AN ABSTRACT OF THE THESIS OF

Sandra K. Frank for the degree of Master of Science in Nutrition and Food Management presented on May 14, 2002.

Title: Relationships among Weight Status, Dairy Food Consumption, Food and Physical Activity Behavior, and Nutritional Status Parameters of Preschoolers in Tillamook County, Oregon.

Abstract approved: ___________________

Constance Georgiou

The purpose of this cross-sectional population study was to provide an assessment of weight status of a county’s preschool population utilizing the new growth charts and expressed as Body Mass Index, or BMI, -for- age percentile. This study was conducted in conjunction with an annual health screen for incoming kindergartners and consisted of two phases. The first phase involved assisting in the collection of, and statistically analyzing preschoolers’ data collected during the Tillamook Health Screen on May 23-25th, 2001. Height, weight, blood pressure, hemoglobin, and blood lead levels were measured. Also, the preschoolers’ parents completed a 24-hour food intake record and answered questions on mealtime habits. Phase Two consisted of a mailed questionnaire that was sent to parents of preschoolers who were screened in May, 2001, to investigate dairy food
consumption, where meals are eaten, and physical activity habits of their preschoolers.

Four significant findings were documented in this research. Foremost, Tillamook County preschoolers had a lower prevalence of healthy weight and a higher prevalence of at risk of overweight and overweight levels than children their age nationwide. Also, both systolic and diastolic blood pressure increased with increasing BMI-for-age percentiles for males and females. Third, hours spent viewing television—sedentary behavior—was positively related to BMI-for-age percentiles. The combination of more hours of physical activity with less television viewing time was inversely related to BMI-for-age percentiles. Last, Tillamook County preschoolers who were above the healthy weight range ate more Food Guide Pyramid servings of concentrated fats/sweets than children in the healthy weight range.

Data that were not strong enough to reach conclusions about weight status related to dairy product consumption, fat content of dairy products, mealtime habits, meals eaten away from home, blood hemoglobin, and blood lead. Also, no significant associations were found between dairy food intake and blood hemoglobin, blood lead, or blood pressure.

Even at preschool ages, physical activity and diet are important to assess when increasing rates of overweight levels and associated increases in blood pressure are being investigated.
Relationships among Weight Status, Dairy Food Consumption, Food and Physical Activity Behavior, and Nutritional Status Parameters of Preschoolers in Tillamook County, Oregon

by

Sandra K. Frank

A THESIS

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APPROVED:

Major Professor, representing Nutrition and Food Management

Head of Department of Nutrition and Food Management

Dean of Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Sandra K. Frank, Author
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The author expresses sincere appreciation to Dr. Constance Georgiou, PhD, RD, LD. Dr. Georgiou inspired me to pursue this research. Her time, expertise, and commitment to excellence are gratefully appreciated in the preparation of this manuscript.

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DEDICATION

Dedicated to my husband, Bob Frank and children, Rachaele and Nicholas whose support and encouragement made this pursuit possible. The prayers and support of my parents, Norma and Ralph Morrison and Betty and Curtis Frank were also invaluable. This work is also dedicated to my Lord Jesus Christ.
RELATIONSHIPS AMONG WEIGHT STATUS, DAIRY FOOD
CONSUMPTION, FOOD AND PHYSICAL ACTIVITY BEHAVIOR, AND
NUTRITIONAL STATUS PARAMETERS OF PRESCHOOLERS IN
TILLAMOOK COUNTY, OREGON

INTRODUCTION

Objective

Childhood obesity has seen a significant increase in prevalence over the past
two decades (Flegal, Ogden, Wei, Kuczmmarski, & Johnson, 2001; Center for
Disease Control, 2001; Story, Holt, Sofka, 2000). Even preschoolers are included
in this growing trend of children who are at risk of overweight or who are
overweight (Flegal, et al., 2001; Mei, Scanlon, Grummer-Strawn, Freedman, Yip,
& Trowbridge, 1998). This growing concern of childhood obesity, the persistence
of obesity into adulthood, and the health consequences associated with obesity are
the rationale for evaluating the weight status of a county’s preschool population
(Whitaker, Wright, Pepe, Seidel, & Dietz, 1997; Center for Disease Control, 2000;

For over fifteen years, a rural county in northwestern Oregon has conducted a
multi-modular health screening for preschoolers between three- and five-years of
age. The Tillamook County Health Department and Educational Services District
provide a comprehensive health exam to approximately 300 children of Tillamook
County, Oregon during three days each May. The purpose of this research was to
provide an assessment of weight status of the participating preschoolers in the 2001
Health Screen utilizing growth charts that measure overweight differently than it has been assessed before—expressed as Body Mass Index, or BMI, -for- age percentile (Centers for Disease Control, 2000). Weight status of these Tillamook County preschoolers then was compared with national rates of childhood obesity.

Also, preschoolers who were at a healthy weight, at risk of overweight, or who were overweight were compared regarding their food and physical activity behavior. Additional nutritional status parameters—blood hemoglobin and blood lead levels and blood pressure—were also analyzed in relation to weight status. A factor that may be unique to this dairy community—dairy food consumption—was analyzed in relation to weight status, blood hemoglobin and lead levels, and blood pressure.

**Research Questions**

1. Based upon the 2000 BMI-for-age growth charts, what are the rates of risk of overweight and overweight for the preschool children in this 2001 Tillamook County Health Screen and how do these compare with national rates?

2. Is there a relationship between the preschoolers’ BMI-for-age percentile and the following:
   a. amount of dairy food consumption,
   b. fat level of dairy foods consumed,
   c. positive mealtime habits, or
d. where the preschoolers eat their meals and snacks?

3. Is there a relationship between the preschoolers’ weight status and their physical activity levels in terms of the amount of time spent watching television or playing computer or video games and the amount of active play-time?

4. a. Is weight status related to blood hemoglobin, blood lead, or blood pressure levels?
   b. Is dairy food consumption related to blood hemoglobin, blood lead, or blood pressure levels?

**Hypotheses**

1. The proportion of preschoolers screened in Tillamook County’s 2001 Health Screen who are overweight (≥ 95th BMI-for-age percentile) and at risk of overweight (85th to < 95th BMI-for-age percentile) will be no different than the national rates from NHANES III for two- to five-year-olds based upon CDC-US growth charts.

2. BMI-for-age percentiles will increase progressively on the continuum from underweight to overweight with:
   a. increasing dairy food consumption and
   b. increasing consumption of higher fat dairy products; and

2. BMI-for-age percentiles will:
   c. be inversely associated with positive mealtime habits and
d. will increase with increasing frequency of meals and snacks eaten away from home.

3. Preschoolers who spend less time watching television or playing computer or video games and more time in active play will have lower BMI-for-age percentiles than children who spend more time watching television or playing computer or video games and less time in active play.

4. a. Weight status (BMI-for-age percentile) will be related to:
   - **blood hemoglobin**—Underweight preschoolers will have lower hemoglobin levels than preschoolers of other weight status levels.
   - **blood lead**—Underweight preschoolers will be more likely to have blood lead levels higher than 10.0 μg/dL than preschoolers of other weight status levels.
   - **blood pressure**—Blood pressure levels will increase progressively with increasing BMI-for-age percentile.

4. b. Dairy food consumption is related to:
   - **blood hemoglobin**—Preschoolers who consume more than four servings of dairy foods per day will have lower hemoglobin levels than children who eat four or fewer servings of dairy foods daily.
   - **blood lead**—Preschoolers who eat less than the FGP dairy product recommendation of two servings per day are more likely to have higher blood lead levels than preschoolers who eat two or more servings of dairy foods per day.
-blood pressure—The number of daily servings of dairy foods will be inversely related to blood pressure levels.

**Definition of Terms**

**Body Mass Index, BMI:** An index of a person's body weight in relation to their height calculated by dividing weight (in kilograms) by height (in meters) squared. Recent reference growth curves developed by the National Center for Health Statistics (NCHS) now utilize gender and age specific BMI percentile curves for children beginning at two years of age (Centers for Disease Control, 2000).

**BMI-for-age percentile:** BMI percentiles are calculated according to age listed at the half-month point and are gender-specific. Exact percentiles and z-scores are generated statistically utilizing files of L, M, and S parameters. L is listed as the power of the Box-Cox transformation, M as the median of the BMI-for-age, and S as the coefficient of variation of the BMI. A z-score that corresponds to the BMI-for-age percentile is calculated as the following: $z = \frac{((\text{BMI}/M)^*L) - 1}{LS}$ (Centers for Disease Control, 2000).

- **Underweight:** Less than the 5th percentile for BMI-for-age and gender (Centers for Disease Control, 2000).

- **Healthy weight:** At the 5th percentile to less than the 85th percentile for BMI-for-age and gender (Centers for Disease Control, 2000).
• **Risk of overweight**: The 85th percentile to less than the 95th percentile for BMI-for-age and gender (Centers for Disease Control, 2000).

• **Overweight**: At the 95th percentile or above for BMI-for-age and gender (Centers for Disease Control, 2000).

**FGP**: Food Guide Pyramid. USDA's daily food guide for two- to six-year olds is used in this research (United States Department of Agriculture, 1999).

**Preschooler**: In this study, a child who is between three and five years of age.
Body Mass Index—Significance

Childhood obesity is a growing problem that is beginning at increasingly younger ages. This trend is observed in the new CDC growth charts utilizing BMI-for-age percentiles that are designed to provide appropriate reference values for all US children (Flegal, et al., 2001). For example, the prevalence of overweight for two-to-five year-old females in the National Health Examination Surveys was 15.6% in NHANES II, 1976-1980; in NHANES III, 1988-1994, it had increased to 19.1%. The prevalence of overweight for two-to-five year-old males in NHANES II, 1976-1980, was 12.7%; by NHANES III, 1988-1994, the overweight prevalence had increased to 16.7% (Flegal, et al., 2001).

Even in the overweight range, ≥ 95th BMI-for-age percentile, a dramatic increase has been documented. The prevalence of overweight for two-to-five year-old females in NHANES II, 1976-1980, was 5.3%; by NHANES III, 1988-1994, overweight levels had increased to 8.2%. For two-to-five year-old males in NHANES II, 1976-1980, the prevalence of overweight was 4.7%; in NHANES III, 1988-1994, overweight levels were 6.2%. (Flegal, et al., 2001).

