milk Intakes Are Not Associated with Percent Body Fat in Children from Ages 10 to 13 Years. *Journal of Nutrition, 141*(11), 2035-2041.

- Same data used as the Bigornia et al study.

Perrin, E., Jacobson Vann, J., Benjamin, J., Skinner, A., Wegner, S., & Ammerman, A. (2010). Use of a Pediatrician Toolkit to Address Parental Perception of Children's Weight Status, Nutrition, and Activity Behaviors. *Academic Pediatrics*, *10*(4), 274-281.

- Assessed parents' perceptions of their child's weight status and not milk consumption.

O'Neil, C., Nicklas, T., & Kleinman, R. (2010). Relationship Between 100% Juice Consumption and Nutrient Intake and Weight of Adolescents. *American Journal of Health Promotion, 24*(4), 231-237.

- Assessed juice intake and not milk.

Zhai, F., Wang, H., Du, S., He, Y., Wang, Z., Ge, K., & Popkin, B. (2009). Prospective study on nutrition transition in China. *Nutrition Reviews*, *67*, S56-S61.

- Assessed the effects of social and economic transitions on childhood nutrition in China.

Provost-Craig, M., Walczak, S., & Hall, S. (2006). Comparison of Two and Three Component Body Composition Measurements and Bone Mineral Density of Female Figure Skaters. *Medicine & Science in Sports & Exercise, 38*(Supplement), S312.

- Assessed a specific group of people that was not nationally-representative of the child, adolescent, and young adult population.

Matthiessen, J., Fagt, S., Biltoft-Jensen, A., Beck, A., & Ovesen, L. (2003). Size makes a difference. *Public Health Nutrition*, *6*(01).

- Analyzed trends in portion sizes.

Siega-Riz, A., El Ghormli, L., Mobley, C., Gillis, B., Stadler, D., & Hartstein, J. et al. (2011). The effects of the HEALTHY study intervention on middle school student dietary intakes. *Int J Behav Nutr Phys Act*, *8*(1), 7.

- Analyzed how well a program worked, not milk consumption behaviors.

Wiley, A., (2011). Milk Intake and Total Dairy Consumption: Associations with Early Menarche in NHANES 1999-2004. *Plos ONE, 6*(2), e14685.

- Analyzed milk frequency and menarche

Zheng, M., Rangan, A., Olsen, N., Andersen, L., Wedderkopp, N., Kristensen, P. et al (2015). Substituting sugar-sweetened beverages with water or milk is inversely associated with body fatness development from childhood to adolescence. *Nutrition, 31*(1), 38-44.

- Analyzed SSBs

Summary of Articles Identified to Review:

- Included Primary Research Articles Identified: 25
- Included Review Articles Identified: 0
- Number of Articles Considered but Excluded: 16
- Total Number of Included Articles: 9

Step Three: Critically Appraise Each Article

This step involves assessing each included article for methodological quality. Each study is evaluated based on appropriateness of study design and the quality of how the study was conducted using the Academy's risk of bias tool called the Quality Criteria Checklist (QCC). Key information is abstracted and put into the worksheets, where it is later used to write a conclusion statement; determining the strength of the evidence. The worksheets help identify study details, summarize major findings, record the author's conclusion, organize data, and note reviewer's comments.

Step Four: Summarize the Evidence

This step involves summarizing the data extracted from each study into a concise, easy-to-read summary. The end results are the Evidence Summary, which is a synthesis

of the evidence, discussing themes among the articles. Included in this step is the development of an Overview Table, allowing for the assessment of studies that are most important to answering the research question. Stronger research designs will be more important for writing the summary than ones that are weaker. This is a table for people to easily compare the studies at a glance.

Step 5: Write and Grade the Conclusion Statement

This step includes developing a concise conclusion statement for the research question and assigning a grade to the conclusion statement. The grade will reflect the overall strength and weakness of evidence in forming the conclusion statement. The grading scale used by the Academy is: Grade I (good/strong), II (fair), III (limited/weak), IV (expert opinion only), V (not assignable). This step describes the overall evidence and what it tells us along with the answer to the evidence analysis question.

Table 4: AND's Grade Definition and Conclusion Grading Table

Table 5.0 Conclusion Grading Table

Strength of Evidence Elements	Grades				
	I Good/Strong	**II Fair**	**III Limited/Weak**	**IV Expert Opinion Only**	V **Grade Not Assignable**
Quality • Scientific rigor/validity • Considers design and execution	Studies of strong design for question Free from design flaws, bias and execution problems	Studies of strong design for question with minor methodological concerns, OR Only studies of weaker study design for question	Studies of weak design for answering the question OR Inconclusive findings due to design flaws, bias or execution problems	No studies available Conclusion based on usual practice, expert consensus, clinical experience, opinion, or extrapolation from basic research	No evidence that pertains to question being addressed
Consistency Of findings across studies	Findings generally consistent in direction and size of effect or degree of association, and statistical significance with minor exceptions at most	Inconsistency among results of studies with strong design, OR Consistency with minor exceptions across studies of weaker design	Unexplained inconsistency among results from different studies OR single study unconfirmed by other studies	Conclusion supported solely by statements of informed nutrition or medical commentators	NA
Quantity • Number of studies • Number of subjects in studies	One to several good quality studies Large number of subjects studied Studies with negative results have sufficiently large sample size for adequate statistical power	Several studies by independent investigators Doubts about adequacy of sample size to avoid Type I and Type II error	Limited number of studies Low number of subjects studied and/or inadequate sample size within studies	Unsubstantiated by published research studies	Relevant studies have not been done
Clinical impact • Importance of studied outcomes • Magnitude of effect	Studied outcome relates directly to the question Size of effect is clinically meaningful Significant (statistical) difference is large	Some doubt about the statistical or clinical significance of the effect	Studied outcome is an intermediate outcome or surrogate for the true outcome of interest OR Size of effect is small or lacks statistical and/or clinical significance	Objective data unavailable	Indicates area for future research
Generalizability To population of interest	Studied population, intervention and outcomes are free from serious doubts about generalizability	Minor doubts about generalizability	Serious doubts about generalizability due to narrow or different study population, intervention or outcomes studied	Generalizability limited to scope of experience	NA

(Academy of Nutrition and Dietetics Evidence Analysis Library, 2012)

CHAPTER 4: RESULTS

The current research on milk fat consumption and weight status among children and adolescents is limited. For the literature review, nine studies were critically analyzed and appraised using Quality Criteria Checklists and data extraction worksheets. An overview table including each study can be found in Appendix A. Below are brief summaries of each study, followed by the graded conclusion statements that answer both research questions. All studies analyzed children and adolescents of the ages 18 and younger, which are consistent with the guidelines used in the National School Lunch Program (NSLP).

Narrative Summaries

Fiorito et al., (2009) (Rating: +)

Fiorito et al., 2009 assessed whether beverage intake at age 5 predicted energy intake, adiposity, and weight status across childhood and adolescence in a prospective cohort study. Only sweetened beverage intake at age 5 was a significant predictor of adiposity at each age from 5-15 years. The association between sweetened beverages and milk ($r = -0.10$, $P<0.01$) and the association between sweetened beverages and fruit juice ($r = -0.19$, $P<0.05$) was negative. However, there was no association between milk and fruit juice ($r = -0.10$, NS). Authors concluded that early intake of sweetened beverages predicts adiposity and weight status across childhood and adolescence. Perhaps milk fat is not to blame, but rather sugar sweetened beverages in contributing to childhood obesity. Limiting the amounts of sugar sweetened beverages in a child's diet may be an area of focus.

Scharf and DeBoer, (2013) (Rating: +)

Scharf and DeBoer, (2013) found that the consumption of higher-fat milk was associated with lower BMI z-score ($p<0.0001$) in a longitudinal cohort study. Preschoolers drinking 1%/skim versus 2%/whole milk had higher odds of being overweight or obese. Children with higher BMI's, who drank 1%/skim, at both ages were more at risk for being overweight or obese than those drinking 2%/whole. Consumption of 1% or skim milk was associated with overweight and obesity. Authors concluded that 1%/skim milk drinkers are more common among overweight and obese preschoolers, which may reflect the choice of the parents in trying to maintain their child's weight status. These data do not support consuming 1% or skim milk as a sole way to prevent weight gain among preschoolers. More evidence-based research needs to be conducted for recommendations to restrict milk-fat to manage weight status in young children.

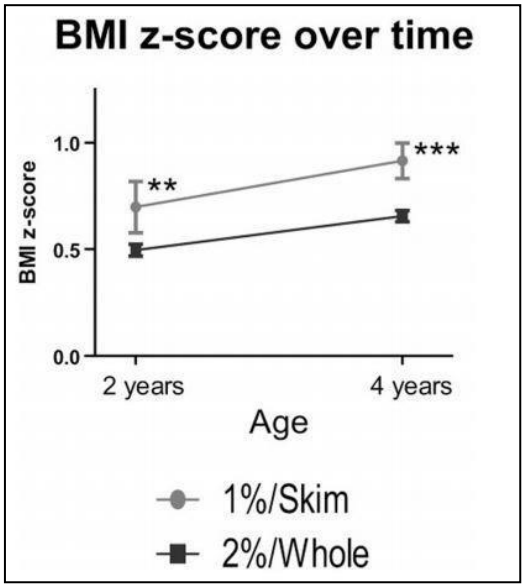

Figure 1: Scharf, et al., 2013

Murphy et al., (2008) (Rating: +)

Murphy et al., (2008) found that BMI measures of milk drinkers were comparable to or lower than measures of nondrinkers ($P<0.05$). Findings from this retrospective cohort suggest that consumption of either flavored or plain milk is associated with a positive influence on nutrient intakes by children and adolescents and is not associated with adverse effects on BMI measures. There was no significant difference in energy

intakes between the three milk categories of flavored milk drinkers, exclusively plain milk drinkers, and non-milk drinkers. However, the data used in this analysis are from 1999-2002, and may not reflect the most recent trends in milk consumption patterns.

Bradlee et al., (2009) (Rating: +)

Bradlee et al., (2009) explored the mean food group intakes associated with central obesity anthropometry among children and adolescents in this cross-sectional study. In younger children, there was no relationship between central adiposity and mean intakes of dairy, while a positive association with meat intake was found among boys. Participants who met the criteria for central obesity (waist circumference >85th percentile for age and sex) reported consuming significantly less total dairy. Both milk (p=0.004) and cheese intakes (P=0.020) were inversely associated with central obesity. This study demonstrated that intakes of dairy were inversely associated with central obesity among adolescents in the study. Authors concluded that more prospective studies are needed to determine the effects of USDA's recommendations for food-based dietary guidelines that are aimed at age, sex and physical activity level.

Huh et al., (2010) (Rating: +)

Huh et al., (2010), in a prospective cohort, found that the intake of milk at age 2 years, whether full- or reduced-fat, was not associated with risk of incident overweight at age 3 years. Neither total milk nor total dairy intake at age 2 years was associated with BMI z-score or incident overweight at age 3 years. Neither consuming more dairy products, nor switching from whole milk to reduced-fat milk at age 2 years, appears likely to prevent overweight in early childhood. The findings suggest that a higher intake of milk, whether full or reduced-fat, is unlikely to prevent development of obesity among

preschool-aged children. Milk intake, however, may offer other health benefits, including provision of calcium, vitamin D, and other nutrients vital for growth and development.

Bigornia et al., (2014) (Rating: +)

Bigornia et al., (2014) found that children in the highest vs. lowest quartile of full-fat dairy intakes (g/d) had a 37% lower risk of excess fat mass at age 13 years in this prospective cohort**.** Total and full- and reduced-fat dairy consumption during preadolescence was not associated with excess fat accumulation during early adolescence. These data suggest a protective effect of dairy consumption. Authors concluded that higher dairy consumption during preadolescence does not adversely affect excess fat deposition during early adolescence. Most associations between dairy intakes and excess adiposity were inversely related, particularly for full-fat dairy products, suggesting a protective relation.

Vanderhout et al., (2016) (Rating: +)

Vanderhout et al., (2016), a cross-sectional study, explored the association between milk fat percentage and both BMI z-score and serum vitamin D levels in children. There was a positive relation between milk-fat percentage and 25(OH)D ($p=0.006$) and a negative relation between milk-fat percentage and BMI z-score ($P<0.0001$). Whole milk drinkers had higher mean vitamin D levels than 1% milk drinkers, which was a similar change in serum vitamin D that equates to about 1 cup per day. Whole milk drinkers had lower BMI z-scores than 1% milk drinkers. The authors concluded that children may benefit from higher fat milks for healthy serum vitamin D levels and adiposity.