Mexican-American children had a higher prevalence of overweight (defined as above the 95th percentile of weight-for-stature) than non-Hispanic black and non-Hispanic white children in NHANES III—1988-1994 (Ogden, Troiano, Briefel,
Kuczmarski, Flegal, & Johnson, 1997). Four- and five- year-old Mexican-American females had a 13.2% prevalence of overweight while 12.0% of Mexican-American males in this age range were overweight (Ogden, et al., 1997).

In addition to providing an assessment of our population’s weight status, BMI is a simple tool to assess fatness in children and is considered the initial screen in obesity evaluation and treatment (Dietz & Bellizzi, 1999; Barlow & Dietz, 1998). The BMI-for-age percentile also relates to increased health risk including hyperlipidemia, elevated insulin, and high blood pressure levels (Center for Disease Control, 2000; Berkey, et al., 2000). Sixty percent of five-to-seventeen year-olds with a BMI-for-age above the 95th percentile have at least one risk factor for cardiovascular disease; twenty percent have two or more risk factors (Freedman, Dietz, Srinivasan, & Berenson, 1999).

At one-to two-years of age, childhood obesity was not a significant predictor of adult obesity, but in three-to-five year-olds it became a strong predictor (Whitaker, et al., 1997). One-third of obese preschool children become obese adults; one-half of obese school-aged children remain obese into adulthood (Serdula, Ivery, Coates, Freedman, Williamson, & Byers, 1993). The persistence of obesity into adulthood, the growing trend of preschoolers who are at risk of overweight or who are overweight, and the health consequences associated with elevated BMI levels summarizes the significance of assessing weight status of preschoolers.
Blood Pressure in Relation to BMI Levels and Dairy Product Consumption

BMI correlates positively with secondary complications of obesity including hypertension (Barlow & Dietz, 1998). A study of children ranging from 0.1 to 6.9 years-of-age found that both systolic and diastolic blood pressure levels increased in obese and non-obese children with an increase of BMI levels (He, Ding, Fong, & Karlberg, 2000). Another study of elementary school-aged children indicated that both systolic and diastolic blood pressures were significantly higher in children at the 95\textsuperscript{th} or above percentile for BMI-for-age and gender compared with non-obese children (Figueroa-Colon, Franklin, Lee, Aldridge, & Alexander, 1997).

Childhood blood pressure is considered to be one of the most significant predictors of adult blood pressure; thus, weight status of the children may have long-lasting health implications (Dietz, 1998; Sinaiko, 2001).

Elevated blood pressure levels have been linked with a calcium deficiency in a segment of the hypertensive population (Groff & Gropper, 2000). Eight observational studies examining dietary calcium with blood pressure in children and adolescents however were inconclusive (Simons-Morton & Obarzanek, 1997). One cohort study with three-to-six year-old children from The Framingham Children's Study noted that as dietary calcium increased, systolic blood pressure decreased (Gillman, Oliveria, Moore, & Ellison, 1992). Conversely, no association was found for diastolic blood pressure and calcium intake. Dairy products were the major source of calcium in this study (Gillman, et al., 1992). New research through
a three-year Dietary Intervention Study in Children (DISC), found blood pressure
to be inversely associated with calcium intake for both systolic and diastolic
pressures (Simons-Morton, Hunsberger, Van Horn, Barton, Robson, McMahon,
Muhonen, Kwiterovich, Lasser, Kimm, & Greenlick, 1997). Dairy products are a
significant source of calcium (Groff & Gropper, 2000; Carruth & Skinner, 2001).
Milk, cheese, and ice cream are included in the list of foods most commonly eaten
by preschoolers with milk, fruit drinks, and regular carbonated beverages all tying
for first place (Skinner, Carruth, Houck, Bounds, Morris, Cox, Moran III, &
Coletta, 1999).

**Blood Hemoglobin in Relation to BMI Levels and Dairy Product Consumption**

Blood hemoglobin levels reflect iron status at the later stages of iron deficiency
(Centers for Disease Control and Prevention, 1998; Lee & Neiman, 1996). Low-
income and minority children are at increased risk for iron deficiency anemia
(Bogen, Duggan, Dover, & Wilson, 2000; Centers for Disease Control and
Prevention, 1998). The Pediatric Nutrition Surveillance System (PedNSS) tracks
low-income children through programs such as the Special Supplemental Nutrition
Program for Women, Infants, and Children (WIC) and Head Start. In the 1997
PedNSS, 16.9% of children aged two to less than five years had anemia (Centers
for Disease Control, 1997). The anemia level based upon race or ethnicity for this
age group was 15.2% for white children and 18.4% for Hispanics. The criteria
used for this assessment was a hemoglobin level of <11.2 g/dL, the CDC level prior to 1998 (Centers for Disease Control, 1997). This anemia rate is higher than the general U.S. population since the PedNSS preferentially enrolls low-income children and children with anemia (Centers for Disease Control, 1997).

The 2000 population for Tillamook County was 24,262 with 93.9% classified as white persons and 5.1% listed as persons of Hispanic or Latino origin (Tillamook County, Oregon, 2000). In Tillamook County, 20.7% of the children were below poverty per the 1997 model-based estimate compared to 16.3% for the state of Oregon (Tillamook County, Oregon, 2000).

Annual screening for iron-deficiency anemia is recommended at ages two- to five-years for children with limited access to food due to poverty or neglect, for those with special health care needs, and for children whose diet is low in iron (Story, Holt, & Sofka, 2000). The Recommended Dietary Allowance, RDA, for iron is seven mg per day for one- to three-year-olds; for four- to eight-year-olds it is ten mg per day (Trumbo, Yates, Schlicker, Poos, 2001). The hemoglobin concentration cutoff values for anemia are age-specific; however, they are not gender-specific until twelve-years of age (Centers for Disease Control and Prevention, 1998).

Blood hemoglobin levels are more closely associated with an intake of high-iron foods such as meats and iron-fortified cereals than with total caloric intake; thus, they may not necessarily correspond with body mass index. (Groff, & Gropper, 2000). Calories from all food sources contribute to BMI. Therefore,
neither an excessive caloric intake nor one that maintains one’s weight is necessarily associated with iron deficiency anemia if high-iron foods are also eaten (Boutry & Needleman, 1996).

An excessive dairy intake—exceeding one quart of milk per day—may have a negative effect on iron absorption in children (Groff & Grooper, 2000). A retrospective study of 55 children ranging from 0.8 to 3.9 years-old with iron deficiency anemia found that 76 percent of the children had a daily milk intake exceeding one quart. Only 16 percent of the children regularly ate meat or iron-fortified cereal (Kwiatkowski, West, Heidary, Smith-Whitley, & Cohen, 1999). When a disproportionate quantity of one food group such as dairy products that are rich in calcium but low in iron displaces iron-rich foods, iron-deficiency anemia may result (Whitney & Rolfes, 1999). This rationale led the Centers for Disease Control and Prevention to recommend that children aged one- to five-years-old drink no more than 24 ounces of cow’s milk, goat’s milk, or soy milk per day (Centers for Disease Control and Prevention, 1998).

The mechanisms explaining how calcium hinders iron absorption have not been fully determined. A meta-analysis of calcium’s role on iron absorption revealed that in most multiple-meal human studies, calcium’s influence on iron absorption is much less than single-meal studies have shown (Lynch, 2000). Included in this analysis was a study of eleven three- to five-year-old children whose mean calcium intake varied from 502 mg/day during a low-calcium diet to 1180 mg/day during a high-calcium diet. Calcium intake was increased by additional dairy products and
calcium-fortified orange juice in the diet. Hemoglobin levels did not differ significantly after adaptation to the high- and low-calcium intakes (Ames, 1999). Further research was recommended for both iron absorption and iron status in children consuming varying calcium intakes (Ames, 1999).

Blood Lead in Relation to BMI Levels and Dairy Product Consumption

Body mass index levels thus far have not been directly correlated with blood lead levels. The connection between blood lead levels and diet is that malnourished children are most vulnerable to lead poisoning (Ballew & Bowman, 2001; Whitney & Rolfes, 1999). When a child has three or more meals per day, the absorption of lead is reduced especially if the diet is high in iron, calcium, and vitamin C (Owen, Splett, & Owen, 1999).

Calcium intake may be inversely linked with lead absorption due to the following actions:

- calcium may bind lead in the gut restricting its availability for absorption;
- calcium may compete with lead in the gut for transport sites;
- calcium may alter intestinal cell avidity for lead; and
- the affinity of target tissues for lead may be changed by calcium intake (Ballew & Bowman, 2001; Groff & Gropper, 2000). A meta-analysis reviewing calcium’s role in reducing lead toxicity in children, however, reviewed an equal
number of studies showing and not showing significant inverse associations between dietary calcium intake and blood lead levels (Ballew & Bowman, 2001). As seen in adult feeding studies, calcium’s protective effect for children may be dependant upon calcium and lead being consumed together (Ballew & Bowman, 2001).

During 1988-1994, US children between the ages of three- to five-years of age had a 5.1% incidence of elevated blood lead levels (10.0 or greater µg/dL) (Kaufmann, Clouse, Olson, & Matte, 2000). While elevated blood lead levels in children decreased approximately 80% from the late 1970’s to 1991-1994, surveillance still needs to be done on a local level (Centers for Disease Control and Prevention, 2000).

**Food Consumption Behavior in Relation to BMI Levels and Dairy Product Consumption**

The interactions among a preschooler’s weight status, food intake, and food consumption behavior, including mealtime habits and where the children eat their meals and snacks, are important to understand.

A high BMI is likely when children eat a higher proportion of calories from protein or fat (Jequier, 2001; Carruth & Skinner, 2001; Anand, Basiotis, & Klein, 1999). However, not all research with preschoolers found a correlation between dietary intakes of total energy, fat, carbohydrate, or protein and percentage of body fat (Atkin & Davies, 2000; Davies, 1997). Instead, physical activity and body
composition were shown to be significantly related to each other in research with 1.5 – 4.5 year-old children; neither energy nor macronutrient intake affected body composition (Atkin & Davies, 2000).

In 1989, two-to-five year-olds’ average total caloric daily intake was 1381 kcalories compared with 1515 kcalories in 1996, according to the Continuing Survey of Food Intakes by Individuals, CSFII (Jahns, Siegaio-Riz, & Popkins, 2001). Total grams of fat increased in the two-to-five year-olds’ diets while the percentage of preschoolers who snacked also increased during the same time frame (Morton & Guthrie, 1998; Jahns, Siegaio-Riz, & Popkins, 2001).

The FGP Dairy Foods group is of particular interest given that Tillamook County, Oregon has been a dairy farming community since the 1850’s when the first cheese was made there (Satterfield, 2000). Tillamook County preschoolers may not follow the national trend for dairy product consumption growing up where mailboxes proudly display, “Got milk?”, where cows outnumber people, and where the world-famous Tillamook Cheese Factory is a major industry (T. Downing, OSU Extension for Tillamook County (personal communication, July 31, 2001); Bradbury, 2001; Tillamook Creamery Association, 2001).

National rates of dairy product consumption decreased overall from 1989-91 to 1994-95 for children aged two to seventeen-years-old according to the Continuing Survey of Food Intakes by Individuals, CSFII (Morton & Guthrie, 1998). Whole milk consumption decreased, low fat milk consumption was stable, and skim milk, cheese, ice cream bars, and pudding consumption rose (Morton & Guthrie, 1998).
Studies have found a positive correlation between the quantity of milk consumed and intake of the micronutrients Vitamin A, iron, zinc, and folate among seven-to-eight year-olds (Ruxton, Kirk, Belton, & Holmes, 1994) and calcium, riboflavin, vitamin B12, and vitamin A among college students (Georgiou & Arquitt, 1992). Conversely, lower intakes of milk along with meat, bread, and vegetables were associated with higher intakes of fruit juice and a lower micronutrient intake (Gibson, 1997). Also, a recent study found that mean longitudinal intakes of calcium (mg/day) and dairy products (number of servings/day) were negatively associated with body fat levels in preschoolers (Carruth & Skinner, 2001). A review of adults participating in NHANES III found that low calcium diets favor increased efficiency of energy storage while high calcium diets favor increased thermogenesis (Zemel M., Shi, Greer, Dirienzo, & Zemel P., 2000).

Parents have a strong influence on their young children’s food intake in terms of food selection, food availability, and modeling of eating behavior (Golan & Weizman, 2001; Birch & Fisher, 1998; Klesges, R., Stein, Eck, Isbell, & Klesges, L., 1991). Klesges and colleagues found that parental monitoring of preschoolers’ diets lowered the number of non-nutritious foods consumed independent of the weight status of the child (Klesges, et al., 1991). However, further studies demonstrated that parents’ restriction of foods increased the desire for and consumption of those foods (Fisher & Birch, 2000; Zive, Frank-Spohrer, Sallis, McKenzie, Elder, Berry, Broyles, & Nader, 1998). Modeling of eating behavior
was demonstrated in Cutting’s research on mothers’ dietary disinhibition—
overeating in the absence of hunger. This parental characteristic was positively
related to their preschool daughters’ overweight status (Cutting, Fisher, Grimm-
Thomas, & Birch, 1999).

Parenting styles including permissive, authoritarian, and authoritative influence
the amount and the kinds of foods that a preschooler eats (Nicklas, et al., 2001;
attitude that allows the preschooler to eat whatever they want is more common in
mothers who work outside the home (Nicklas, et al., 2001). When parents had a
permissive approach to their preschoolers’ food intake, children drank less milk
and had a lower intake of all nutrients, except fat (Anliker, Laus, Samonds, & Beal,
1992). Authoritarian food parenting practices such as rewarding or punishing the
child with food and prompting them to eat when they are not hungry may lead to
increased overweight levels in their children (Birch, et al., 2001; Baughcum,
Burklow, Deeks, Powers, & Whitaker, 1998) Authoritative parenting, on the other
hand, allows the child to make decisions regarding the type of food eaten after
explaining health benefits, introduces new foods with small portions, and praises

Where preschoolers eat their meals also has an impact on dietary intake. Meals
eaten away from home tend to have more total fat, saturated fat, cholesterol, and
sodium but less fiber, calcium, and iron (Stockmyer, 2001; Zoumas-Morse, Rock,
Sobo, & Neuhouser, 2001). Away-from-home meals and snacks increased from
16% in 1977 and 1978 to 27% in 1995 for Americans of all ages (Zoumas-Morse, et. al., 2001). A study of children ages 7-17 years revealed that the top three locations for eating when away from home were, in the following order: work/school/day care, restaurants, and a friend’s home (Zoumas-Morse, et. al., 2001). During the preschool-age, child-care likewise plays an important role in their dietary intakes. In 1995, 14.4 million (75%) of the 19.3 million U.S. children younger than five-years-of-age were in some form of regular child-care arrangement during a usual week (U.S. Census Bureau, 2000). Child-care centers typically provide one or two daily meals in addition to snacks (Nicklas, Baranowski T., Baranowski J., Cullen, Rittenberry, & Olvera, 2001). Parents report that the child-care providers are at least as important and sometimes have more influence than family members in shaping food preferences of their preschoolers (Nicklas, et al., 2001).

Restaurant meals also play a significant role in children’s eating. In the same study of 7-17 year-olds, restaurant meals accounted for only 6% of reported eating yet the energy content was 55% higher than average energy intake at home (Zoumas-Morse, et. al., 2001). Thus restaurants, especially the fast-food type that are proliferating in all areas of the country, are significant in terms of children’s nutrition based on an increased intake of energy from fat and saturated fat (Harnack, Jeffery & Boutell, 2000; Lin, Guthrie, & Frazao, 1999).
Physical Activity in Relation to BMI Levels

In preschoolers, the correlation between body mass index and physical activity is not clearly defined (Sallis, Nader, Broyles, Berry, Elder, McKenzie, & Nelson, 1993). Physical activity energy expenditure may be highly variable in young children with exercise play, rough-and-tumble play, and imaginary play making up their physical activity patterns (Fulton, Burgeson, Perry, Sherry, Galuska, Alexander, Wechsler, & Caspersen, 2001).

Assessment of physical activity and sedentary behavior has been done by indirect calorimetry and the doubly labeled water method; however, they were not seen as viable methods for preschool-age children due to the cost of the research and high burden to participants and staff (Fulton, et al., 2001). In a study of 1.5-4.5 year-old children that did use the doubly labeled water technique to measure total energy expenditure, physical activity level was inversely related to body fat (Atkin & Davies, 2000). But in a longitudinal study of four- to six-year-olds utilizing the doubly labeled water technique and indirect calorimetry, activity energy expenditure was only weakly related positively to fat free mass and negatively to body weight. Activity time, instead, was found to be more significant with a lower weight status corresponding with a more active lifestyle (Goran, Hunter, Nagy, & Johnson, 1997)

The amount of activity time is difficult to measure especially in active children. Direct observation results found that the strongest indicator of children’s physical
activity at home was how much time the preschooler spent outdoors (Sallis, et al., 1993; Klesges, R., Eck, Hanson, Haddock, & Klesges, L., 1990).

Even at preschool age, physical activity may have an impact on weight status. Environmental factors that may indirectly affect children’s physical activity include proximity to a play area, safety of the environment, frequency of play, time spent playing outside, time spent in day care, quality of daycare, and television viewing (Fulton, et al., 2001).

Last, the sedentary behavior of television viewing has been strongly implicated in childhood obesity (Gable, & Lutz, 2000; Anand, et al., 1999; Kohl, & Hobbs, 1998; Anderson, Crespo, Bartlett, Cheskin, & Pratt, 1998). Children who watch more than five hours of television per day are over 4 ½ times more likely to be overweight compared with children who watch no more than two hours per day. The average child watches three to four hours of television per day, but the American Academy of Pediatrics recommends a maximum of one to two hours of quality television, video, or computer games combined per day (Dietz & Stern, 1999). Both the sedentary activity of television viewing and the impact of advertisements on children’s food preferences and food selection seem to have an impact on weight status (Coon, Goldberg, Rogers, & Tucker, 2001; Berkey, et al., 2000; Birch, & Fisher, 1998).
METHODS

Study Design

This cross-sectional population study of a county’s preschool population was conducted in conjunction with an annual health screen for incoming kindergartners and consisted of two phases. The first phase involved assisting in the collection of and statistically analyzing preschoolers’ data collected during the Tillamook Health Screen on May 23-25\textsuperscript{th}, 2001. Height, weight, blood pressure, hemoglobin, and blood lead levels were measured. Also, the preschoolers’ parents completed a 24-hour food intake record and answered questions on mealtime habits. Phase Two consisted of a mailed questionnaire that was sent January of 2002 to parents of preschoolers who were screened in May, 2001, to investigate dairy food consumption, where meals are eaten, and physical activity habits of their preschoolers.

Approval to conduct the study was obtained from the Oregon State University Institutional Review Board for the Protection of Human Subjects. The Tillamook County Health Department provided a letter of agreement for the Phase One study protocol.
Phase One: May 23-25, 2001, Data Collection

Sample

Tillamook County conducts an annual health screen for incoming kindergartners. In addition, three- and four-year-old children are eligible to attend. A total of 286 three- to five-year-olds completed the May 2001, Health Screen and were eligible to participate in the study. Two three-year-olds had forms but height and weight levels were not recorded and four parent consent forms had no charts due to the children not completing the screening process; thus, these children were excluded.

Measurement of Height and Weight

Health Department personnel trained to record anthropometric measurements measured the height of the children to the nearest 1/8-inch, in stocking feet, against a wall tape. Weight was recorded to the nearest ¼-pound on a beam balance scale. Weight was converted into kilograms, height converted into centimeters, and age was recorded in months according to the date of measurement and date of birth.

BMI-for-age and gender was calculated utilizing the LMS technique with L listed as the power of the Box-Cox transformation, M as the median of BMI-for-age, and S as the coefficient of variation of the BMI. The z-scores of -1.881,
-1.645, -1.282, -0.674, 0, 0.674, 1.036, 1.282, 1.645, and 1.881 correspond respectively to the 3rd, 5th, 10th, 25th, 50th, 75th, 85th, 90th, 95th, and 97th smoothed BMI percentiles by gender and age (Kuczmarski, Ogden, Grummer-Strawn, Flegal, Wei, Mei, Curtin, Roche, & Johnson, 2000). Specific instructions were followed for the two SAS programs (gc-setup.sas and gc-calculate.sas) to calculate the percentiles and z-scores based on the CDC growth reference year 2000 (http://www.cdc.gov/nccdphp/dnpa/growthcharts/sas.htm).