Schroder et al., (2014) (Rating: Neutral)

Schroder et al., (2014), a cross-sectional study, assessed the impact of beverage consumption pattern on diet quality and anthropometric proxy measures for abdominal adiposity in Spanish adolescents. A caloric beverage pattern dominated by the consumption of "soft-drinks" is related to general and abdominal adiposity and diet quality in Spanish male adolescents. Boys in the whole-fat milk cluster had a lower mean weight than those in the low-fat milk and the soft drink cluster (57.2kg; 59.8kg; and 61.7 kg respectively). Girls in the whole-fat milk cluster had a lower mean weight than those in the low-fat milk cluster (52.8kg and 54.1kg respectively), but not the juice cluster (52.5kg).

The findings in this study showed boys in the soft drinks cluster had an increased risk of higher BMI z-scores, WC and WHtR in comparison to those in the whole-milk cluster. The authors concluded that long-term prospective studies are needed for better insight about the impact of caloric beverage consumption on diet quality and adiposity in adolescents.

Lin et al., (2012) (Rating: Neutral)

Lin et al., (2012) examined the associations of milk or other dairy product consumption with adolescent obesity**.** For the 5,968 adolescents with a BMI z-score, neither non-milk dairy products nor milk consumption at 11 years was prospectively associated with BMI z-score at 13 years, adjusted for sex, BMI z-score at 11 years, birth order and maternal age. For the 3,084 children who self-reported their waist and hip circumference, neither non-milk dairy products nor milk consumption at about 11 years

was associated with WHR. This study did not specify the milk types, milk fat percentages, dairy types or dairy fat percentages.

Question

1. Should preschoolers and school-aged children consume low-fat and fat-free dairy products rather than full-fat?

Conclusion Statement

According to the research, preschoolers and school-aged children should not necessarily consume low-fat and fat-free dairy products rather than full-fat. Three studies analyzed dairy products specifically: Bradlee et al. (2009) showed no relationship between central adiposity and mean intakes of dairy, although specific milk fat percentages were not reported. Lin et al. (2012) showed milk and other dairy product consumption was not associated with BMI z-score or waist to hip ratio. Bigornia et al., (2014) showed those who consumed the highest versus the lowest amounts of total dairy had smaller increases in BMI ($P<0.05$). The data do not support low-fat dairy products as a way to limit caloric intake or prevent obesity. In fact, children and adolescents who are continuing to grow and develop should not be restricted from essential fat and calories.

Grade: II, Fair

Question

2. Are the current NSLP guidelines on milk types evidence-based in terms of maintaining and preventing weight gain in preschool and school-aged children?

Conclusion Statement

According to the research, the current NSLP guidelines on milk types are not evidence-based in terms of maintaining and preventing weight gain in preschool and

school-aged children. Two studies showed an inverse relationship between milk fat and weight status; consumption of higher fat milks, reduced and whole, being associated with lower BMI z-scores. Scharf and DeBoer, (2013) found that the consumption of higher fat content in milk was associated with lower BMI z-score ($p<0.0001$). Vanderhout et al. (2016) showed a negative relation between milk-fat percentage and BMI z-score ($P<0.0001$), although this was a cross-sectional study and therefore could not make a causal relationship. Four studies showed types of milk fat to not be a predictor of weight status. Fiorito et al., (2009) showed early intake of sweetened beverages and not milk intake to be a predictor of adiposity and weight status in children and adolescents. Murphy et al., (2008) showed BMI measures of milk drinkers were comparable to or lower than measures of non-milk drinkers ($P<0.05$). Huh et al., (2010) showed neither total milk nor total dairy intake at age 2 years was associated with BMI z-score at age 3 years. Lastly, Schroder et al., (2014) showed boys and girls consuming whole milk had lower mean weight than those consuming low-fat milk. The current guidelines in the NSLP restricting milk fats to control weight status in children and adolescents are not consistent with the most recent research.

Grade: II, Fair

CHAPTER 5: CONCLUSION AND SUMMARY

Evidence Summary

All nine studies assessed children and adolescents 18 years of age and younger, which is consistent with the age/grade groups involved in the NSLP. However, those ages 2 and under are covered under a different federal program, CACFP. This program recommends 1 year olds to consume whole or reduced-fat milk. It does however mimic NSLP in that it restricts 2 year olds to low-fat and fat-free milks. Not all studies solely analyzed milk fats and their effect on overweight and obesity in children and adolescents. Some studies, along with milk, measured sugar-sweetened beverages, soft drinks and juice intake, as well as fruit, vegetable, grain, and meat consumption. Consumption of dairy products and their specific fat percentages on children and adolescents weight status were also analyzed. Beverage consumption patterns among children and adolescents were in a few of the studies. None of the studies showed an increase in BMI with intake of higher-fat milks or dairy products.

Instead, all showed an inverse relationship or no association between higher fat milk intake and weight status, according to BMI. Fiorito et al., (2009) showed only sweetened beverage intake to be a significant predictor of adiposity at each age. Scharf and DeBoer (2013) showed consumption of higher fat content in milk to be associated with lower BMI z-score. Murphy et al., (2008) showed that the BMI of milk drinkers were comparable to or lower than that of non-drinkers. Bradlee et al., (2009) showed no relationship between central adiposity and mean intakes of dairy, although specific fat percentages were not reported. Huh et al., (2010) showed that higher intake of whole milk at age 2, but not reduced-fat milk, was associated with a slightly lower BMI z-score

at age 3 (−0.09 unit per daily serving [95% CI −0.16, −0.01]). Bigornia et al., (2014) showed children who consumed the most full-fat dairy (348 +/- 176 g/day) versus those that consumed the lowest amounts of full-fat dairy (9 +/- 10 g/day) had a 37% lower risk of excess fat mass. Vanderhout et al., (2016) found a negative relation between milk-fat percentage and BMI z-score (P<0.0001). Schroder et al., (2014) showed boys and girls who consumed whole milk had lower mean weight than those consuming 1% milk. Lastly, Lin et al (2012) showed milk and other dairy product consumption was positively associated with socio-economic status, but not BMI z-score or waist to hip ratio.

Study Design

Six of the studies were from Class B and were longitudinal; five being prospective cohorts and one being a retrospective cohort. The other three were from Class D and were cross-sectional studies. Because cross-sectional studies analyze a population at a specific point in time, a causal relationship cannot be determined and thus this is a limitation of the findings of this analysis. Cohort studies analyze risk factors and health outcomes, trying to find stronger associations. A question about etiology, causation or harm is best answered through a cohort study, which is the highest level of evidence for prognosis (Academy of Nutrition and Dietetics Evidence Analysis Library, 2012).

Type of Milk

All studies specifically analyzed cow's milk, and not almond milk, soy milk, or other milk-substitutes. Only three of the studies looked at specific milk-fat types and weight status among children and adolescents. Other studies examined beverage consumption patterns, which is still an important aspect in evaluating the topic of milk fats and overweight and obesity.

Bradlee et al., (2009), Bigornia et al., (2014) and Lin et al., (2012) analyzed dairy products in general, which included cheese, yogurt, ice cream, and other desserts like pudding. Bradlee et al., (2009) and Lin et al., (2012) looked at overall dairy consumption, while Bigornia et al., (2014) specifically analyzed total, full- and reduced-fat dairy products, including milk. Just like milk regulations, dairy products served in federal child nutrition programs are required to be low-fat or fat-free to meet each age/grade group calorie range. Because there are different types of fats in dairy products, it is important to consider other dairy products when discussing weight status in children and adolescents.

Fiorito et al., (2009) and Murphy et al., (2008) also analyzed sugar-sweetened beverages, which included 100% fruit juice, soda, fruit-flavored drinks, energy and sport drinks with added sugar, sweetened teas and coffees, and flavored milks (including milkshakes). Fiorito et al., (2009) concluded that early intake of sweetened beverages predicts adiposity and weight status across childhood and adolescence. However, Murphy et al., (2008) concluded that consumption of either flavored or plain milk is associated with a positive influence on nutrient intakes by children and adolescents and is not associated with adverse effects on BMI measures.

Data Collection

All of the studies included self-reported data; specifically 24-hour dietary recalls, waist and hip circumference, and maternal pregnancy height and weight. Four of the studies included children and adolescents from other countries, which may not reflect the dietary patterns, specifically milk consumption, of those in the United States. One study examined specific nutrient intakes of children, which included Vitamin A, calcium, phosphorus, magnesium, potassium and saturated fat. One study specifically took blood

samples, showing serum vitamin D levels related to milk fat consumption. Two of the studies posed a risk for bias because they were funded by the National Dairy Council.

Conclusion

The current guidelines in the National School Lunch Program, which are derived from the Dietary Guidelines for Americans, require children and adolescents over the age of two to consume 1% or fat-free milk only. This is not consistent with the research, which shows that consumption of higher-fat milk is not a predictor of overweight and obesity. One study goes so far as to not support consuming 1% or skim milk as a sole way to prevent weight gain among preschoolers (Scharf et al., 2009). Perhaps full-fat dairy products have a protective effect against overweight and obesity. The requirements to restrict milk fats in federal child nutrition programs, specifically the NSLP, are based on the desire to reduce the amount of saturated fat and calories a child and adolescent consumes.

However, more research needs to be conducted on the long-term effects of low-fat and fat-free milks on an individual's weight status. Perhaps milk consumption and a child's weight status is more closely tied to their overall diet quality. It is also possible that low-fat and fat-free milk consumption are reported with children and adolescents due to transition periods in milk types based on the Dietary Guidelines for Americans recommendations.

Perhaps not only do the child nutrition programs need to be reanalyzed, but the Dietary Guidelines for Americans as a whole, as this is what dictates the regulations. Because the NSLP is for children pre-kindergarten to 18 years of age, perhaps research on specific age groups is warranted to determine the effect of full-fat milk and dairy on

weight status. It would also be interesting to specifically look at the effect of fatty acids found in higher-fat milks and dairy products on growth and development. Perhaps whole milk and reduced-fat milk are appropriate for those of elementary school age, but low-fat and fat-free milks are appropriate for middle and high school students. However, beverage consumption patterns show an age-related decline in dairy intake appearing to be in adolescents. It continues to be low among adult females, and overall, 80% of the entire U.S. population does not meet the daily dairy intake recommendation (ODPHS, 2016). Therefore, perhaps the low-fat and fat-free restriction is not warranted for the older children and adolescents.

Applications to Practice

The nutrition guidelines used in child nutrition programs are based on the Dietary Guideline for Americans. These recommendations are to be based on the latest research in the field of nutrition. The guidelines are issued by the United States Department of Agriculture (USDA), and the Health and Human Services (HHS). There are recommendations for low-fat and fat-free items, including milk and other dairy products. However, perhaps the guidelines set by the USDA are not warranted in restricting schools to non-fat and low-fat milks for children and adolescents. Although the intent of the regulations are to reduce the number of calories and saturated fat a child consumes, perhaps there needs to be more research on the long-term effects as well as more focus on sugar-sweetened beverage intake. It would be interesting to determine if participation rates in school lunch for those in the NSLP would increase if the milk fat restrictions were lifted.

Recommendations for Future Research

More research needs to be done on the effects of full-fat dairy and full-fat milk products on a child's weight status over time. None of the research shows weight gain with full-fat dairy, therefore the guidelines should be reassessed to align with the research. Perhaps the next Dietary Guidelines for Americans in 2020-2025, needs to pose the question about low-fat and fat-free options and if it is good for younger children and adolescents to consume. It is possible there needs to be a closer look at lower-fat milk and dairy options and their effect on fat-soluble vitamin absorption. For now, low-fat and fat-free milk options are still viable ways for school-aged children and adolescents to obtain essential nutrients like calcium, potassium, vitamin A, vitamin D, phosphorus, and magnesium. Dietitians and healthcare professionals should continue to recommend milk and dairy products as part of a healthy diet.