**Measurement of Blood Pressure**

Blood pressure was taken by Tillamook County Health Department (TCHD) RN’s, by medical students from Oregon Health Sciences University (OHSU), or by nursing students from Tillamook Bay Community College (TBCC). Child-size cuffs were used to take blood pressure. One measurement was recorded on each child unless a blood pressure reading of \( \geq 116 \) (mm Hg) for systolic and \( \geq 76 \) (mm Hg) for diastolic was recorded, levels classified as significant hypertension in three-to-five-year-olds (Task Force on Blood Pressure Control in Children, 1987). Then, two blood pressure readings were recorded and the average was used in this study. A diagnosis of hypertension requires measurements obtained on at least three separate occasions (Fernandes & McCrindle, 2000). A diagnosis, therefore, cannot be made on this one occasion or in this Health Screen setting when children may have been upset due to having blood drawn or immunizations given or hearing
the reactions of other children. Blood pressure in relation to weight status, however, was investigated in this research.

**Measurement of Blood Lead Levels and Hemoglobin**

A finger stick capillary draw was used for hemoglobin and blood lead assessment. Tillamook County Health Department and the Department of Human Services, Oregon Health Division medical staff collected and analyzed the blood samples. A sample blood size of 50 μL, or 2½ drops of blood, were required for the LeadCare System portable lead analyzer (Esa, Inc, 2001). This system uses the Anodic Stripping Voltammetry method for measuring blood lead concentrations (Esa, Inc, 2001). Blood lead levels were recorded to the nearest 0.1 /μg L and were recorded either as < 1.4 μg /dL or the specific number for higher levels. Blood lead levels of 10.0 μg /dL or greater were considered elevated according to CDC guidelines for children under six-years-of-age (Centers for Disease Control and Prevention, 2000).

Hemoglobin was measured by the Hemocue B-Hemoglobin Photometer to the nearest 0.1 g/dL (Hemocue, Inc.). A hemoglobin level of less than 11.1 g/dL was considered low in the children ages three- to less-than five-years-old; a hemoglobin level of less than 11.5 g/dL was considered low for the five-year-old children (Centers for Disease Control and Prevention, 1998).
Measurement of Food Consumption Behavior

For Phase One, a 24-hour Food Record of the preschooler’s meals and snack intake was mailed to the parents to be completed for the day prior to the preschool screening. The researcher, a Registered Dietitian, coded the Food Record according to the number of servings per day in each food category of the Food Guide Pyramid, FGP, according to the Food Guide Pyramid for Young Children (USDA, 1999). FGP servings were coded as whole or half servings and summed as the number of servings in each food group consumed daily.

For dietary method validation purposes, the 24-hour Food Record and Dairy Food Intake instrument from Phase Two of this study were evaluated on a small sample. During fall of 2001, the Tillamook County Public Health Nutritionist compared dairy food data from the assessment of typical intakes for individuals seen at the Health Department with their 24-hour Food Record and the Dairy Food Intake instrument from Phase Two. For the dairy foods response being investigated, seventy-five percent, 24 out of 32 Food Records reviewed, were in excellent agreement, or within 0.5 servings of their usual intake response.

On the reverse-side of the Food Record, the parents responded to statements describing positive mealtime habits of their child. Responses described as “Always” were coded with a “3”, “Most of the time” was coded with a “2”, “Sometimes” was coded as “1”, and “Never” was given a “0. These answers were summed to calculate a positive mealtime habits score with a range of 15—most
positive—to 0—least positive. The five statements included in the mealtime habits survey were the following:

1. Our family eats meals together.
2. I sit with my child when he or she is eating.
3. I let my child decide how much or how little to eat.
4. I offer my child a variety of foods every day.
5. My child can feed himself or herself.

**Phase Two: Mailed Follow-up Questionnaire**

**Sample**

Two hundred seventeen parents of the 286 screened children (76%) from Phase One who signed consent forms at the May 23-25, 2001, Health Screen authorizing a questionnaire to be sent received a mailed questionnaire to obtain additional information. The purpose of the questionnaire, its confidentiality, and voluntary nature were explained to the parents. In the questionnaire was informed consent language stating that participation was voluntary and that by returning the survey, consent was given to include the parent's responses in this study. A pre-stamped return envelope was included to facilitate a response. Those parents who used a Spanish version of the 24-hour food recall received the information and survey in Spanish. Approximately one week after the initial questionnaire was sent out, a
reminder postcard was sent to all participants who had not returned their form. Also, according to guidelines by Salant and Dillman, another questionnaire packet was mailed to any parent who had not returned their form after approximately three weeks from the initial mailing (Salant & Dillman, 1994). Then, if the questionnaires were not returned, parents were called to inquire if they needed help in completing the survey or if they preferred to complete it by phone. To further encourage participation, small incentives (grocery list note pads and recipes from the Oregon Dairy Council) were offered and sent to all parents who completed the survey.

The Hispanic preschool population was less well represented in Phase Two than in Phase One—8.1% versus 17.1% of the respondents, respectively. The consent form parents needed to fill out during the May 23-25, 2001 Health Screen that would allow them to receive a mailed survey was only in English. If a translator was not available to explain the nature of the form/research, the Spanish-speaking parents were not sent a mailed questionnaire. Out of 49 Spanish-speaking parents in Phase One, 22 were sent mailed questionnaires. Every effort was made to encourage response by these Spanish-speaking parents for Phase Two by providing a Spanish-version of the following: the mailed questionnaire, the reminder postcard, the follow-up note with the second questionnaire, and the incentive. A Spanish-speaking nutrition graduate student followed up with a telephone interview as the researcher did for the English-speaking parents to encourage participation in Phase Two.
Measurement of Types of Dairy Food Consumed

The Phase Two questionnaire surveyed higher fat (whole milk; ice cream, ice cream bars, and milkshakes; and regular cheese or cottage cheese) and lower fat (2% milk; 1% or skim milk; frozen yogurt or flavored yogurt; and low fat cheese including low fat cottage cheese) dairy products consumed in the last week. Each lower-fat and each higher-fat dairy product reported was given a value of "1". Responses for lower fat dairy products were summed to calculate a score for lower-fat dairy products. Likewise, responses for higher-fat dairy products were summed to calculate a score for higher-fat dairy products. The lower-fat dairy product score ranged from 0 to 4 and the higher-fat dairy product score ranged from 0 to 3. The milk response—whole milk, 2%, and 1% or skim milk—was also independently reviewed.

Measurement of Where Meals are Eaten

The questionnaire also asked for information on frequency with which the preschooler eats his/her meals or snacks at daycare, preschool, or kindergarten; at a restaurant or fast-food eating place; or at a relative’s or friend’s home. Responses for each eating place were coded as times per day meals/snacks were eaten at that category of location. “Two or more times each day” was coded as “2”, “about one time each day” as “1”, “about two to four times per week” as “. 43” (3/7th times per
day), “one time per week or less” as “.14” (1/7th times per day), and “not at all” as “0”. Responses for eating at daycare, preschool, or kindergarten; at a restaurant or fast-food eating place; and at a relative’s or friend’s home were reviewed separately and also summed as a measure of meals/snacks eaten away from home.

**Measurement of Physical Activity**

Physical activity and sedentary habits included in the questionnaire asked how many hours per day the preschoolers spent in specified physical activities and how many hours per day they spent watching television or playing computer and video games. Time spent viewing television and playing computer or video games was coded as “3” for “Less than 2 hours each day”, “2” for “2-3 hours each day”, and “1” for “More than 3 hours each day”.

The following physical activities listed in the questionnaire were:

1. Plays outdoors at home with friends or family when weather permits;
2. Participates in physical activity classes such as swimming, gymnastics, or plays team sports; and
3. Plays actively at school during gym class or recess.

If the response for a usual day’s physical activities was “Not at all”, it was coded as “0”. “Less than 1 hour each day” was coded as “0.5”. “One to two hours each day” was coded as “1.5” and “More than 2 hours each day” was coded as “2.5”.
The television viewing response and activities response were analyzed independently of one another. The two scores were also summed to calculate a physical activity score with a range of 1 (more than 3 hours of television watching and a "not at all" response to the three activity questions, daily) to 10.5 (less than 2 hours of television watching and "more than 2 hours each day" to each of the three activity questions, daily).

Phase Two Instrument Development

The Phase Two questionnaire was pilot tested on a limited-income population at the Tillamook County Health Department during August and September 2001. Twelve mothers were asked to complete the questionnaire to test the readability, word usage, and their understanding of the questions. From this input, the wording of how often their child eats meals and snacks was altered for clarity.

The Spanish-version of the questionnaire was developed by paying for the questionnaire to be translated into Spanish, having it reviewed by the bilingual-speaking Tillamook County Health Department health care promotora, and having final revisions translated by a Spanish-speaking nutrition graduate student.

The activity question was altered from its original inquiry regarding the amount of time the child spent in outdoor play after recognizing that the questionnaire would be mailed in January. Further research and input from the following sources
led to asking three physical activity questions that encompassed the entire past year:

- My graduate committee and faculty/ students attending the thesis proposal;
- An OSU Exercise and Sports Science professor; and
- Communicating with recognized authorities who were expert panelists for the Centers for Disease Control and Prevention Workshop on the Assessment of physical activity and sedentary behavior in two- to five-year-old children (Fulton, et al., 2001).

**Subject Consent and Confidentiality**

The data for each child were identified with a number. Request and authorization for release of information is on the Tillamook County Health Department Preschool Health Exam and is dated, signed by the parent (or guardian) of the child, and signed by a witness.

The Phase Two questionnaires were numbered to correspond with the Health Screen number to track responses. When the mailed questionnaires were returned, they were statistically analyzed only as a group and the names/ addresses were destroyed after correspondence with participants was completed. Research data were made available to the Tillamook County Health Department and in a thesis format.
Data Analysis

Statistical tests were performed using JMP IN® statistical analysis software (2001, version 4.0.3, SAS Institute, Pacific Grove, CA) with significance levels set at P < .05. The BMI-for-age percentiles were calculated utilizing two SAS programs (gc-setup.sas and gc-calculate.sas) (http://www.cdc.gov/nccdphp/dnpa/growthcharts/sas.htm). on SAS (2001, version 8.1, SAS Institute, Cary, NC). These figures were then imported into JMP. The Statistics Department at OSU was consulted during the planning stages of the research and after data collection to assist with interpreting statistical tests.