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APPENDIX A: OVERVIEW TABLE

Author, Year, Study Design, Class, Rating	**Study Purpose**	**Study Populations**	**Outcomes**	**Limitations**
Fiorito et al., 2009. **Study Design**: Prospective Cohort **Class**: B **Rating**: +	To assess whether beverage intake at age 5 predicted energy intake, adiposity, and weight status across childhood and adolescence.	White, non-Hispanic, 5-year-old girls in central Pennsylvania. **Initial**: 170 females (170 families) **Final**: N=166 Parents were well-educated: fathers with a mean educational level of 14.9 +/- 2.7 y, and mothers with an educational level of 14.8 +/- 2.3 y. On average, parents were slightly overweight at the first time of measurement, with a mean BMI of 28.0 +/- 4.35 for fathers and 26.4 +/- 6.05 for mothers.	Only sweetened beverage intake at age 5 was a significant predictor of adiposity at each age from 5-15 years. Sweetened beverage intake at age 5 years significantly explained 9%, 7%, 9%, 5%, 3%, and 3% of the variation in the prediction of participants' percentage body fat at each time point assessed (age 5, 7, 9, 11, and 15 respectively). The proportion of girls classified as overweight increased significantly from age 5 to 15 years. The association of sweetened beverages with milk ($P<0.01$) and sweetened beverages and fruit juice ($P<0.05$) intake was negative, whereas milk and fruit juice were not associated ($r = -0.10$).	Only one gender was represented in this sample and all participants were from central Pennsylvania, which is not nationally-representative of the US population. Intake of water was also not assessed. This data was self-reported, which may include biases or human error. This longitudinal study did allow for a high number of measurements over a 10-year period.
Scharf and DeBoer, 2013. **Study Design**: Prospective Cohort **Class**: B **Rating**: +	To evaluate relationships between types of milk fat consumed and weight status, specifically BMI, among preschool children.	U.S., preschool children, ages 2-4 years. **Initial**: 14,000 **Final**: N=10,500 Overweight/obesity: 30.1% at 2 years; 32.2% at 4 years.	Consumption of higher fat content in milk was associated with lower BMI z-score ($p<0.0001$). Preschoolers drinking 1%/skim versus 2%/whole had higher odds of being overweight or obese. Children with higher BMI's, who drank 1%/skim, at both ages were more at risk for being overweight or obese than those drinking 2%/whole. However, there was no significant difference between lower fat and higher fat milk drinkers in change in BMI Z-SCORE over time ($p=0.06$). In longitudinal analysis, children drinking 1%/skim at both 2 and 4 years were more likely to become overweight/obese between these time points (OR	Food consumption was not taken into consideration, data was self-reported by parents and not actually observed, and no physical activity was recorded.

			1.57 P<0.05).	
Murphy et al., 2008. **Study Design**: Retrospective Cohort **Class**: B **Rating**: +	To compare nutrient intakes and body measurements among children and adolescents drinking flavored milk (with or without plain milk), exclusively plain milk, and no milk.	Children and adolescents aged 2 to 18 years who were interviewed in NHANES 1999-2002. **Initial**: 8,503 **Final**: N=7,557	Children and adolescents who included flavored milk in their diets reported higher total milk intakes than exclusively plain milk drinkers (P<0.05). Intakes of vitamin A, calcium, phosphorus, magnesium, potassium, and saturated fat were generally comparable among milk drinking groups, whereas intakes by milk nondrinkers were significantly lower (P<0.05). Among females aged 12 to 18 years, calcium intakes by flavored and exclusively plain milk drinkers were 992 +/- 41.5 and 1,038 +/- 22.5 mg/day, respectively, whereas intake by nondrinkers was 576 +/- 11.7 mg/day. Intake of added sugars did not differ between flavored milk drinkers and milk nondrinkers. BMI measures of milk drinkers were comparable to or lower than measures of nondrinkers (P<0.05).	The data used in this analysis are from 1999-2002, and may not reflect the most recent trends in milk consumption patterns. Fat content was also not specified for 45-55% of those that were flavored milk drinkers, suggesting they could not accurately remember information provided on their 24-hour dietary recall.
Bradlee et al., 2009. **Study Design**: Cross-sectional Study **Class**: D **Rating**: +	To explore mean food group intakes associated with central obesity anthropometry among children and adolescents enrolled in the Third National Health and Nutrition Examination Survey (NHANES III).	Subjects in one of three categories of racial or ethnic origin: non-Hispanic whites, non-Hispanics blacks and Mexican-Americans. **Initial**: 4,329 children; 2,079 adolescents **Final**: N=3,761 children aged 5-11 years; 1,803 adolescents aged 12-16 years.	In younger children, there was no relationship between central adiposity and mean intakes of dairy, while a positive association with meat intake was found among boys. In adolescent boys and girls, central body fat measures were inversely associated with mean dairy and grain intakes. Adolescent boys in the highest quartile of central adiposity consumed less fruit and fewer vegetables; those in the lowest central adiposity quartile consumed less meat. Finally, adolescents who met the criteria for central obesity (waist circumference >85th percentile for age and sex) reported consuming significantly less total dairy (as well as milk and cheese separately), total grains (whole	Data was from the US population sample from 1998-2002, which is outdated compared to the current year. Data was based on one 24-hour recall, which may not be representative of a participant's everyday eating habit. Recalls can also contain missing or incorrect information due to poor recall by participants. This study was funded by the National Dairy Council, which has a

			and refined) and total fruit and vegetables.	potential for bias. However, they were not directly involved in the study design, data collection, analysis, or interpretation of results.
Huh et al., 2010. **Study Design**: Prospective cohort **Class**: B **Rating**: +	To determine whether the quantity and type of milk (whole, reduced fat, or 1%/nonfat) consumed at age 2 years is associated with adiposity at age 3 years.	Preschool-aged children. From April 1999 to July 2002, participants were enrolled in Project Viva, a longitudinal pre-birth cohort of mother-offspring pairs in the Boston, Massachusetts area. **Initial**: 1,579 **Final**: N=852 Ethnicity: white; 73.9%	At age 2 years, mean milk intake was 2.6 (standard deviation 1.2) servings per day. Higher intake of whole milk at age 2, but not reduced-fat milk, was associated with a slightly lower BMI z-score (0.09 unit per daily serving [95% confidence interval: 0.16 to 0.01]) at age 3 years; when restricted to children with a normal BMI (5th to 85th percentile) at age 2 years, the association was null (0.05 unit per daily serving [95% confidence interval: 0.13 to 0.02]). Intake of milk at age 2 years, whether full- or reduced-fat, was not associated with risk of incident overweight at age 3 years. Neither total milk nor total dairy intake at age 2 years was associated with BMI z-score or incident overweight at age 3 years.	Possible misclassification of the exposure from using a single estimate of intake during a 1-month period at age 2 years. Self-reported data by the mother may have resulted in misclassification of intake as well. Possible underreporting of energy intake by mothers and overweight children. Generalizability of study may be limited due to high levels of maternal education and household income.
Bigornia et al., 2014. **Study Design**: Prospective Cohort **Class**: B **Rating**: +	To determine the effects of total and full- and reduced-fat dairy intake in children at 10 y of age on risk of excess total body fat mass (TBFM) and overweight at age 13 y.	Participants were a part of the Avon Longitudinal Study of Parents and Children (ALSPAC), which was designed to examine the relationship between the environment and the health and development of children. **Initial**: 5,102 **Final**: N= 2,455; aged 13 years.	Children in the highest vs. lowest quartile of full-fat dairy intakes (g/d) had a 37% lower risk of excess fat mass at age 13 y in the simple adjusted model (model 1; P-trend = 0.03). In analyses of dairy servings, no relation was evident (P-trend = 0.65; risk of excess TBFM, model 4). In models 1 and 4, those with the highest intakes of total dairy tended ($P < 0.1$) to have smaller gains in BMI (kg/m2) from ages 10 to 13 y compared with those with the lowest intakes of dairy. There was a significant linear trend in	Maternal pregnancy height and weight were self-reported by mothers and used to calculate maternal overweight. Estimates did not reach significance in many cases. Total dairy intakes were underestimated because dairy from mixed dishes such as cheese on pizza were

		Maternal overweight (n=1880; 77%), maternal educational attainment (n=2292; 93%), and dieting at 13 years (n=2135; 87%).	model 4 (P = 0.04) for smaller gains in BMI among children with higher intakes of total dairy. With regard to full-fat dairy products, those children with the highest intakes compared with those with the lowest intakes had smaller gains in BMI during follow-up in models 1 to 4 (P < 0.05 for quartile 1 vs. quartile 4; P-trend < 0.01).	excluded. Compared to US children, total dairy intakes in this cohort of British children were relatively small.
Vanderhout et al., 2016. **Study Design:** Cross-sectional **Class:** D **Rating:** +	To explore the association between milk fat percentage and both BMI z-score and serum vitamin D levels in children. Secondly, to assess whether milk volume consumed altered this relation.	Children from The Applied Research Group for Kids (TARGet Kids!) collaboration in Toronto, Canada. **Initial**: 5,301 **Final**: N=2,745; children ages 1-6 years.	There was a positive relation between milk fat percentage and 25(OH)D (P=0.006) and a negative relation between milk-fat percentage and BMI z-score (P<0.001). Those who drank whole milk had higher levels of serum vitamin D and lower BMI z-scores than those drinking 1%. The authors concluded that children could benefit from higher fat milks for healthy serum vitamin D levels and adiposity.	This study included a broad, healthy, culturally diverse, large sample size of children with data on milk consumption, serum vitamin D levels, and adiposity. This was a cross-sectional study, in which the causality and direction cannot be established. Other sources of vitamin D were also not accounted for.
Schroder et al., 2014. **Study Design**: Cross-sectional **Class**: D **Rating**: Neutral	To assess the impact of beverage consumption pattern on diet quality and anthropometric proxy measures for abdominal adiposity in Spanish adolescents.	The enKid study on nutritional status and food habits of Spanish children and young people, aged 2-24 years conducted between 1998 and 2000. **Initial**: 3,534 **Final**: N= 1,149; aged 10-18 years.	In the whole-fat milk cluster, the mean intake was 301 and 244 ml/day in boys and girls, respectively. In the low-fat milk cluster, similar intakes were reported by boys (357 ml/day) and girls (321 ml/day). Boys in the soft drinks cluster had a daily mean consumption of 530 ml of soft drinks, whereas girls in the juice cluster reported an intake of 248 ml of juices per day. The “soft drinks” and “juice” clusters provide the highest amount of energy from beverages in boys (14.0%) and girls (12.9%), respectively.	Cross-sectional design, which prevents drawing causal relationships. One 24-hour recall is not representative of one's overall diet. Day-to-day variation results in random errors that may have weakened the association between caloric beverage consumption and adiposity.
Lin et al.,	To examine the	The Hong Kong	Only 65.7% regularly	Waist and hip

2012. **Study Design**: Prospective Cohort **Class**: B **Rating**: Neutral	associations of milk or other dairy product consumption with adolescent obesity.	"Children of 1997" birth cohort covered 88.0% of all births from April 1st, 1997 to May 31st, 1997. **Initial**: 8,327 **Final**: N= 3,679; aged 11-13 years.	consumed milk and 72.4% other dairy products. Milk and other dairy product consumption was positively associated with socio-economic position but not with BMI z-score or WHR, with or without adjustment for sex, mother's birthplace, parental education, physical activity and other food consumption.	circumference was self-reported by participants, which may lead to misclassification. This study reviewed milk consumption in the last week therefore may not be an overall representation of participants' diets. This study also did not specify the milk types, milk fat percentages, or dairy types or dairy fat percentages. Not all height and weight measurements were exactly at age 13 years. The results section was weak and did not fully explain the results of the waist and circumference measures at 13 years. When stating the results, the author continuously grouped non-dairy with dairy consumption, which should be assessed separately.

APPENDIX B: QUALITY CRITERIA CHECKLISTS AND EVIDENCE WORKSHEETS

Evidence Worksheet for Primary RESEARCH Article

Citation:	Fiorito, L., Marini, M., Francis, L., Smiciklas-Wright, H., & Birch, L. (2009). Beverage intake of girls at age 5 y predicts adiposity and weight status in childhood and adolescence. *American Journal Of Clinical Nutrition, 90*(4), 935-942.
Study Design:	Prospective Cohort
Class (A,B,C,D):	B
Quality Rating:	Positive (+)
Research Purpose:	To assess whether beverage intake at age 5 predicted energy intake, adiposity, and weight status across childhood and adolescence.
Inclusion Criteria:	Non-Hispanic, 5-year-old girls in central Pennsylvania, who completed dietary intake and body weight data at 4 of 6 times of measurement, and their parents.
Exclusion Criteria:	Not living with both biological parents, having a severe food allergy or chronic medical problem affecting food intake, having dietary resitrictions involving animal products.
Study Protocol:	• Participants were part of a longitudinal study of the health and development of young girls living in central Pennsylvania. Participants were recruited using flyers and newspaper advertisements. Those with age-eligible female children within a 5-county radius received mailings and follow-up phone calls. • Blinding: N/A • Intervention: N/A • Statistical Analysis: mutiple regression analyses were used to predict the girls' adiposity.
Data Collection Summary:	• Biennially from age 5 to 15 years. Body fat percentage was taken at each 2 year increment up to age 11 and up to 15 years. At each 2-year increment, three 24-hour recalls were conducted, which included weekdays and one weekend day, and they were averaged to produce one 24-hour recall. • Dependent variables: Percentage of body fat and waist circumference. • Independent variables: Sugar sweetened beverage consumption servings • Control variables: sex, age.
Description of Actual Data Sample:	• Initial: 170 families • Final: N=167 • Age: 5 years old • Demographics: Average income for the sample ranged from $50,000 to $75,000. Parents were relatively well educated: fathers had a mean educational level of 14.9 +/- 2.7 y, and mothers had an educational level of 14.8 +/- 2.3 y. On average, parents were slightly overweight at the first time of measurement, with a mean BMI of 28.0 +/- 4.35 for fathers and 26.4 +/- 6.05 for mothers.

Summary of Results:	Only sweetened beverage intake at age 5 was a significant predictor of adiposity at each age from 5-15 years. Sweetened beverage intake at age 5 years significantly explained 9%, 7%, 9%, 5%, 3%, and 3% of the variation in the prediction of participants' percentage body fat at each time point assessed (age 5, 7, 9, 11, and 15 respectively). The proportion of girls classified as overweight increased significantly from age 5 to 15 years. The association of sweetened beverages with milk ($P<0.01$) and fruit juice ($P<0.05$) intake was negative, whereas milk and fruit juice were not associated ($r = -0.10$). This study suggests that early consumption of sweetened beverages, and not milk or fruit juice consumption, predicted higher adiposity during childhood and adolescence.
Author Conclusion:	These findings provide new longitudinal evidence that early intake of sweetened beverages predicts adiposity and weight status across childhood and adolescence.
Reviewer Comments	Strengths: this study's length was acceptable; being conducted over 10 years. Limitations: Only one gender was represented in this sample and all participants were from central Pennsylvania, which is not nationally-representative of the US population. Intake of water was also not assessed. This data was self-reported, which may include biases or human error.
Funding Source	Pennsylvania State University

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	N/A
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	N/A
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
2.2. Were criteria applied equally to all study groups?	2.2	Yes
2.3. Were health, demographics, and other characteristics of subjects described?	2.3	Unclear
2.4. Were the subjects/patients a representative sample of the relevant population?	2.4	Yes
3. Were <u>study groups comparable</u>?	3	Yes
3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	N/A
3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.2	N/A
3.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.3	N/A
3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.4	Unclear
3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3.5	N/A
3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.6	N/A

4. Was method of handling withdrawals described?	4	Yes
4.1. Were follow up methods described and the same for all groups?	4.1	Yes
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.2	Yes
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.3	Unclear
4.4. Were reasons for withdrawals similar across groups	4.4	Yes
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
5. Was blinding used to prevent introduction of bias?	5	N/A
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.2	N/A
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.3	Yes
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	5.4	N/A
5.5. In diagnostic study, were test results blinded to patient history and other test results?	5.5	N/A
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	6	N/A
6.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.1	N/A
6.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.2	Yes
6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.3	N/A
6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured?	6.4	N/A
6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described?	6.5	N/A
6.6. Were extra or unplanned treatments described?	6.6	N/A
6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6.7	N/A
6.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
7. Were outcomes clearly defined and the measurements valid and reliable?	7	Yes
7.1. Were primary and secondary endpoints described and relevant to the question?	7.1	Yes
7.2. Were nutrition measures appropriate to question and outcomes of concern?	7.2	Yes
7.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.3	Yes
7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.4	Yes
7.5. Was the measurement of effect at an appropriate level of precision?	7.5	Yes
7.6. Were other factors accounted for (measured) that could affect outcomes?	7.6	No
7.7. Were the measurements conducted consistently across groups?	7.7	Yes

8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8	Yes
8.1. Were statistical analyses adequately described the results reported appropriately?	8.1	Yes
8.2. Were correct statistical tests used and assumptions of test not violated?	8.2	Yes
8.3. Were statistics reported with levels of significance and/or confidence intervals?	8.3	Yes
8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	8.4	N/A
8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.5	Yes
8.6. Was clinical significance as well as statistical significance reported?	8.6	Yes
8.7. If negative findings, was a power calculation reported to address type 2 error?	8.7	N/A
9. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?**	9	Yes
9.1. Is there a discussion of findings?	9.1	Yes
9.2. Are biases and study limitations identified and discussed?	9.2	Yes
10. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
10.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
10.2. Was there no apparent conflict of interest?	10.2	No
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Rating: Positive (+)

Citation: Fiorito, L., Marini, M., Francis, L., Smiciklas-Wright, H., & Birch, L. (2009). Beverage intake of girls at age 5 y predicts adiposity and weight status in childhood and adolescence. *American Journal Of Clinical Nutrition*, *90*(4), 935-942.

Evidence Worksheet for Primary RESEARCH Article

Citation:	Scharf R, Demmer R, DeBoer M. Longitudinal evaluation of milk type consumed and weight status in preschoolers. *Archives of Disease in Childhood. 2013;98*(5):335-340. doi:10.1136/archdischild-2012-302941.
Study Design:	Prospective Cohort
Class (A,B,C,D):	B
Quality Rating:	Positive (+)
Research Purpose:	To evaluate relationships between type of milk fat consumed and weight status, specifically BMI, among preschool children.
Inclusion Criteria:	US, preschool children, evaluated at ages 2 and 4, milk drinkers
Exclusion Criteria:	Non-milk drinkers, children evaluated at less than 2 years of age or greater than 4 years of age.
Study Protocol:	• Random sampling of brith certificates. Data collected from the Early Childhood Longitduinal Survey - Birth (ECLS-B) cohort. • Blinding used: N/A • Intervention: N/A • Statistical Analysis: All statistical significance tests were two-sided with significance of alpha=0.05. Using multivariable linear regression models, both cross-sectional and longitudinal analyses were performed. Regressed were: age 2 and 4 year BMI z-score on milk-type categories cross-sectionally, longitudinal change in BMI z-score on baseline milk-type categories, and multivariable logistic regression models were used to examind the odds of overweight and obesity across the milk-type categories in both cross-sectional and longitudinal analyses. 4 year multivariate models were adjusted for sex, race, socioeconomic status (SES), juice, and sugar sweetened beverage (SSB) intake.
Data Collection Summary:	• Computer-assisted interviews were completed by parents at the 2 year and 4 year visits. Parents were interviewed in their home by trained assessors. Height and weights were measured by researchers at each visit. • Timing of measurements: ages 2 and 4 years • Dependent variables: BMI Z-score and weight status. • Independent variables: Milk-type consumption • Control variables: social economic status (SES)
Description of Actual Data Sample:	• Initial: 14,000 • Final: N=10,500 • Age: 2-4 years • Anthropometrics: Overweight/obesity= 30.1% at 2 years; 32.2% at 4 years
Summary of Results:	Consumption of higher fat content in milk was associated with lower BMI z-score ($p<0.0001$). Preschoolers drinking 1%/skim versus 2%/whole had higher odds of being overweight or obese. Children with higher BMI's, who drank 1%/skim, at both ages were more at risk for being overweight or obese than those drinking 2%/whole. However, there was no significant difference between lower fat and higher fat milk drinkers in change in BMI Z SCORE

	over time (p=0.06). In logitudinal analysis, children drinking 1%/skim at both 2 and 4 years were more likely to become overweight/obese between these time points (OR 1.57 P<0.05).
Author Conclusion:	Consumption of 1% or skim milk was associated with overweight and obesity. Data does not support consuming 1% or skim milk as a sole way to prevent weight gain among preschoolers.
Reviewer Comments	Strengths: large sample size, nationally representative population. Limitations: food consumption was not taken into consideration, data was self-reported by parents and not actually observed, and no physical activity was recorded.
Funding Source	National Institute of Health Grant

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	N/A
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	N/A
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	No
2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
2.2. Were criteria applied equally to all study groups?	2.2	Yes
2.3. Were health, demographics, and other characteristics of subjects described?	2.3	Yes
2.4. Were the subjects/patients a representative sample of the relevant population?	2.4	No
3. Were <u>study groups comparable</u>?	3	No
3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	N/A
3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.2	Yes
3.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.3	N/A
3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.4	Unclear
3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3.5	N/A
3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.6	N/A

4. Was method of handling withdrawals described?	4	Yes
4.1. Were follow up methods described and the same for all groups?	4.1	Yes
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.2	Yes
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.3	Yes
4.4. Were reasons for withdrawals similar across groups	4.4	Yes
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
5. Was blinding used to prevent introduction of bias?	5	N/A
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.2	N/A
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.3	Yes
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	5.4	N/A
5.5. In diagnostic study, were test results blinded to patient history and other test results?	5.5	N/A
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	6	N/A
6.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.1	N/A
6.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.2	Yes
6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.3	N/A
6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured?	6.4	N/A
6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described?	6.5	N/A
6.6. Were extra or unplanned treatments described?	6.6	N/A
6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6.7	N/A
6.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
7. Were outcomes clearly defined and the measurements valid and reliable?	7	Yes
7.1. Were primary and secondary endpoints described and relevant to the question?	7.1	Yes
7.2. Were nutrition measures appropriate to question and outcomes of concern?	7.2	Yes
7.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.3	Yes
7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.4	Yes
7.5. Was the measurement of effect at an appropriate level of precision?	7.5	Yes
7.6. Were other factors accounted for (measured) that could affect outcomes?	7.6	Yes
7.7. Were the measurements conducted consistently across groups?	7.7	Yes

8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8	Yes
8.1. Were statistical analyses adequately described the results reported appropriately?	8.1	Yes
8.2. Were correct statistical tests used and assumptions of test not violated?	8.2	Yes
8.3. Were statistics reported with levels of significance and/or confidence intervals?	8.3	Yes
8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	8.4	N/A
8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.5	Yes
8.6. Was clinical significance as well as statistical significance reported?	8.6	Yes
8.7. If negative findings, was a power calculation reported to address type 2 error?	8.7	N/A
9. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?**	9	Yes
9.1. Is there a discussion of findings?	9.1	Yes
9.2. Are biases and study limitations identified and discussed?	9.2	Yes
10. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
10.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
10.2. Was there no apparent conflict of interest?	10.2	Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Rating: Positive (+)

Citation: Scharf R, Demmer R, DeBoer M. Longitudinal evaluation of milk type consumed and weight status in preschoolers. *Archives of Disease in Childhood. 2013;98*(5):335-340. doi:10.1136/archdischild-2012-302941.

Evidence Worksheet for Primary RESEARCH Article

Citation:	Murphy, M., Douglass, J., Johnson, R., & Spence, L. (2008). Drinking Flavored or Plain Milk Is Positively Associated with Nutrient Intake and Is Not Associated with Adverse Effects on Weight Status in US Children and Adolescents. *Journal Of The American Dietetic Association, 108*(4), 631-639. http://dx.doi.org/10.1016/j.jada.2008.01.004
Study Design:	Retrospective Cohort
Class (A,B,C,D):	B
Quality Rating:	Positive (+)
Research Purpose:	To compare nutrient intakes and body measures among children and adolescents drinking flavored milk (with or without plain milk), exclusively plain milk, and no milk.
Inclusion Criteria:	Children and adolescents aged 2-18 years who consumed cow's milk.
Exclusion Criteria:	Pregnant, lactating, fasting, and breastfeeding children and adolescents. Those that drank milk-based meal replacements, milkshakes, eggnog, beverages made with milk ingredients, such as Yoo-Hoo (Cadbury Schweppes, Plano, TX), and cocoa beverages made from flavored powders and water.
Study Protocol:	• The study population consisted of children and adolescents included in the 1999-2000 and 2001-2002 National Health and Nutrition Examination Surveys (NHANES). Data used in the study included intakes reported in 24-hour dietary recalls and height and weight measurements collected during a physical examination in the 1999-2002 National Health and Nutrition Examination Surveys. The milk drinking status of each person was identified, and nutrient intakes and body mass index (BMI) measures were determined by milk drinking status. NHANES 1999-2002 respondents were grouped into five subpopulations: children aged 2 to 5 years, boys aged 6 to 11 years, girls aged 6 to 11 years, boys aged 12 to 18 years, and girls aged 12 to 18 years. • Blinding: N/A • Intervention: N/A • Statistical Analysis: Comparisons among mean milk intakes, energy and nutrient intakes, and BMI measures by milk drinking status were completed using linear regression analysis.
Data Collection Summary:	• Dependent variables: weight status • Independent variables: milk type consumption
Description of Actual Data Sample:	• Initial: 8,503 children and adolescents • Final: N= 7,557 • Age: 2-18 years
Summary of Results:	Children and adolescents who included flavored milk in their diets reported higher total milk intakes than consumers of exclusively plain milk ($P<0.05$). Intakes of vitamin A, calcium, phosphorus, magnesium, potassium, and saturated fat (adjusted for energy intake and age) were generally

	comparable among milk drinking groups, whereas intakes by milk nondrinkers were significantly lower (P<0.05). Among females aged 12 to 18 years, calcium intakes by flavored and exclusively plain milk drinkers were 992 +/- 41.5 and 1,038 +/- 22.5 mg/day, respectively, whereas intake by nondrinkers was 576 +/- 11.7 mg/day. Intake of added sugars did not differ between flavored milk drinkers and milk nondrinkers. BMI measures of milk drinkers were comparable to or lower than measures of nondrinkers (P<0.05).
Author Conclusion:	Findings from this study suggest that consumption of either flavored or plain milk is associated with a positive influence on nutrient intakes by children and adolescents and is not associated with adverse effects on BMI measures.
Reviewer Comments	Strengths: This study provided a large, nationally representative nutrition and health data as well as the prevalence estimates for nutrition and health status measures. Also, interviewers collected detailed information on all foods and beverages consumed in the diet recalls. Limitations: The data used in this analysis are from the period 1999-2002, and may not reflect the most recent trends in milk consumption patterns. The fat content was also not specified for 45-55% of those that were flavored milk drinkers, suggesting they could not accurately remember information provided on their 24-hour dietary recall.
Funding Source	National Dairy Council