The chi square goodness-of-fit test was used for Hypothesis 1 to compare the distribution of preschoolers in this study who were at risk of overweight and who were overweight to national rates from NHANES III for two-to five-year-olds based upon CDC-US growth charts for both males and females (Flegal, et al., 2001). The prevalence of underweight/ healthy weight children for NHANES III was determined as the proportion from 100% that were not at risk of overweight and overweight. The chi square goodness-of-fit test also was used to compare the distribution of preschoolers who used a Spanish form compared with those who used an English form by weight categories and to compare the distribution of Phase One participants with Phase Two participants.

Linear regression was used to analyze the associations between continuous variables such as blood pressure and BMI-for-age percentiles. An independent
group $t$-test assessed a continuous variable such as hemoglobin for two levels of dairy servings.

Comparing continuous variables with two independent groups when normality was violated, for example, BMI-for-age percentile by two levels of activity, was accomplished by the non-parametric Wilcoxon rank sum test. The Modified Bonferroni procedure then determined if the differences were significantly different from zero, $P<0.05$. The Welch Anova test compared a continuous variable such as female diastolic blood pressure with two weight categories when the variances were not homogeneous. Analysis of Variance was used to compare blood pressure levels by three weight categories. When normality was violated, the Kruskal-Wallis test was used, for example, to compare BMI-for-age percentile for three levels of television viewing. The nature of the relationship for each possible pair of group means was determined by Tukey-Kramer HSD.

The chi-square 2x2 Fisher’s exact test was used to compare two categorical variables (Phase Two milk response by two weight levels); and Pearson’s chi-square test was used to compare three categorical variables (milk response by three categories of age).

Multiple regression comparing the means of lower-fat and higher-fat dairy responses by BMI-for-age percentiles was done using SPSS (2000, version 10.07, SPSS, Inc., Chicago, IL). JMP IN® data was imported into Microsoft Excel and then imported into SPSS for this test.
Medians and ranges were shown in table format when variables were not normally distributed as with the number of FGP servings daily by food group. The FGP servings daily by food group, however, was shown by mean intake in another table to make a comparison of mean intake with the USDA Continuing Survey of Food Intakes by Individuals, 1994-96 (USDA Continuing Survey of Food Intakes by Individuals, 1994-96). Mean and standard error were shown if normality was not violated. Quartiles for meal time habits and for FGP dairy food servings daily were shown by weight status groups to examine relationships at the 25th and 75th percentiles.

Males and females were only analyzed separately to determine if any differences existed, as with the mealtime habits question, and when the literature specified different values by gender. Blood pressure assessment (Fernandes & McCrindle, 2000), prevalence of weight status groups (Flegal, et al., 2001), and mean number of FGP servings daily by food group (USDA Continuing Survey of Food Intakes by Individuals, 1994-96) accordingly were specified by gender. Hemoglobin concentrations for anemia do not vary by gender until age eight (Centers for Disease Control and Prevention, 1998); however, males and females were assessed separately when no significance was seen analyzing them combined.

Hypothesis 4a. proposed that underweight preschoolers would have different blood hemoglobin and blood lead levels than preschoolers of other weight status levels. However, only two underweight preschoolers were part of this study. Healthy weight status children were compared with those at risk of overweight/
overweight for blood hemoglobin. But, weight status was not assessed with blood lead levels since only one child had a blood lead level greater than 10.0 μg/dL.

When comparing weight categories, the two underweight preschoolers were excluded from analysis. Hypothesis 1 was an exception to this when 100% of the distribution of preschoolers in this research was compared with national rates.
RESULTS AND DISCUSSION

Overview of Results

Table 1 shows the method of contact and response rate for Phase Two participants—a subset of Phase One participants. Of the 217 eligible participants who signed consent forms during the May 2001 Health Screen, 136, or 63%, returned the mailed questionnaire. The initial mailing had the highest return—45% of the response. The next most successful method of contact was calling the parents by telephone and the researcher completing the questionnaire according to the parent’s responses.

Table 1—Response for Phase Two participants

<table>
<thead>
<tr>
<th>Method of Contact</th>
<th>n</th>
<th>(Percent of Response)</th>
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<tbody>
<tr>
<td>Initial mailing</td>
<td>61</td>
<td>(44.9%)</td>
</tr>
<tr>
<td>Postcard reminder</td>
<td>15</td>
<td>(11.0%)</td>
</tr>
<tr>
<td>Second mailing</td>
<td>13</td>
<td>( 9.5%)</td>
</tr>
<tr>
<td>Telephone interview</td>
<td>47</td>
<td>(34.6%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>136</td>
<td>62.7% of eligible participants</td>
</tr>
</tbody>
</table>

*a Phase Two participants are a subset of Phase One participants*
Table 2 provides a description of Phase One participants—the 286 three- to five-year-olds who completed the May 2001, Health Screen—and Phase Two participants—a subset of Phase One. The chi-square goodness-of-fit test confirms that there is no difference between Phase One participants compared with Phase Two participants for age, $P=0.5393$, and for gender, $P=0.5306$.

**Table 2—Description of Phase One and Phase Two participants**

<table>
<thead>
<tr>
<th></th>
<th>Phase One participants (n=286)</th>
<th>Phase Two participants (n=136)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age of Participants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-years-old</td>
<td>70 (24.5%)</td>
<td>34 (25.0%)</td>
</tr>
<tr>
<td>4-years-old</td>
<td>111 (38.8%)</td>
<td>58 (42.6%)</td>
</tr>
<tr>
<td>5-years-old</td>
<td>105 (36.7%)</td>
<td>44 (32.4%)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>146 (51.0%)</td>
<td>72 (52.9%)</td>
</tr>
<tr>
<td>Female</td>
<td>140 (49.0%)</td>
<td>64 (47.1%)</td>
</tr>
<tr>
<td><strong>Language Used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish Form Requested</td>
<td>49 (17.1%)</td>
<td>11 (8.1%)</td>
</tr>
<tr>
<td>English Form Used</td>
<td>237 (82.9%)</td>
<td>125 (91.9%)</td>
</tr>
</tbody>
</table>

*Parents who requested forms for the 24-hour food record in Spanish are listed as "Spanish Form requested."
Table 3 shows anthropometric data of Phase One and Phase Two participants, by gender. The chi-square goodness-of-fit test showed no difference between Phase One participants compared with Phase Two participants by weight status category, \( P=0.5487 \) for males and \( P=0.4819 \). In addition, the chi-square goodness-of-fit test showed no difference between Phase One males compared with Phase One females by weight status category, \( P=0.7008 \). Likewise, the chi-square goodness-of-fit test showed no difference between Phase Two males compared with Phase Two females by weight status category, \( P=0.3454 \).

Only two of the Tillamook County preschoolers in this research, or 0.7% were in the underweight weight status category. Data from the 1997 Pediatric Nutrition Surveillance System (PedNSS) lists the prevalence of underweight (defined as weight-for-height <5\textsuperscript{th} percentile of NCHS-CDC reference population) in Oregon as 1.5% of children aged less than five years (Centers for Disease Control, 1997). Thus, the prevalence of underweight preschool children in Oregon overall is a small percentage of children under five-years of age.

The median BMI-for-age percentile for males (81.14) and females (80.57) in Phase One and Phase Two (83.07 for males; 84.34 for females) is within the healthy weight status category; although in Phase Two, the median BMI-for-age percentile is approaching the at risk of weight category (the 85\textsuperscript{th} percentile to less than the 95\textsuperscript{th} percentile for BMI-for-age and gender).
Table 3—Anthropometric data of Phase One and Phase Two participants, by gender

<table>
<thead>
<tr>
<th>Anthropometric Data</th>
<th>Phase One participants</th>
<th>Phase Two participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males n=146</td>
<td>Females n=140</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>Median (Range)</td>
<td>Median (Range)</td>
</tr>
<tr>
<td>Males</td>
<td>19.09 (12.50 - 46.36)</td>
<td>17.96 (12.27 - 37.27)</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>106.68 (90.17 - 127.00)</td>
<td>104.46 (88.90 - 120.65)</td>
</tr>
<tr>
<td>BMI-for-age Percentile</td>
<td>81.14 (1.15 - 100.00)</td>
<td>80.57 (4.48 - 99.94)</td>
</tr>
<tr>
<td>Weight status category</td>
<td>n (Percent of Total)</td>
<td>n (Percent of Total)</td>
</tr>
<tr>
<td>Underweight</td>
<td>1 (0.7%)</td>
<td>1 (0.7%)</td>
</tr>
<tr>
<td>Healthy weight</td>
<td>85 (58.2%)</td>
<td>80 (57.1%)</td>
</tr>
<tr>
<td>Risk of Overweight</td>
<td>28 (19.2%)</td>
<td>32 (22.9%)</td>
</tr>
<tr>
<td>Overweight</td>
<td>32 (21.9%)</td>
<td>27 (19.3%)</td>
</tr>
</tbody>
</table>
Table 4 shows the characteristics of food consumption behavior of Phase One participants, by gender. The median FGP intake for the Dairy, Fruit, and Meat Groups either met or exceeded the FGP for Young Children Daily Guidelines (United States Department of Agriculture, 1999) for both the males and females in this research. However, the median FGP intake for the Vegetable and Grain Group was below the FGP for Young Children Daily Guidelines (United States Department of Agriculture, 1999) for both the males and females in this research. Comparing the Tillamook County preschool males with females in this study, males had a higher Dairy Group intake (median 2.5) than females (median 2.0; **P=0.0049). There was no significant difference in the Grain, Fruit, Vegetable, Meat, and Fats and Sweets FGP Group by gender.

Food consumption behavior was also assessed in this research through determining a mealtime habits score and meals away from home score. The mealtime habits score investigated parenting styles, food availability, and modeling of eating behavior. The Wilcoxon rank sum-test comparing the mean ranks found no significant difference, P=0.4056, between male and female mealtime habits scores.