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	N/A
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
2.2. Were criteria applied equally to all study groups?	2.2	Yes
2.3. Were health, demographics, and other characteristics of subjects described?	2.3	Unclear
2.4. Were the subjects/patients a representative sample of the relevant population?	2.4	Yes
3. Were <u>study groups comparable</u>?	3	Yes
3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Yes
3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.2	Yes
3.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.3	Yes
3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.4	Yes
3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3.5	N/A
3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.6	N/A

4. Was method of handling withdrawals described?	4	Yes
4.1. Were follow up methods described and the same for all groups?	4.1	Yes
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.2	Yes
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.3	Yes
4.4. Were reasons for withdrawals similar across groups	4.4	Yes
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
5. Was blinding used to prevent introduction of bias?	5	N/A
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.2	N/A
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.3	Yes
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	5.4	N/A
5.5. In diagnostic study, were test results blinded to patient history and other test results?	5.5	N/A
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	6	N/A
6.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.1	N/A
6.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.2	N/A
6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.3	N/A
6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured?	6.4	N/A
6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described?	6.5	N/A
6.6. Were extra or unplanned treatments described?	6.6	N/A
6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6.7	N/A
6.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
7. Were outcomes clearly defined and the measurements valid and reliable?	7	Yes
7.1. Were primary and secondary endpoints described and relevant to the question?	7.1	Yes
7.2. Were nutrition measures appropriate to question and outcomes of concern?	7.2	Yes
7.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.3	Yes
7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.4	Yes
7.5. Was the measurement of effect at an appropriate level of precision?	7.5	Yes
7.6. Were other factors accounted for (measured) that could affect outcomes?	7.6	Yes
7.7. Were the measurements conducted consistently across groups?	7.7	Yes

8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8.1	Yes
8.1. Were statistical analyses adequately described the results reported appropriately?	8.2	Yes
8.2. Were correct statistical tests used and assumptions of test not violated?	8.3	Yes
8.3. Were statistics reported with levels of significance and/or confidence intervals?	8.4	N/A
8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	8.5	Yes
8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.6	Yes
8.6. Was clinical significance as well as statistical significance reported?	8.7	N/A
8.7. If negative findings, was a power calculation reported to address type 2 error?		
9. Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?	9	Yes
9.1. Is there a discussion of findings?	9.1	Yes
9.2. Are biases and study limitations identified and discussed?	9.2	Yes
10. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	No
10.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
10.2. Was there no apparent conflict of interest?	10.2	No
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Rating: Positive (+)

Citation: Murphy, M., Douglass, J., Johnson, R., & Spence, L. (2008). Drinking Flavored or Plain Milk Is Positively Associated with Nutrient Intake and Is Not Associated with Adverse Effects on Weight Status in US Children and Adolescents. *Journal Of The American Dietetic Association*, *108*(4), 631-639. http://dx.doi.org/10.1016/j.jada.2008.01.004

Evidence Worksheet for Primary RESEARCH Article

Citation:	Bradlee, M., Singer, M., Qureshi, M., & Moore, L. (2009). Food group intake and central obesity among children and adolescents in the Third National Health and Nutrition Examination Survey (NHANES III). *Public Health Nutr.*, *13*(06), 797-805. http://dx.doi.org/10.1017/s1368980009991546
Study Design:	Cross-Sectional
Class (A,B,C,D):	D
Quality Rating:	Positive (+)
Research Purpose:	To explore mean food group intakes associated with central obesity anthropometry among children and adolescents enrolled in the Third National Health and Nutrition Examination Survey (NHANES III).
Inclusion Criteria:	Subjects who were 5-16 years of age and in one of three categories of racial or ethnic origin: non-Hispanic whites, non-Hispanis blacks and Mexican-Americans.
Exclusion Criteria:	Those over 17 years of age, those who were insufficient to provide stable estimates of association (n=99), those with dietary data designated as missing or unreliable (n=317), those with extreme energy intake (n=227), and those who were pregnant or breastfeeding (n=18), taking diabetes medication (n=8), had missing data for WC circumference (n=128), or had potential confounders of interest in the study (n=47).
Study Protocol:	• Recruitment: NHANES III and NHANES 1999-2002. • Design: Dietary intake in both NHANES III and NHANES 1999-2002 was assessed through a single 24-hour recall. Those younger than aged 12 had a dietary recall completed with a proxy respondent. • Blinding: N/A • Intervention: N/A • Statistical Analysis: The adjusted mean level of intake in each quartile of central body fat was estimated using analysis of covariance modelling with PROC GLM in the SAS statistical software package version 9.1.
Data Collection Summary:	• Dependent variables: Waist circumference was the primary measure of central adiposity. Suprailiac and subscapular skinfold thickness was the secondary mesaure. • Independent variables: dietary intake
Description of Actual Data Sample:	• Initial: 4,329 children aged 5-11 years, 2079 adolescents aged 12-16 years • Final: N= 3761 children aged 5-11 years, 1803 adolescents aged 12-16 years • Other relevant demographics: Parental Education: less than high school, high school, and more than high school.
Summary of Results:	Results were controlled for confounding by age, height, race/ethnicity, Tanner stage, television viewing and parental education. In younger children, there was no relationship between central adiposity and mean intakes of dairy, fruit, vegetables or grains, while a positive association with meat intake was found among boys. In adolescent boys and girls, central body fat

	measures were inversely associated with mean dairy and grain intakes. Adolescent boys in the highest quartile of central adiposity consumed less fruit and fewer vegetables; those in the lowest central adiposity quartile consumed less meat. Finally, adolescents who met the criteria for central obesity (waist circumference >85th percentile for age and sex) reported consuming significantly less total dairy (as well as milk and cheese separately), total grains (whole and refined) and total fruit and vegetables. There was no association with meat consumption. To test the stability of these findings, the final analysis was replicated in 2541 same-aged adolescents from NHANES 1999–2002; the results were very similar. Among 12- to 16-year-old male and female adolescents, intakes of dairy products and total grains were inversely associated with both measures of central body fat. For example, those in the lowest quartile of WC consumed nearly half a serving more of dairy per day than those in the highest quartile (P for trend = 0.001 and 0.015 for girls and boys, respectively).
Author Conclusion:	These cross-sectional analyses suggest that intakes of dairy, grains and total fruits and vegetables are inversely associated with central obesity among adolescents.
Reviewer Comments	Strengths: Representative sampling of the US population (1998–2002). This study analyzed many pieces including parental education and income, pubertal development, television watching, weight and standing height, and physical activity, which are all important when considering weight status in children and adolescents. In regards to the dietary recall, each of the five food groups were examined, which provides detail about each child and adolescent's diet. Limitations: Data was from the US population sample from 1998-2002, which is outdated compared to the current year. Data was based on one 24-hour recall, which may not be representative of participant's everyday eating habits. Recalls can also contain missing or incorrect information due to poor recall by participants. This study was funded by the National Dairy Council, which has a potential for bias. However, they were not directly involed in the study design, data collection, analysis, or interpretation of results. This study pointed out that those who met the criteria for central obesity consumed significantly less total dairy, and among 12- to 16-year-old male and female adolescents, intakes of dairy products and total grains were inversely associated with both measures of central body fat. For example, those in the lowest quartile of WC consumed nearly half a serving more of dairy per day than those in the highest quartile (P for trend = 0.001 and 0.015 for girls and boys, respectively). This suggests that dairy consumption, including milk, may not be contributing to the overweight and obesity issue among children and adolescents, but may help with maintaining a proper weight status.
Funding Source	National Dairy Council

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	N/A
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
2.2. Were criteria applied equally to all study groups?	2.2	Yes
2.3. Were health, demographics, and other characteristics of subjects described?	2.3	Yes
2.4. Were the subjects/patients a representative sample of the relevant population?	2.4	Yes
3. Were <u>study groups comparable</u>?	3	Yes
3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Yes
3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.2	Yes
3.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.3	Yes
3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.4	Yes
3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3.5	N/A
3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.6	N/A

4. Was method of handling withdrawals described?	4	Yes
4.1. Were follow up methods described and the same for all groups?	4.1	Yes
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.2	Yes
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.3	Yes
4.4. Were reasons for withdrawals similar across groups	4.4	Yes
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
5. Was blinding used to prevent introduction of bias?	5	N/A
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.2	N/A
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.3	Yes
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	5.4	N/A
5.5. In diagnostic study, were test results blinded to patient history and other test results?	5.5	N/A
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	6	N/A
6.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.1	N/A
6.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.2	N/A
6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.3	N/A
6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured?	6.4	N/A
6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described?	6.5	N/A
6.6. Were extra or unplanned treatments described?	6.6	N/A
6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6.7	N/A
6.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
7. Were outcomes clearly defined and the measurements valid and reliable?	7	Yes
7.1. Were primary and secondary endpoints described and relevant to the question?	7.1	Yes
7.2. Were nutrition measures appropriate to question and outcomes of concern?	7.2	Yes
7.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.3	Yes
7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.4	Yes
7.5. Was the measurement of effect at an appropriate level of precision?	7.5	Yes
7.6. Were other factors accounted for (measured) that could affect outcomes?	7.6	Yes
7.7. Were the measurements conducted consistently across groups?	7.7	Yes

8. Was the statistical analysis appropriate for the study design and type of outcome indicators?	8	Yes
8.1. Were statistical analyses adequately described the results reported appropriately?	8.1	Yes
8.2. Were correct statistical tests used and assumptions of test not violated?	8.2	Yes
8.3. Were statistics reported with levels of significance and/or confidence intervals?	8.3	Yes
8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	8.4	N/A
8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.5	Yes
8.6. Was clinical significance as well as statistical significance reported?	8.6	Yes
8.7. If negative findings, was a power calculation reported to address type 2 error?	8.7	N/A
9. **Are conclusions supported by results with biases and limitations taken into consideration?**	9	Yes
9.1. Is there a discussion of findings?	9.1	Yes
9.2. Are biases and study limitations identified and discussed?	9.2	Yes
10. Is bias due to study's funding or sponsorship unlikely?	10	No
10.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
10.2. Was there no apparent conflict of interest?	10.2	No
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Rating: Positive (+)

Citation: Bradlee, M., Singer, M., Qureshi, M., & Moore, L. (2009). Food group intake and central obesity among children and adolescents in the Third National Health and Nutrition Examination Survey (NHANES III). *Public Health Nutr.*, *13*(06), 797-805. http://dx.doi.org/10.1017/s1368980009991546

Evidence Worksheet for Primary RESEARCH Article

Citation:	Huh, S., Rifas-Shiman, S., Rich-Edwards, J., Taveras, E., Gillman, M. (2010). Prospective Association Between Milk Intake and Adiposity in Preschool-Aged Children. *Journal of the American Dietetic Association, 110*(4), 563-570.
Study Design:	Prospective Cohort
Class (A,B,C,D):	B
Quality Rating:	Positive (+)
Research Purpose:	To determine whether the quantity and type of milk (whole, reduced fat, or 1%/nonfat) consumed at age 2 years is associated with adiposity at age 3 years.
Inclusion Criteria:	Women with singleton pregnancies if they entered prenatal care within the first 22 weeks of gestation, intended to continue their obstetric care at Harvard Vanguard Medical Associate, and were able to answer questionnares in English.
Exclusion Criteria:	Women with multiple prenancies and those who were non-English speaking. Children excluded were those that did not drink milk, or who reported drinking predominantly formula or nondairy milk, and those without a 2-year BMI z-score.
Study Protocol:	• From April 1999 to July 2002, participants were enrolled in Project Viva, a longitudinal prebirth cohort of mother-offspring pairs in the Boston, Massachusettes area. Recruitment was conducted at eight obstetric practices within Harvard Vanguard Medical Associates, a managed-care group practice. • Design: Assessed milk and dairy intake at age 2 years with food frequency questionnaires completed by mothers. Our primary outcomes were body mass index (BMI; calculated as kg/m2), z score and overweight at age 3 years, defined as BMI for age and sex 85th percentile. • Blinding: N/A • Intervention: N/A • Statistical Analysis: Linear and logistic regression models, adjusting for maternal BMI and education, paternal BMI, and child age, sex, race/ethnicity, intake of evergy. nondairy beverages, television viewing, and BMI z score at age 2 years were used.
Data Collection Summary:	• Timing of measurements: once at 2 years and again at 3 years old. • Dependent variables: quantity and type of milk drank, BMI and BMI Z-score. • Independent variables: Television viewing hours per week, time spent with other caregivers, maternal and paternal education, yearly household income.
Description of Actual Data Sample:	• Initial: 1,579 • Final: N=852 • Age: preschool-aged children • Anthropometrics: Mean BMI (16.5), BMI z score (0.43), percent

	overweight (26.1%) at age three years, mean birth weight (3,498 g), child daily energy intake at age 2 years (1,549 kcal), mean maternal BMI (24.3), and paternal BMI (26.5).
Summary of Results:	At age 2 years, mean milk intake was 2.6 (standard deviation 1.2) servings per day. Higher intake of whole milk at age 2, but not reduced-fat milk, was associated with a slightly lower BMI z score (0.09 unit per daily serving [95% confidence interval: 0.16 to 0.01]) at age 3 years; when restricted to children with a normal BMI (5th to 85th percentile) at age 2 years, the association was null (0.05 unit per daily serving [95% confidence interval: 0.13 to 0.02]). Intake of milk at age 2 years, whether full- or reduced-fat, was not associated with risk of incident overweight at age 3 years. Neither total milk nor total dairy intake at age 2 years was associated with BMI z score or incident overweight at age 3 years. There was no association between milk intake at age 2 and incident overweight at age 3, regardless of type of milk intake.
Author Conclusion:	Neither consuming more dairy products, nor switching from whole milk to reduced-fat milk at age 2 years, appears likely to prevent overweight in early childhood. Our findings suggest that a higher intake of milk, whether full- or reduced-fat, is unlikely to prevent development of obesity among preschool-aged children. Milk intake, however, may offer other health benefits, including provision of calcium, vitamin D, and other nutrients.
Reviewer Comments	Strengths: prospective dietary data collection; research-standard anthropometric outcome measures and detailed information regarding potential biological, social, and environmental cofounders. Limitations: possible misclassification of the exposure from using a single estimate of intake during a 1-month period at age 2 years. Self-reported data by the mother may have resulted in misclassification of intake as well. Possible underreporting of energy intake by mothers and overweight children. Generalizability of study may be limited due to high levels of maternal education and household income.
Funding Source	National Institute of Health Grants.

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	N/A
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	N/A
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Unclear
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
2.2. Were criteria applied equally to all study groups?	2.2	Yes
2.3. Were health, demographics, and other characteristics of subjects described?	2.3	Yes
2.4. Were the subjects/patients a representative sample of the relevant population?	2.4	Yes
3. Were <u>study groups comparable</u>?	3	Yes
3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Yes
3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.2	Yes
3.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.3	Yes
3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.4	Yes
3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3.5	N/A
3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.6	N/A

4. Was method of handling withdrawals described?	4	Yes
4.1. Were follow up methods described and the same for all groups?	4.1	Yes
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.2	Yes
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.3	Yes
4.4. Were reasons for withdrawals similar across groups	4.4	Yes
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
5. Was blinding used to prevent introduction of bias?	5	N/A
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.2	N/A
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.3	Yes
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	5.4	N/A
5.5. In diagnostic study, were test results blinded to patient history and other test results?	5.5	N/A
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	6	N/A
6.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.1	N/A
6.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.2	N/A
6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.3	N/A
6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured?	6.4	N/A
6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described?	6.5	N/A
6.6. Were extra or unplanned treatments described?	6.6	N/A
6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6.7	N/A
6.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
7. Were outcomes clearly defined and the measurements valid and reliable?	7	Yes
7.1. Were primary and secondary endpoints described and relevant to the question?	7.1	Yes
7.2. Were nutrition measures appropriate to question and outcomes of concern?	7.2	Yes
7.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.3	Unclear
7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.4	Yes
7.5. Was the measurement of effect at an appropriate level of precision?	7.5	Yes
7.6. Were other factors accounted for (measured) that could affect outcomes?	7.6	Yes
7.7. Were the measurements conducted consistently across groups?	7.7	Yes

8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8	Yes
8.1. Were statistical analyses adequately described the results reported appropriately?	8.1	Yes
8.2. Were correct statistical tests used and assumptions of test not violated?	8.2	Yes
8.3. Were statistics reported with levels of significance and/or confidence intervals?	8.3	Yes
8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	8.4	N/A
8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.5	Yes
8.6. Was clinical significance as well as statistical significance reported?	8.6	Yes
8.7. If negative findings, was a power calculation reported to address type 2 error?	8.7	N/A
9. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?**	9	Yes
9.1. Is there a discussion of findings?	9.1	Yes
9.2. Are biases and study limitations identified and discussed?	9.2	Yes
10. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
10.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
10.2. Was there no apparent conflict of interest?	10.2	Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Rating: Positive (+)

Citation: Huh, S., Rifas-Shiman, S., Rich-Edwards, J., Taveras, E., Gillman, M. (2010). Prospective Association Between Milk Intake and Adiposity in Preschool-Aged Children. *Journal of the American Dietetic Association, 110*(4), 563-570.

Evidence Worksheet for Primary RESEARCH Article

Citation:	Bigornia, S., LaValley, M., Moore, L., Northstone, K., Emmett, P., Ness, A., & Newby, P. (2014). Dairy Intakes at Age 10 Years Do Not Adversely Affect Risk of Excess Adiposity at 13 Years. *Journal Of Nutrition*, *144*(7), 1081-1090. http://dx.doi.org/10.3945/jn.113.183640
Study Design:	Prospective Cohort
Class (A,B,C,D):	B
Quality Rating:	Positive (+)
Research Purpose:	To determine the effects of total and full- and reduced-fat dairy intake in children at 10 y of age on risk of excess total body fat mass (TBFM) and overweight at age 13 y.
Inclusion Criteria:	All pregnant women residing in the former County of Avon located in southwest England with an expected delivery date between April 1991 and December 1992 (n=20,248).
Exclusion Criteria:	Participants missing anthropometric, DXA, dietary, and/or physical activity information.
Study Protocol:	• Participants were apart of the Avon Longitudinal Study of Parents and Children (ALSPAC), which was designed to examine the relationship between the environment and the health and development of children. • Design: At age 7 years, children in the study were invited to attend clinical examinations at which time more detailed information was obtained. Data were collected on diet, antropometry, body composition by DXA at 11 and 13 years. • Blinding: N/A • Intervention: N/A • Statistical Analysis: Three separate dietary exposures were tested: total and full- and reduced-fat dairy intakes. We treated these variables as quantiles at baseline (10 y). Outcomes at age 13 were excess TBFM and overweight. We additionally examined change in BMI from baseline to follow-up. We conducted tests for linear trend by treating the independent variable as continuous rather than categorical. The relation between categories of dairy intakes and adiposity were further explored by using change in BMI (13 y minus 10 y) as an outcome.
Data Collection Summary:	• Timing of measurements: Participants completed a 3-day dietary recall before the 10 year and 13 year visits. • Dependent variables: total body fat mass (TBFM) at 13 years. • Independent variables: category of dairy intake
Description of Actual Data Sample:	• Initial: 5102 • Final: N=2455 • Age: 13 years • Other relevant demographics: maternal overweight (n=1880; 77%), maternal educational attainment (n=2292; 93%), and dieting at 13 years (n=2135; 87%).

Summary of Results:	Children in the highest vs. lowest quartile of full-fat dairy intakes (g/d) had a 37% lower risk of excess fat mass at age 13 y in the simple adjusted model (model 1; P-trend = 0.03). In analyses of dairy servings, no relation was evident (P-trend = 0.65; risk of excess TBFM, model 4). In models 1 and 4, those with the highest intakes of total dairy tended ($P < 0.1$) to have smaller gains in BMI (kg/m2) from ages 10 to 13 y compared with those with the lowest intakes of dairy. There was a significant linear trend in model 4 ($P = 0.04$) for smaller gains in BMI among children with higher intakes of total dairy.With regard to full-fat dairy products, those children with the highest intakes compared with those with the lowest intakes had smaller gains in BMI during follow-up in models 1 to 4 ($P < 0.05$ for quartile 1 vs. quartile 4; P-trend < 0.01).
Author Conclusion:	Total and full- and reduced-fat dairy consumption during preadolescence was not associated with excess fat accumulation during early adolescence. These data suggest a protectice effect of dairy consumption but should be interpreted with caution given the wide confidence limits of our estimates. Data indicate that higher dairy consumption during preadolescence does not adversely affect excess fat deposition during early adolescence. Most associations between dairy intakes and excess adiposity were inverse, particularly for full-fat dairy products, suggesting a protective relation. However, given the wide confidence limits of our parameter estimates, additional prospective research is warranted to examine the relation between dairy intake and obesity.
Reviewer Comments	Strengths: Strengths: 3-day food recall instead of 1-day food recall, follow-up of participants, the prospective design reduced the chance of reverse causation, many covariates were adjusted for. Limitations: maternal pregnancy height and weight were self-reported by mothers and used to calculate maternal overweight. Estimates did not reach significance in many cases. Total dairy intakes were underestimated because dairy from mixed dishes such as cheese on pizza were excluded. Compared to US children, total dairy intakes in this cohort of British children were relatively small.
Funding Source	Supported by a grant from the American Diabetes Association.

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	N/A
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
2.2. Were criteria applied equally to all study groups?	2.2	Yes
2.3. Were health, demographics, and other characteristics of subjects described?	2.3	Yes
2.4. Were the subjects/patients a representative sample of the relevant population?	2.4	Yes
3. Were <u>study groups comparable</u>?	3	Yes
3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Yes
3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.2	Yes
3.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.3	Yes
3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.4	Yes
3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3.5	N/A
3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.6	N/A

4. Was method of handling withdrawals described?	4	Yes
4.1. Were follow up methods described and the same for all groups?	4.1	Yes
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.2	Yes
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.3	Yes
4.4. Were reasons for withdrawals similar across groups	4.4	Yes
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
5. Was blinding used to prevent introduction of bias?	5	N/A
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.2	N/A
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.3	Yes
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	5.4	N/A
5.5. In diagnostic study, were test results blinded to patient history and other test results?	5.5	N/A
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	6	N/A
6.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.1	N/A
6.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.2	N/A
6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.3	N/A
6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured?	6.4	N/A
6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described?	6.5	N/A
6.6. Were extra or unplanned treatments described?	6.6	N/A
6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6.7	N/A
6.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
7. Were outcomes clearly defined and the measurements valid and reliable?	7	Yes
7.1. Were primary and secondary endpoints described and relevant to the question?	7.1	Yes
7.2. Were nutrition measures appropriate to question and outcomes of concern?	7.2	Yes
7.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.3	Yes
7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.4	Yes
7.5. Was the measurement of effect at an appropriate level of precision?	7.5	Yes
7.6. Were other factors accounted for (measured) that could affect outcomes?	7.6	Yes
7.7. Were the measurements conducted consistently across groups?	7.7	Yes

8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8	Yes
8.1. Were statistical analyses adequately described the results reported appropriately?	8.1	Yes
8.2. Were correct statistical tests used and assumptions of test not violated?	8.2	Yes
8.3. Were statistics reported with levels of significance and/or confidence intervals?	8.3	Yes
8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	8.4	N/A
8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.5	Yes
8.6. Was clinical significance as well as statistical significance reported?	8.6	Yes
8.7. If negative findings, was a power calculation reported to address type 2 error?	8.7	N/A
9. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?**	9	Yes
9.1. Is there a discussion of findings?	9.1	Yes
9.2. Are biases and study limitations identified and discussed?	9.2	Yes
10. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
10.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
10.2. Was there no apparent conflict of interest?	10.2	Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Rating: Positive (+)

Citation: Bigornia, S., LaValley, M., Moore, L., Northstone, K., Emmett, P., Ness, A., & Newby, P. (2014). Dairy Intakes at Age 10 Years Do Not Adversely Affect Risk of Excess Adiposity at 13 Years. *Journal Of Nutrition*, *144*(7), 1081-1090. http://dx.doi.org/10.3945/jn.113.183640