Meals and snacks eaten away from home were defined as food eaten at three eating places other than home: at daycare/school; restaurant or fast-food eating place; and at a relative’s or friend’s home. The Wilcoxon rank sum-test comparing the mean ranks found no significant difference, P=0.7532, between the male and female eating meals away from home scores.
Table 4—Characteristics of food consumption behavior of Phase One participants, by gender

<table>
<thead>
<tr>
<th>FGP Group</th>
<th>Males Median (Range)</th>
<th>Females Median (Range)</th>
<th>FGP for Young Children Daily Guidelines</th>
<th>P Value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>2.5 (0.5 - 9.5)</td>
<td>2.0 (0.0 - 5.5)</td>
<td>2</td>
<td>0.0049**</td>
</tr>
<tr>
<td>Fruit</td>
<td>3.0 (0.0 - 8.0)</td>
<td>3.0 (0.0 - 8.0)</td>
<td>2</td>
<td>0.6540</td>
</tr>
<tr>
<td>Vegetable</td>
<td>1.0 (0.0 - 4.0)</td>
<td>1.0 (0.0 - 5.0)</td>
<td>3</td>
<td>0.0906</td>
</tr>
<tr>
<td>Grain</td>
<td>5.5 (1.0 -11.0)</td>
<td>5.0 (1.0 -10.0)</td>
<td>6</td>
<td>0.0670</td>
</tr>
<tr>
<td>Meat</td>
<td>2.0 (0.0 - 6.0)</td>
<td>2.0 (0.5 - 5.0)</td>
<td>2</td>
<td>0.5019</td>
</tr>
<tr>
<td>Fats and Sweets</td>
<td>1.0 (0.0 - 7.0)</td>
<td>1.0 (0.0 - 7.0)</td>
<td>&quot;eat less&quot;</td>
<td>0.5551</td>
</tr>
<tr>
<td>Mealtime habits score&lt;sup&gt;c&lt;/sup&gt;</td>
<td>12.0 (8.0 -15.0)</td>
<td>12.0 (8.0 -15.0)</td>
<td></td>
<td>0.4056</td>
</tr>
<tr>
<td>Meals away from home score&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1.8 (0.0 - 4.1)</td>
<td>1.4 (0.1 - 4.1)</td>
<td></td>
<td>0.7532</td>
</tr>
</tbody>
</table>

<sup>a</sup>Reference: United States Department of Agriculture, 1999.

<sup>b</sup>Wilcoxon rank-sum test comparing the mean ranks between genders.

<sup>**P<.01</sup>, using the Modified Bonferroni procedure.

<sup>c</sup>Mealtime habits score ranged from 0 (least positive) to 15 (most positive).

<sup>d</sup>Responses to each of the three eating places away from home (1. daycare, preschool, or kindergarten; 2. restaurant or fast food eating place; and 3. relative’s or friend’s home) were coded as “0” for “not at all”; “.14” for “1 time each week or less”; “.43” for “About 2 to 4 times each week”; “1” for “About 1 time each”; and “2” for “2 or more times each day”. Possible score range was 0 - 6.
Table 5 shows physical activity behavior by gender. Time spent watching television and videos and playing computer and video games addressed sedentary behavior. The Pearson chi-square statistic found no difference in the amount of time spent watching television between males and females, $P=0.8633$.

Time spent in active play addresses physical activity. The Wilcoxon rank-sum test comparing the mean ranks between genders found no difference in the amount of time spent in physical activity, $P=0.4354$.

The television viewing score for sedentary behavior and the physical activity score were then combined for a physical activity behavior score. No difference was found between genders for this combined physical activity score, $P=0.06830$. 
Table 5—Physical activity behavior scores of preschoolers, by gender

<table>
<thead>
<tr>
<th>Physical activity behavior</th>
<th>Male n=72</th>
<th>Female n=64</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Television viewing score&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.0 (1.0 – 3.0)</td>
<td>2.0 (1.0 – 3.0)</td>
<td>0.8633&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Active play-time score&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.5 (0.5 – 7.5)</td>
<td>3.0 (0.5 – 7.5)</td>
<td>0.4354&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Combined television viewing &amp; activity score&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5.5 (2.0 – 10.5)</td>
<td>5.75 (2.5 – 8.5)</td>
<td>0.6830&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Television viewing score was coded as “1” (more than 3 hours each day), “2” (2 to 3 hours each day), and “3” (less than 2 hours each day).

<sup>b</sup> The Pearson chi-square test was not significant, P<.05.

<sup>c</sup> Active play-time was coded as “0” for “not at all”, “0.5” for “less than 1 hour each day”, “1.5” for “1-2 hours each day”, and “2.5” for “more than 2 hours each day” to the following three active play-time questions:
- plays outdoors at home with friends or family when weather permits;
- participates in physical activity classes such as swimming, gymnastics, or plays team sports;
- plays actively at school during gym class or recess.

Possible score range was 0 - 7.5.

<sup>d</sup> Possible score range was 1 - 10.5—televisions viewing and active play-time score combined.

<sup>e</sup> Wilcoxon rank-sum test comparing the mean ranks between genders, P<.05.
Table 6 shows the nutritional status parameters measured in the May 2001 Health Screen, by gender. Blood lead levels were positively skewed; thus, mean ranks were compared between genders with the Wilcoxon rank-sum test. Males and females had significantly different blood lead levels, **P=0.0016.

The mean hemoglobin levels for both males (12.4 g/dL) and females (12.5 g/dL) were above the maximum hemoglobin concentration for anemia—<11.1 g/dL in children ages 2 - <5 years-old and < 11.5 g/dL in children 5 - <8 years-old (Centers for Disease Control and Prevention, 1998). An independent group t test comparing the means between males and females found no difference, P=0.3783.

Systolic blood pressure means for males (95 mm Hg) and females (94 mm Hg) overall were not different, P=0.2802. For both males and females, the mean systolic blood pressure levels were below significant hypertension levels of ≥116 mm Hg in three-to-five-year-olds (Report of the Second Task Force on blood pressure control in children, 1987).

An independent group t test comparing the diastolic blood pressure means between males (62 mm Hg) and females (62 mm Hg) found no difference, P=0.6238. For both males and females, the mean diastolic blood pressure levels were below significant hypertension levels of ≥76 mm Hg in three-to-five-year-olds (Report of the Second Task Force on blood pressure control in children, 1987).
Table 6—Nutritional status parameters of preschoolers, by gender

<table>
<thead>
<tr>
<th>Nutritional status parameters</th>
<th>Male n=146</th>
<th>Female n=140</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood lead (µg/dL)(^a)</td>
<td>Median (Range)</td>
<td>Median (Range)</td>
<td>0.0016**(^b)</td>
</tr>
<tr>
<td></td>
<td>&lt;1.4 (&lt;1.4 – 6.7)</td>
<td>&lt;1.4 (&lt;1.4 – 11.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean±SE (^c)</td>
<td>Mean±SE</td>
<td></td>
</tr>
<tr>
<td>Hemoglobin (g/dL)(^d)</td>
<td>12.4±0.1</td>
<td>12.5±0.1</td>
<td>0.3783(^f)</td>
</tr>
<tr>
<td>Blood pressure (mm Hg)</td>
<td>Systolic(^e)</td>
<td>95±0.8</td>
<td>94±0.8</td>
</tr>
<tr>
<td></td>
<td>Diastolic(^f)</td>
<td>62±0.6</td>
<td>62±0.7</td>
</tr>
</tbody>
</table>

\(^a\) Blood lead levels were coded as 1.4 µg/dL for the recorded level of <1.4 µg/dL or as the specific number for higher levels. Blood lead levels of ≥10.0 µg/dL are considered elevated according to CDC guidelines for children under six-years-of-age (Centers for Disease Control and Prevention, 2000).

\(^b\) Wilcoxon rank-sum test comparing the mean ranks between genders, **P<.01.

\(^c\) SE=standard error.

\(^d\) A hemoglobin level of <11.1 g/dL is considered low in children ages 2 - <5 years-old; a hemoglobin level of < 11.5 g/dL is considered low in children 5 - <8 years-old (Centers for Disease Control and Prevention, 1998).

\(^e\) A systolic blood pressure of ≥116 mm Hg is classified as significant hypertension in three-to-five-year-olds (Report of the Second Task Force on blood pressure control in children, 1987).

\(^f\) A diastolic blood pressure of ≥76 mm Hg is classified as significant hypertension in three-to-five-year olds (Report of the Second Task Force on blood pressure control in children, 1987).

\(^g\) Independent group \(^t\) test comparing the means between males and females, P<.05.
Hypothesis Testing

Hypothesis 1.—Prevalence of Risk of Overweight and Overweight

- The proportion of preschoolers screened in Tillamook County’s 2001 Health Screen who are overweight (≥ 95th BMI-for-age percentile) and at risk of overweight (85th to < 95th BMI-for-age percentile) will be no different than the national rates from NHANES III for two- to five-year-olds based upon CDC-US growth charts.

Table 7 compares the prevalence of overweight, at risk of overweight, and underweight/healthy weight among the preschoolers screened in Tillamook County’s 2001 Health Screen with the weight status of two- to five-year-olds in NHANES III (1988-1994) based upon CDC-US growth charts. The chi square goodness-of-fit statistic showed significance, P<.0001, for both genders. The pre-kindergarteners in this county had lower rates of BMI-for-age percentiles in the underweight/healthy weight ranges and higher rates of BMI-for-age percentiles in the at risk for overweight and overweight ranges than children their age nationwide. The hypothesis is thus rejected.

The most dramatic disparity between Tillamook County and NHANES III preschoolers was in the overweight category. The percent of the Tillamook population who were at the ≥ 95th BMI-for-age percentile was 21.9% for males and
19.3% for females. This contrasts with national rates of overweight of 6.2% for males and 8.2% for females (Flegal, et al., 2001).

Mexican-American children have a higher prevalence of overweight than non-Hispanic black and non-Hispanic white children their age nationwide (Ogden, et al., 1997). While ethnic background was not surveyed in this Tillamook research, parents were asked if they preferred a Spanish version of the 24-hour Food Record compared with an English-version. The distribution of preschoolers by weight categories, gender, and version of the Food Record is shown in Table 8. Weight status distributions of neither male nor female preschoolers were statistically different between the English- and Spanish-speaking categories. The Spanish-speaking males, however, showed a tendency in the direction of higher rates of overweight and lower rates of underweight/ healthy weight than the English males. Both English and Spanish-speaking males in Tillamook County appear to be more often overweight than the national rate of 12.0% of four- and five- year-old Mexican-American males who were overweight (defined as above the 95th percentile of weight-for-stature) in NHANES III, 1988-1994 (Ogden, et al., 1997).

The new CDC growth charts utilizing BMI-for-age percentiles are derived from NHANES data. The most recent cross-sectional nationally representative US survey that CDC used—NHANES III—was conducted in 1988-1994, the comparison time-frame for this research (Flegal, et al., 2001). The epidemic of childhood obesity is well-documented and rates have increased steadily over the past decades (Flegal, et al., 2001; Mei, et al., 1998; Ogden, et al., 1997).
dramatically higher level of overweight in Tillamook County preschoolers than nationwide in NHANES III may not be as stark a contrast with national levels in 2001, as yet undocumented.
Table 7—Distribution of weight status categories among preschoolers screened in Tillamook County’s 2001 Health Screen compared with two-to-five year-olds from NHANES III\(^a\) based upon CDC-US growth charts\(^b\), by gender and three weight categories

<table>
<thead>
<tr>
<th>Weight Status</th>
<th>Tillamook</th>
<th>NHANES III</th>
<th>Tillamook</th>
<th>NHANES III</th>
<th>Tillamook</th>
<th>NHANES III</th>
<th>P value(^* * *)(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=86</td>
<td></td>
<td>n=28</td>
<td>n=32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight/Healthy Weight</td>
<td>58.9</td>
<td>77.1</td>
<td>19.2</td>
<td>16.7</td>
<td>21.9</td>
<td>6.2</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Risk of overweight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=81</td>
<td></td>
<td>n=32</td>
<td>n=27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight/Healthy Weight</td>
<td>57.8</td>
<td>72.7</td>
<td>22.9</td>
<td>19.1</td>
<td>19.3</td>
<td>8.2</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Risk of overweight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


\(^c\) The chi-square goodness-of-fit test comparing the relationship between Tillamook BMI-for-age percentiles and national rates.

\(* * *\) \(P<.001\).
Table 8—Distribution of weight status categories among preschoolers screened in Tillamook County's 2001 Health Screen who used a form translated into Spanish compared with those using the English-version\textsuperscript{a}, by gender and three weight categories

<table>
<thead>
<tr>
<th></th>
<th>Underweight/Healthy Weight %</th>
<th>Risk of overweight %</th>
<th>Overweight %</th>
<th>P value\textsuperscript{b}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spanish</td>
<td>English</td>
<td>Spanish</td>
<td>English</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>n=10</td>
<td>n=76</td>
<td>n=5</td>
<td>n=23</td>
</tr>
<tr>
<td></td>
<td>45.5</td>
<td>61.3</td>
<td>22.7</td>
<td>18.5</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>n=15</td>
<td>n=66</td>
<td>n=6</td>
<td>n=26</td>
</tr>
<tr>
<td></td>
<td>55.6</td>
<td>58.4</td>
<td>22.2</td>
<td>23.0</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Preschoolers whose parents requested forms for the 24-hour Food Record in Spanish are listed as “Spanish”; the English-version of the Food Record was used for all other preschoolers and they are listed as “English”.

\textsuperscript{b} The chi-square goodness-of-fit test comparing the relationship between preschoolers using forms translated into Spanish with preschoolers who had an English-version forms was not statistically significant, P<.05, for either gender.
Hypothesis 2a.—Weight Status and FGP Dairy Food Intake

- BMI-for-age percentiles will increase progressively on the continuum from underweight to overweight with increasing dairy food consumption.

BMI-for-age percentiles of Tillamook County preschoolers did not increase with increasing number of dairy food servings daily. Linear regression of the number of FGP dairy food servings daily on BMI-for-age percentiles was not statistically significant—

\[
\text{BMI-for-age percentiles} = 73.83 - 0.60 \times \text{FGP Dairy Servings} \\
(\text{SE} = 3.41) \quad (\text{SE} = 1.21)
\]

\( n = 268 \quad P = 0.6194 \quad \text{R Square} = 0.0009 \)

The hypothesis is rejected.

Table 9 shows quartiles of FGP dairy food servings daily by three weight status categories and gender.

There were no significant differences between weight status categories and FGP dairy food servings daily for either males, \( P = 0.7104 \) or females, \( P = 0.2209 \).

Two servings of dairy foods is the recommended number of FGP daily servings for two- to six year olds (United States Department of Agriculture, 1999).

Preschoolers in this research at the 25\textsuperscript{th} percentile and below for dairy food servings did not meet the recommended two dairy food servings, with the exception of males in the at risk of overweight category. Children of all weight status categories at the 50\textsuperscript{th} percentile and above met or exceeded the recommendation. In fact, at
the 75th percentile, at risk of overweight and overweight males had an intake of twice the dairy food recommendation.

This research, then, does not correlate with Carruth and Skinner’s longitudinal results that mean intakes of calcium (mg/day) and dairy products (number of servings/day) were negatively associated with body fat levels in preschoolers (Carruth & Skinner, 2001). The healthy weight children in this study did not consume a significantly greater number of dairy products than the overweight children.
Table 9—Quartiles of FGP dairy food servings daily\(^{a}\) for males and females in three weight status categories

<table>
<thead>
<tr>
<th>Quartiles</th>
<th>Recommended # of Dairy Food Servings/day(^{a})</th>
<th>Healthy Weight(^{b}) # of Dairy Food Servings/day</th>
<th>At Risk of Overweight(^{b}) # of Dairy Food Servings/day</th>
<th>Overweight(^{b}) # of Dairy Food Servings/day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25(^{th}) percentile</td>
<td>2</td>
<td>n=80</td>
<td>1.5</td>
<td>n=24</td>
</tr>
<tr>
<td>50(^{th}) percentile</td>
<td>2</td>
<td>n=80</td>
<td>2.5</td>
<td>n=24</td>
</tr>
<tr>
<td>75(^{th}) percentile</td>
<td>2</td>
<td>n=80</td>
<td>3.5</td>
<td>n=24</td>
</tr>
<tr>
<td>(range)</td>
<td>(0.5-7.0)</td>
<td>(0.5-6.0)</td>
<td>(1.0-9.5)</td>
<td></td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25(^{th}) percentile</td>
<td>2</td>
<td>n=75</td>
<td>1.5</td>
<td>n=31</td>
</tr>
<tr>
<td>50(^{th}) percentile</td>
<td>2</td>
<td>n=75</td>
<td>2.0</td>
<td>n=31</td>
</tr>
<tr>
<td>75(^{th}) percentile</td>
<td>2</td>
<td>n=75</td>
<td>3.0</td>
<td>n=31</td>
</tr>
<tr>
<td>(range)</td>
<td>(0-5.5)</td>
<td>(0.5-5.5)</td>
<td>(0-5.0)</td>
<td></td>
</tr>
</tbody>
</table>

\(^{a}\) FGP dairy food servings daily for two- to six year olds is two servings (United States Department of Agriculture, 1999).

\(^{b}\) A Kruskal-Wallis test was applied to the rank data relating the number of dairy food servings/day to weight status categories. The results were not statistically significant, \(P<.05\), for males, \(P=0.7104\) or for females, \(P=0.2209\).
Hypothesis 2b.—Weight Status and Fat Level of Dairy Products

- BMI-for-age percentiles will increase progressively on the continuum from underweight to overweight with increasing consumption of higher fat dairy products.

BMI-for-age percentiles of Tillamook County preschoolers did not increase with increasing consumption of higher fat dairy products. BMI-for-age percentiles were not related to number of lower-fat or higher-fat dairy products.

\[
\text{BMI-for-age percentiles} = 75.17 + 1.63 \text{ Lower-fat dairy} - 1.54 \text{ Higher-fat dairy}
\]

\[
(\text{SE}=8.52) \quad (\text{SE}=2.44) \quad (\text{SE}=2.91)
\]

\[
(\text{P}=0.506) \quad (\text{P}=0.597)
\]

n=136

The hypothesis is rejected.

The number of lower-fat and higher-fat dairy foods was not a significant predictor of BMI-for-age percentiles. Tables 10 and 11 show the lower-fat and higher-fat dairy intake responses for preschoolers who were healthy weight and above healthy weight. Children in both healthy weight and in risk of overweight/overweight categories reported eating both lower-fat and higher-fat foods such as 2% milk and regular cheese. However, the data collected on lower-fat and higher-fat dairy foods did not include specific amounts of each kind of dairy foods consumed.
According to the Continuing Survey of Food Intakes by Individuals (CSFII), whole milk consumption decreased, low fat milk consumption was stable, and skim milk, cheese, ice cream bars, and pudding consumption rose from 1989 – 91 to 1995 – 95 (Morton & Guthrie, 1998). Thus, national trends revealed a simultaneous increase in both lower-fat dairy foods (skim milk) and higher-fat dairy foods (cheese, ice cream bars, and pudding) corresponding with this Tillamook County research.

Table 10—Number (percent) of lower-fat dairy foods reported by preschoolers in Phase Two’s mailed survey who were healthy weight and above healthy weight

<table>
<thead>
<tr>
<th># of Lower-fat Dairy Responses a</th>
<th>Healthy Weight b</th>
<th>Risk of Overweight/ Overweight b</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=73</td>
<td>n=62</td>
</tr>
<tr>
<td>0</td>
<td>1 ( 1.4%)</td>
<td>0 ( 0.0%)</td>
</tr>
<tr>
<td>1</td>
<td>19 (26.0%)</td>
<td>16 (25.8%)</td>
</tr>
<tr>
<td>2</td>
<td>29 (39.7%)</td>
<td>25 (40.3%)</td>
</tr>
<tr>
<td>3</td>
<td>20 (27.4%)</td>
<td>19 (30.6%)</td>
</tr>
<tr>
<td>4</td>
<td>4 ( 5.5%)</td>
<td>2 ( 3.3%)</td>
</tr>
</tbody>
</table>

a Lower-fat dairy response ranged from 0 to 4 lower-fat dairy foods—2% milk; 1% or skim milk; frozen or flavored yogurt; and lower fat cheese.
b The Pearson chi-square test was not significant, P<.05, P=0.8514.
Table 11—Number (percent) of higher-fat dairy foods reported by preschoolers in Phase Two’s mailed survey who were healthy weight and above healthy weight

<table>
<thead>
<tr>
<th># of Higher-fat Dairy Responses&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Healthy Weight&lt;sup&gt;b&lt;/sup&gt; n=73</th>
<th>Risk of Overweight/Overweight&lt;sup&gt;b&lt;/sup&gt; n=62</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>0</td>
<td>1 (1.4%)</td>
<td>1 (1.6%)</td>
</tr>
<tr>
<td>1</td>
<td>20 (27.4%)</td>
<td>18 (29.0%)</td>
</tr>
<tr>
<td>2</td>
<td>36 (49.3%)</td>
<td>32 (51.6%)</td>
</tr>
<tr>
<td>3</td>
<td>16 (21.9%)</td>
<td>11 (17.8%)</td>
</tr>
</tbody>
</table>

<sup>a</sup>Higher-fat dairy response ranged from 0 to 3 higher-fat dairy foods—whole milk; ice cream; and regular fat cheese

<sup>b</sup>The Pearson chi-square test was not significant, P<.05, P=0.9458.