Evidence Worksheet for Primary RESEARCH Article

Citation:	Vanderhout, S., Birken, C., Parkin, P., Lebovic, G., Chen, Y., O'Connor, D., and Maguire, J. (2016). Relation between milk-fat percentage, vitamin D, and BMI z score in early childhood. *American Journal of Clinical Nutrition, 104*(5), 1-8. http://dx.doi.org/10.3945/ajcn.116.139675
Study Design:	Cross-sectional
Class (A,B,C,D):	D
Quality Rating:	Positive (+)
Research Purpose:	To explore the association between milk fat percentage and both BMI z-score and venous 25-hydroxyvitamin D [25(OH)D]; the secondary was to assess whether milk volume consumed altered this relation.
Inclusion Criteria:	Children recruited through The Applied Research Group for Kids (TARGet Kids!) collaboration in Toronto, Canada.
Exclusion Criteria:	Growth-altering disorders (ie. Failure to thrive), chronic conditions (asthma), or substantial developmental impairment.
Study Protocol:	• Design: parents answered questions about their child's milk consumption habits, play time, screen time, and milk fat consumption in the past three days. • Blinding: N/A • Intervention: N/A • Statistical Analysis: multivariable linear regression.
Data Collection Summary:	• Timing of measurements: once. • Dependent variables: BMI z-score and serum vitamin D levels. • Independent variables: milk fat consumption.
Description of Actual Data Sample:	• Initial: 5,301 • Final: N=2,745 • Age: 1-6 years • Other data: overweight accounted for 21% of participants, 5% obese. Of the participants, 38% had vitamin D levels <75 nmol/L and 5.9% had vitamin D levels <50 nmol/L.
Summary of Results:	There was a positive relation between milk fat percentage and 25(OH)D ($p=0.006$) and a negative relation between milk fat percentage and BMI z-score ($p<0.0001$). Median 25(OH)D was 1.67 nmol/L higher with every 1% increase in milk fat consumption. The average child who drank whole milk had a median 25(OH)D concentration of 5.43 nmol/L higher than a child who drank 1% milk. Those who drank whole milk had lower odds of a serum vitamin D level <50 nmol/L compared to those drinking 1% milk.
Author Conclusion:	Recommendations to consume 2 servings daily of low-fat milk may be decreasing vitamin D concentrations and increasing adiposity. Children may benefit from the higher fat milks.
Reviewer Comments	Strengths: broad, healthy, culturally diverse, large sample population with

	data on milk consumption, vitamin D and adiposity. Limitations: the cross-sectional study design means that causality and direction cannot be established between exposure and outcomes. Other sources of vitamin D were not accounted for.
Funding Source	The Canadian Institutes of Health Research (CIHR), Institute of Human Development, Child and Youth Health grant no. MOP-106532, the CIHR Institute of Nutrition, Metabolism and Diabetes, and the St. Michael's Hospital Foundation.

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	Yes
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	N/A
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	Yes
2.2. Were criteria applied equally to all study groups?	2.2	Yes
2.3. Were health, demographics, and other characteristics of subjects described?	2.3	Yes
2.4. Were the subjects/patients a representative sample of the relevant population?	2.4	Yes
3. Were <u>study groups comparable</u>?	3	Yes
3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Yes
3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.2	Yes
3.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.3	Yes
3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.4	Yes
3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3.5	N/A
3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.6	N/A

4. Was method of handling withdrawals described?	4	No
4.1. Were follow up methods described and the same for all groups?	4.1	N/A
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.2	No
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.3	Yes
4.4. Were reasons for withdrawals similar across groups	4.4	Unclear
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
5. Was blinding used to prevent introduction of bias?	5	N/A
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.2	N/A
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.3	Yes
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	5.4	N/A
5.5. In diagnostic study, were test results blinded to patient history and other test results?	5.5	N/A
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	6	N/A
6.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.1	N/A
6.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.2	N/A
6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.3	N/A
6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured?	6.4	N/A
6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described?	6.5	N/A
6.6. Were extra or unplanned treatments described?	6.6	N/A
6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6.7	N/A
6.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
7. Were outcomes clearly defined and the measurements valid and reliable?	7	Yes
7.1. Were primary and secondary endpoints described and relevant to the question?	7.1	Yes
7.2. Were nutrition measures appropriate to question and outcomes of concern?	7.2	Yes
7.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.3	N/A
7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.4	Yes
7.5. Was the measurement of effect at an appropriate level of precision?	7.5	Yes
7.6. Were other factors accounted for (measured) that could affect outcomes?	7.6	Yes
7.7. Were the measurements conducted consistently across groups?	7.7	Yes

8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8	Yes
8.1. Were statistical analyses adequately described the results reported appropriately?	8.1	Yes
8.2. Were correct statistical tests used and assumptions of test not violated?	8.2	Yes
8.3. Were statistics reported with levels of significance and/or confidence intervals?	8.3	Yes
8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	8.4	Yes
8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.5	Yes
8.6. Was clinical significance as well as statistical significance reported?	8.6	Yes
8.7. If negative findings, was a power calculation reported to address type 2 error?	8.7	N/A
9. Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?	9	Yes
9.1. Is there a discussion of findings?	9.1	Yes
9.2. Are biases and study limitations identified and discussed?	9.2	Yes
10. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
10.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
10.2. Was there no apparent conflict of interest?	10.2	Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Rating: Positive (+)

Citation: Vanderhout, S., Birken, C., Parkin, P., Lebovic, G., Chen, Y., O'Connor, D., and Maguire, J. (2016). Relation between milk-fat percentage, vitamin D, and BMI z score in early childhood. *American Journal of Clinical Nutrition, 104*(5), 1-8. http://dx.doi.org/10.3945/ajcn.116.139675

Evidence Worksheet for Primary RESEARCH Article

Citation:	Schroder, H., Mendez, M., Ribas, L., Funtikova, A., Gomez, S., Fito, M., and Serra-Maiem, L. (2014). Caloric beverage drinking patterns are differentially associated with diet quality and adiposity among Spanish girls and boys. *European Journal of Pediatrics, 173*(9), 1169-1177. Doi.10.1007/s00431-014-2302-x
Study Design:	Cross-sectional
Class (A,B,C,D):	D
Quality Rating:	Neutral (Ø)
Research Purpose:	To assess the impact of beverage consumption pattern on diet quality and anthropometric proxy measures for abdominal adiposity in Spanish adolscents.
Inclusion Criteria:	Participants aged 10-18 years.
Exclusion Criteria:	Participants younger than 10 years or older than 18 years and without parental consent.
Study Protocol:	• The enKid study on nutritional status and food habits of Spanish children and young people, conducted between 1998 and 2000, was a cross-sectional survey of the Spanish population aged 2-24 years. Selected by mulistage random sampling procedures based on an official population census. • Design: Individual caloric beverages were aggregated in three groups according to their energy value and nutrient properties: (a) 100 % juices, including commercial and natural fruit and vegetable juices; (b) low-fat milk, including skim, and semi-fat (2 %) milk; (c) whole-fat milk (4 % fat); and (d) soft drinks, including carbonated and non-carbonated sugar sweetened beverages (SSB). One 24-hour recall was conducted. • Blinding: N/A • Intervention: N/A • Statistical Analysis: K-means clustering was performed to identify caloric beverage patterns, and individuals were classified into mutually independent groups or clusters. The beverage groups were standardised (z values) before clustering to ensure an equal influence on the cluster procedure. One-way ANOVA compared continuous variables between cluster memberships. Tests of proportions used the chi-square method. Multinomial logistic regression analysis was run to determine the association between cluster membership and waist circumference (WC), regressed for age and height, waist/height ratio and adherence to the Mediterranean diet. The multinomial logistic regression coefficients can be interpreted as changes in the membership probability of the analysed cluster versus the reference category.
Data Collection Summary:	• Timing of measurements: Dietary assessment was performed with a 24-h recall. Beverage patterns were identified by cluster analysis. Body weight, height, and waist circumferences were measured on the day of the interview. • Dependent variables: height, weight, and wasit circumference • Independent variables: physical activity, maternal education.

Description of Actual Data Sample:	• Initial: 35,434 • Final: N=1,149 • Age: 10-18 years • Ethnicity: Hispanic
Summary of Results:	In the whole-fat milk cluster, the mean intake was 301 and 244 ml/day in boys and girls, respectively. In the low-fat milk cluster, similar intakes were reported by boys (357 ml/day) and girls (321 ml/day). Boys in the soft drinks cluster had a daily mean consumption of 530 ml of soft drinks, whereas girls in the juice cluster reported an intake of 248 ml of juices per day. The “soft drinks” and “juice” clusters provide the highest amount of energy from beverages in boys (14.0 %) and girls (12.9 %), respectively. Boys in the "soft drinks" cluster had an increased risk of higher BMI z scores, waist circumference, and weight/height ratio in comparison with the "whole milk" cluster.
Author Conclusion:	A caloric beverage pattern dominated by intake of “softdrinks” is related to general and abdominal adiposity and diet quality in Spanish male adolescents. The soft drinks cluster was associated with somewhat lower diet quality and a slightly higher risk of increased abdominal fat compared with the “whole-fat milk” cluster in male adolescents. Girls in the low fat-milk cluster reported a somewhat higher diet quality compared with their peers of the whole-fat milk cluster. Long-term prospective studies are needed to get better insight about the impact of caloric beverage consumption on diet quality and adiposity in adolescents.
Reviewer Comments	Strengths: This was a nationwide, population-based sample with standardized anthropometric measurements. Limitations: cross-sectional design, which prevents drawing causal relationships. One 24-hour recall is not representative of one's overall diet. Day-to-day variation results in random errors that may have weakened the association between caloric beverage consumption and adiposity.
Funding Source	Grants from the Instituto de Salud Carlos III-FEDER.

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	Yes
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	Yes
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	Yes
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	Yes
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	Unclear
2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	No
2.2. Were criteria applied equally to all study groups?	2.2	Yes
2.3. Were health, demographics, and other characteristics of subjects described?	2.3	No
2.4. Were the subjects/patients a representative sample of the relevant population?	2.4	Yes
3. Were <u>study groups comparable</u>?	3	Yes
3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	Unclear
3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.2	Unclear
3.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.3	Yes
3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.4	Yes
3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3.5	N/A
3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.6	N/A

4. Was method of handling withdrawals described?	4	No
4.1. Were follow up methods described and the same for all groups?	4.1	Yes
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.2	No
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.3	Yes
4.4. Were reasons for withdrawals similar across groups	4.4	Unclear
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
5. Was blinding used to prevent introduction of bias?	5	N/A
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.2	N/A
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.3	Yes
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	5.4	N/A
5.5. In diagnostic study, were test results blinded to patient history and other test results?	5.5	N/A
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	6	N/A
6.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.1	N/A
6.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.2	N/A
6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.3	Yes
6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured?	6.4	Yes
6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described?	6.5	N/A
6.6. Were extra or unplanned treatments described?	6.6	N/A
6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6.7	N/A
6.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
7. Were outcomes clearly defined and the measurements valid and reliable?	7	Yes
7.1. Were primary and secondary endpoints described and relevant to the question?	7.1	Yes
7.2. Were nutrition measures appropriate to question and outcomes of concern?	7.2	Yes
7.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.3	Yes
7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.4	Yes
7.5. Was the measurement of effect at an appropriate level of precision?	7.5	Yes
7.6. Were other factors accounted for (measured) that could affect outcomes?	7.6	Yes
7.7. Were the measurements conducted consistently across groups?	7.7	Yes

8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8	Yes
8.1. Were statistical analyses adequately described the results reported appropriately?	8.1	No
8.2. Were correct statistical tests used and assumptions of test not violated?	8.2	Yes
8.3. Were statistics reported with levels of significance and/or confidence intervals?	8.3	Yes
8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	8.4	N/A
8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.5	Yes
8.6. Was clinical significance as well as statistical significance reported?	8.6	Unclear
8.7. If negative findings, was a power calculation reported to address type 2 error?	8.7	Unclear
9. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?**	9	Yes
9.1. Is there a discussion of findings?	9.1	Yes
9.2. Are biases and study limitations identified and discussed?	9.2	Yes
10. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
10.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
10.2. Was there no apparent conflict of interest?	10.2	Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (∅) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (∅) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Rating: Neutral (Ø)

Citation: Schroder, H., Mendez, M., Ribas, L., Funtikova, A., Gomez, S., Fito, M., and Serra-Maiem, L. (2014). Caloric beverage drinking patterns are differentially associated with diet quality and adiposity among Spanish girls and boys. *European Journal of Pediatrics*, *173*(9), 1169-1177. Doi.10.1007/s00431-014-2302-x

Evidence Worksheet for Primary RESEARCH Article

Citation:	Lin SL, Tarrant M, Hui LL, Kwok MK, Lam TH, et al. (2012) The Role of Dairy Products and Milk in Adolescent Obesity: Evidence from Hong Kong's ''Children of 1997'' Birth Cohort. *PLoS ONE 7*(12): e52575. doi:10.1371/journal.pone.0052575
Study Design:	Prospective Cohort
Class (A,B,C,D):	B
Quality Rating:	Neutral (Ø)
Research Purpose:	To examine the associations of milk or other dairy product consumption with adolescent obesity.
Inclusion Criteria:	Born between April 1st, 1997 and May 31st, 1997 and involved in the Hong Kong "Children of 1997" Chinese birth cohort.
Exclusion Criteria:	Born outside of April 1st, 1997 and May 31st, 1997.
Study Protocol:	• The Hong Kong "Children of 1997" birth cohort is a Chinese birth cohort that covered 88.0% of all births from April 1st, 1997 to May 31st, 1997. Families were recruited at the first postnatal visit in any of the Maternal and Child Health Centers in Hong Kong. • Design: primary exposures were frequency of non-milk dairy products consumption and the frequency of milk consumption at about 11 years. The primary outcome was adiposity at about 13 years. A survey included questions on activity level, developmental progress, as well as a food intake frequency questionnaire. • Blinding: N/A • Intervention: N/A • Statistical Analysis: Multivariable linear regression models were used to examine the associations of milk or other dairy product consumption, obtained from a food frequency questionnaire, at 11 years with body mass index (BMI) z-scores at 13 years and waist hip ratio (WHR) at 11 years, in 5,968 adolescents from a Chinese birth cohort, comprising 88% of births in April and May 1997. Multiple imputation for missing exposures and confounders were used.
Data Collection Summary:	• Timing of measurements: Baseline characteristics were obtained at recruitment using a self-administered questionnaire in Chinese and included socio-demographic information and birth characteristics. Passive follow-up via record linkage was instituted in 2005 to obtain weight and height from birth to five years, annual measurements of weight and height (6-7 years and onward), and bi-annual assessments of pubertal status from the Student Health Service, Department of Health, and death records. • Dependent variables: Adiposity at 13 years relative to the 2007 World Health Organization growth standard. • Independent variables: Adiposity at about 13 years related to dairy consumption.
Description of Actual Data Sample:	• Initial: 8327 • Final: N=3679

	• Age: 11-13 years • Ethnicity: Chinese
Summary of Results:	Only 65.7% regularly consumed milk and 72.4% other dairy products. Milk and other dairy product consumption was positively associated with socio-economic position but not with BMI z-score or WHR, with or without adjustment for sex, mother's birthplace, parental education, physical activity and other food consumption. Neither non-milk dairy products nor milk consumption at 11 years was prospectively associated with BMI z-score at about 13 years, adjusted for sex, BMI z-score at 11 years, birth order, and maternal age. Of those who reported waist and hip circumference, neither non-milk dairy products nor milk consumption at about 11 years was associated with WHR cross-sectionally in any model.
Author Conclusion:	The lack of association of milk and other dairy product consumption with adiposity in a non-Western setting was not consistent with the majority of evidence from Western settings. Observed anti-obesigenic effects in Western settings may be due to socially patterned confounding.
Reviewer Comments	Strengths: Great follow-up procedures as well as a large sample size and long-term study. Limitations: Waist and hip circumference was self-reported by participants, which may lead to misclassification. This study reviewed milk consumption in the last week, so may not be an overall representation of participants' diets. This study also did not specify the milk types, milk fat percentages, or dairy types or dairy fat percentages. Not all height and weight measurements were exactly at age 13 years. The results section was weak and did not fully explain the results of the waist and circumference measures at 13 years. When stating the results, the author continuously grouped non-dairy with dairy consumption, which are two different things and should be assessed separately.
Funding Source	Health Care and Promotion Fund, Health and Welfare Burea, Government of Hong Kong and the Research Fund for the Control of Infectious Diseases in Hong Kong.

Relevance Questions		
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi studies)	1	N/A
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	2	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	3	N/A
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	4	N/A
If the answers to all of the above relevance questions are "Yes," the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.		
Validity Questions		
1. Was the <u>research question</u> clearly stated?	1	Yes
1.1. Was the specific intervention(s) or procedure (independent variable(s)) identified?	1.1	N/A
1.2. Was the outcome(s) (dependent variable(s)) clearly indicated?	1.2	Yes
1.3. Were the target population and setting specified?	1.3	Yes
2. Was the <u>selection</u> of study subjects/patients free from bias?	2	Yes
2.1. Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	2.1	No
2.2. Were criteria applied equally to all study groups?	2.2	Yes
2.3. Were health, demographics, and other characteristics of subjects described?	2.3	Unclear
2.4. Were the subjects/patients a representative sample of the relevant population?	2.4	Yes
3. Were <u>study groups comparable</u>?	3	Yes
3.1. Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	3.1	N/A
3.2. Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	3.2	Yes
3.3. Were concurrent controls used? (Concurrent preferred over historical controls.)	3.3	N/A
3.4. If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	3.4	Yes
3.5. If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	3.5	N/A
3.6. If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	3.6	N/A

4. Was method of handling withdrawals described?	4	Yes
4.1. Were follow up methods described and the same for all groups?	4.1	Yes
4.2. Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	4.2	Yes
4.3. Were all enrolled subjects/patients (in the original sample) accounted for?	4.3	Yes
4.4. Were reasons for withdrawals similar across groups	4.4	Yes
4.5. If diagnostic test, was decision to perform reference test not dependent on results of test under study?	4.5	N/A
5. Was blinding used to prevent introduction of bias?	5	Yes
5.1. In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	5.1	N/A
5.2. Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	5.2	Yes
5.3. In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	5.3	Yes
5.4. In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	5.4	N/A
5.5. In diagnostic study, were test results blinded to patient history and other test results?	5.5	N/A
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	6	N/A
6.1. In RCT or other intervention trial, were protocols described for all regimens studied?	6.1	N/A
6.2. In observational study, were interventions, study settings, and clinicians/provider described?	6.2	N/A
6.3. Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	6.3	N/A
6.4. Was the amount of exposure and, if relevant, subject/patient compliance measured?	6.4	N/A
6.5. Were co-interventions (e.g., ancillary treatments, other therapies) described?	6.5	N/A
6.6. Were extra or unplanned treatments described?	6.6	N/A
6.7. Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	6.7	N/A
6.8. In diagnostic study, were details of test administration and replication sufficient?	6.8	N/A
7. Were outcomes clearly defined and the measurements valid and reliable?	7	Yes
7.1. Were primary and secondary endpoints described and relevant to the question?	7.1	Yes
7.2. Were nutrition measures appropriate to question and outcomes of concern?	7.2	Yes
7.3. Was the period of follow-up long enough for important outcome(s) to occur?	7.3	Yes
7.4. Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	7.4	Yes
7.5. Was the measurement of effect at an appropriate level of precision?	7.5	Yes
7.6. Were other factors accounted for (measured) that could affect outcomes?	7.6	Yes
7.7. Were the measurements conducted consistently across groups?	7.7	Yes

8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?	8	Yes
8.1. Were statistical analyses adequately described the results reported appropriately?	8.1	Unclear
8.2. Were correct statistical tests used and assumptions of test not violated?	8.2	Yes
8.3. Were statistics reported with levels of significance and/or confidence intervals?	8.3	Unclear
8.4. Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	8.4	N/A
8.5. Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	8.5	Yes
8.6. Was clinical significance as well as statistical significance reported?	8.6	No
8.7. If negative findings, was a power calculation reported to address type 2 error?	8.7	N/A
9. **Are <u>conclusions supported by results</u> with biases and limitations taken into consideration?**	9	Yes
9.1. Is there a discussion of findings?	9.1	Yes
9.2. Are biases and study limitations identified and discussed?	9.2	Yes
10. Is bias due to study's <u>funding or sponsorship</u> unlikely?	10	Yes
10.1. Were sources of funding and investigators' affiliations described?	10.1	Yes
10.2. Was there no apparent conflict of interest?	10.2	Yes
MINUS/NEGATIVE (-) *If most (six or more) of the answers to the above validity questions are "No," the report should be designated with a minus (-) symbol on the Evidence Worksheet.*		
NEUTRAL (Ø) *If the answers to validity criteria questions 2, 3, 6, and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (Ø) symbol on the Evidence Worksheet.*		
PLUS/POSITIVE (+) *If most of the answers to the above validity questions are "Yes" (including criteria 2, 3, 6, 7 and at least one additional "Yes"), the report should be designated with a plus symbol (+) on the Evidence Worksheet.*		

Rating: Neutral (Ø)

Citation: Lin SL, Tarrant M, Hui LL, Kwok MK, Lam TH, et al. (2012) The Role of Dairy Products and Milk in Adolescent Obesity: Evidence from Hong Kong's ''Children of 1997'' Birth Cohort. *PLoS ONE 7*(12): e52575. doi:10.1371/journal.pone.0052575

APPENDIX C: QUALITY CRITERIA SUMMARY

Quality Criteria Summary									
Questions	Fiorito et al., 2009	Scharf et al., 2013	Murphy et al., 2008	Bradlee et al., 2009	Huh et al., 2010	Bigornia et al., 2010	Vanderhout et al., 2016	Schroder et al., 2014	Lin et al., 2012
Relevance Questions									
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common concern to the dietetics practice?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A
4. Is the intervention or procedure feasible?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Validity Questions									
1. Was the research question clearly stated?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1 Was the specific intervention(s) or procedure (independent variable(s)) identified?									
1.2 Was the outcome(s) (dependent variable(s)) clearly indicated?									
1.3 Were the target population and setting specified?									
2. Was the selection of study subjects/patients free from bias?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes
2.1 Were inclusions/exclusion criteria specified (e.g. risk, point in disease progression, diagnostic or prognosis criteria, and with sufficient detail and without omitting criteria critical to the study?									
2.2 Were criteria applied equally to all study groups?									
2.3 Were health, demographics,									

and other characteristics of subjects described?									
2.4 Were the subjects/patients a representative sample of the relevant population?									
3. Were study groups comparable?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3.1 Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)									
3.2 Were distribution of disease status, prognostic factors, and other factors (e.g. demographics) similar across study groups at baseline?									
3.3 Were concurrent controls used? (Concurrent preferred over historical controls)									
3.4 If cohort study or cross-sectional study were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?									
3.5 If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)									
3.6 If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g. ‘gold standard’)									
4.1 Were follow-up methods described and the same for all groups?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
4.2 Was the number, characteristics of withdrawals (i.e. dropouts, lost to follow-up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow-up goal for a strong study is 80%)									
4.3 Were all enrolled subjects/patients (in the original sample) accounted for?									
4.4 Were reasons for withdrawal similar across groups?									

5. Was blinding used to prevent introduction or bias?									
5.1 In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?									
5.2 Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5.3 In cohort or cross-sectional study, were measurements of outcomes and risk factors blinded?									
5.4 In case control study, was case definition explicit and case assignment not influenced by exposure status?									
5.5 In diagnostic study, were test results blinded to patient history and other test results?									
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?									
6.1 In RTC or other intervention trial, were protocols described for all regimens studied?									
6.2 In observation study, were interventions, study settings, and clinicals/providers described?									
6.3 Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6.4 Was the amount of exposure and, if relevant, subject/patient compliance measured?									
6.5 Were co-interventions (e.g. ancillary treatments, other therapies) described?									
6.6 Were extra or unplanned treatments described?									
6.7 Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?									
6.8 In diagnostic study, were details of test administration and replication sufficient?									
7. Were outcomes clearly defined and the measurements									

valid and reliable?									
7.1 Were primary and secondary endpoints described and relevant to the question?									
7.2 Were nutrition measures appropriate to question and outcomes of concern?									
7.3 Was the period of follow-up long enough for important outcome(s) to occur?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7.4 Was the observations and measurements based on standard, valid, and reliable data collection instruments/test/procedures?									
7.5 Was the measurements of effect at an appropriate level of precision?									
7.6 Were other factors accounted for (measured) that could affect outcomes?									
7.7 Were the measurements conducted consistently across groups?									
8. Was the statistical analysis appropriate for the study design and type of outcome indicators?									
8.1 Were statistical analyses adequately described and the results reported appropriately?									
8.2 Were correct statistical tests used and assumptions of test not violated?									
8.3 Were statistics reported with levels of significance and/or confidence intervals?									
8.4 Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis?)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8.5 Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g. multivariate analyses?)									
8.6 Was clinical significance as well as statistical significance reported?									
8.7 If negative findings, was a power calculation reported to address type 2 error?									
9. Are conclusions supported by results with biases and limitations taken into									

consideration?									
9.1 Is there a discussion of findings?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9.2 Are biases and study limitations identified and discussed?									
10. Is bias due to study's funding or sponsorship unlikely?									
10.1 Were sources of funding and investigators, affiliations described?	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
10.2 Was there no apparent conflict of interest?									