The high prevalence of Tillamook County preschoolers at risk of overweight and overweight in this study stimulated further investigation of food intake. Table 12 shows the fat content of milk consumed during the previous week by the preschoolers who were healthy weight and above healthy weight. The types of milk consumed by children in different weight categories were not significantly different.

More than one response was possible for the type of milk consumed. Both weight categories included preschoolers who drank more than one type of milk in a given week. Healthy weight preschoolers drank whole milk as well as lower-fat milk. Likewise, at risk of overweight/overweight preschoolers drank lower-fat milk as well as whole milk. Two percent milk appeared to be most popular with both groups.
Table 13 compares the types of milk by age. Recommendations for children one- to two-years-of age are to drink whole milk (Whitney & Rolfes, 1999). But, do parents of three year-olds continue providing their children with whole milk? In this study, three-year-olds tended to drink more whole milk than four or five-year-olds although the differences were not statistically significant. Children drank a variety of milks—whole milk, 2% milk, and 1% or skim milk—in each of the three age groups. The response for 2% milk was highest (59 to 69%) for all ages.

A study reviewing the type of milk New York State WIC preschoolers drank found that 40% of white children aged two to less than five-years drank 2% milk, 39% exclusively drank whole milk, 14% exclusively drank 1% and/ or skim milk, and 7% drank whole milk and reduced-fat milk (Dennison, Rockwell, & Nichols, 2001). Dennison’s study found that white children were less likely to consume whole milk if their parents were more highly educated; however, Hispanic children’s whole milk consumption did not decrease with increasing parental education (Dennison, Rockwell, & Nichols, 2001). In addition, Carruth and Skinner’s research found socioeconomic status to be a factor in the type of dairy products consumed. Preschoolers in the highest income group were more likely to use low fat and/ or fat free products (Carruth & Skinner, 2001).

Ethnic, education, and income information on Tillamook County preschoolers’ families would be required to compare results with these studies.
Table 12—Number (percent) of preschoolers who reported drinking whole milk, 2% milk, and 1%/skim milk in Phase Two’s mailed survey, by two weight categories

<table>
<thead>
<tr>
<th>Type of milk consumed</th>
<th>Healthy Weight n=73</th>
<th>Risk of Overweight/Overweight n=62</th>
<th>P Value$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)$^a$</td>
<td>n (%)$^a$</td>
<td></td>
</tr>
<tr>
<td>Whole milk</td>
<td>23 (31.1%)</td>
<td>17 (27.4%)</td>
<td>0.7060</td>
</tr>
<tr>
<td>2% milk</td>
<td>48 (64.9%)</td>
<td>38 (61.3%)</td>
<td>0.5961</td>
</tr>
<tr>
<td>1%/skim milk</td>
<td>20 (27.0%)</td>
<td>16 (25.8%)</td>
<td>0.8481</td>
</tr>
</tbody>
</table>

$^a$ More than one type of milk response possible per child.
$^b$ A 2x2 Fisher’s exact test was not significant, P<.05, for each milk response.

Table 13—Number (percent) of preschoolers who reported drinking whole milk, 2% milk, and 1%/skim milk in Phase Two’s mailed survey, by age

<table>
<thead>
<tr>
<th>Type of milk consumed</th>
<th>3-year olds n=34</th>
<th>4-year olds n=58</th>
<th>5-year old n=44</th>
<th>P Value$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%) of 3-year olds$^a$</td>
<td>n (%) of 4-year olds$^a$</td>
<td>n (%) of 5-year olds$^a$</td>
<td></td>
</tr>
<tr>
<td>Whole milk</td>
<td>13 (38.2%)</td>
<td>14 (24.1%)</td>
<td>13 (29.5%)</td>
<td>0.3584</td>
</tr>
<tr>
<td>2% milk</td>
<td>21 (61.8%)</td>
<td>40 (69.0%)</td>
<td>26 (59.1%)</td>
<td>0.5615</td>
</tr>
<tr>
<td>1%/skim milk</td>
<td>9 (26.5%)</td>
<td>17 (29.3%)</td>
<td>11 (25.0%)</td>
<td>0.8838</td>
</tr>
</tbody>
</table>

$^a$ More than one type of milk response possible per child.
$^b$ The Pearson chi-square test was not significant, P<.05, for each milk response.
Dairy food intake was the primary FGP focus for the preschoolers in this study. But if dairy consumption in this dairy community was not related to the differences between weight status categories, would the other FGP groups be related? Table 14 shows the median (ranges) number of FGP servings daily in each food group for children at healthy weights and above healthy weights. The children above healthy weights reported eating two times (median intake—2.0) as many Fats and Sweets as healthy weight children (median intake—1.0; *P=0.0358). Also, the Wilcoxon rank-sum test approached significance for differences in servings of the Meat Group between two weight status categories (P=0.0598). These results correspond with the literature findings that a high BMI is likely when children eat a higher proportion of calories from protein or fat (Jequier, 2001; Carruth & Skinner, 2001; Anand, Basiotis, & Klein, 1999).
Table 14—FGP servings consumed by healthy weight and above healthy weight preschool children based on the 24-hour Food Record

<table>
<thead>
<tr>
<th>FGP Group</th>
<th>Healthy Weight n = 155</th>
<th>Risk of Overweight/ Overweight n = 111</th>
<th>FGP for Young Children Daily Guidelines&lt;sup&gt;a&lt;/sup&gt;</th>
<th>P value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median (Range)</td>
<td>Median (Range)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>2.0 (0.0 - 7.0)</td>
<td>2.0 (0.0 - 9.5)</td>
<td>2</td>
<td>0.5034</td>
</tr>
<tr>
<td>Fruit</td>
<td>2.5 (0.0 - 8.0)</td>
<td>3.0 (0.0 - 8.0)</td>
<td>2</td>
<td>0.7877</td>
</tr>
<tr>
<td>Vegetable</td>
<td>1.0 (0.0 - 4.0)</td>
<td>1.0 (0.0 - 5.0)</td>
<td>3</td>
<td>0.1950</td>
</tr>
<tr>
<td>Grain</td>
<td>5.0 (1.0 - 11.0)</td>
<td>5.0 (1.0 - 10.0)</td>
<td>6</td>
<td>0.9993</td>
</tr>
<tr>
<td>Meat</td>
<td>2.0 (0.0 - 5.0)</td>
<td>2.0 (1.0 - 6.0)</td>
<td>2</td>
<td>0.0598</td>
</tr>
<tr>
<td>Fats and Sweets</td>
<td>1.0 (0.0 - 5.0)</td>
<td>2.0 (0.0 - 7.0)</td>
<td>“eat less”</td>
<td>0.0358*</td>
</tr>
<tr>
<td>FGP Groups Summed</td>
<td>15.5 (8.0 - 23.0)</td>
<td>16.5 (8.0 - 26.0)</td>
<td></td>
<td>0.0696</td>
</tr>
</tbody>
</table>

<sup>a</sup>Reference: United States Department of Agriculture, 1999.

<sup>b</sup>Wilcoxon rank-sum test comparing the mean ranks between weight categories with the Modified Bonferroni procedure, *P< .05.
Table 15 compares the Tillamook County preschoolers’ FGP Food Groups with the USDA Continuing Survey of Food Intakes by Individuals (CSFII), 1994-96 and the standards of the FGP for Young Children (United States Department of Agriculture, 1999). The mean intake of the Dairy Group for Tillamook County male preschoolers (2.7 servings/day) and female preschoolers (2.4 servings/day) appears somewhat higher than the nationally representative CSFII (1.9 servings/day for both genders) and the FGP for Young Children guidelines (2.0 servings/day). Tillamook County males had a higher Dairy Group intake than Tillamook County females, **P=0.0049.

The mean servings of daily Fruit intake among Tillamook County males (2.9) and females (2.8) also appears somewhat higher than the nationally representative CSFII (2.3 for males; 2.2 for females) and the FGP for Young Children guidelines (2.0). The mean servings per day for the Meat Group appears slightly lower for Tillamook County preschoolers (2.4 for males; 2.3 for females) than young children in the CSFII, 1994-96 (2.8 for males; 2.6 for females) but met the daily recommendations for young children (2.0 servings).

For both the Vegetable and Grains FGP group, the mean intake for Tillamook County preschoolers appeared to be not only less than amounts reported in CSFII but also less than the FGP for Young Children Daily Recommendations. It is nationally recognized that children do not eat the recommended number of vegetable servings per day (American Dietetic Association, 1999; Skinner, Carruth, Houck, Bounds, Morris, Cox, Moran, & Coletta, 1999). Tillamook County
preschoolers are no exception with the mean male Vegetable intake at 43% of recommended servings per day and the mean female Vegetable intake at 53% of the recommendation (United States Department of Agriculture, 1999).

A review of the literature finds conflicting research findings regarding preschoolers' dietary intake and weight status. For example, excessive fruit juice consumption (≥12 fl. oz /day) has both been associated with obesity (Dennison, Rockwell, & Baker, 1997) and not associated with obesity in preschool-aged children (Kloeblen-Tarver, 2001; Skinner Carruth, 2001). Protein intakes have been positively associated with increased adiposity in preschoolers (Carruth & Skinner, 2001); while other research found no correlation with dietary intakes of total energy, fat, carbohydrate, or protein and percentage of body fat (Atkin & Davies, 2000; Davies, 1997).

Tillamook County’s FGP intakes between healthy weight and above healthy weight preschoolers and compared with a national survey found interesting differences, especially for the Fats and Sweets category. However, because this research with Tillamook County preschoolers used the FGP and questions regarding dairy foods based upon fat content to assess dietary intake, specific associations between dietary intakes of total energy, fat, carbohydrate, or protein and weight status cannot be made.
Table 15—Comparison of mean numbers of FGP servings consumed per day by preschoolers in Tillamook County’s 2001 Health Screen and by preschoolers in USDA’s Continuing Survey of Food Intakes by Individuals, 1994-96, by food group and gender with Daily Guidelines for the FGP for Young Children.

<table>
<thead>
<tr>
<th>FGP Group</th>
<th>Tillamook County’s Phase I Results, 2001</th>
<th>USDA Continuing Survey of Food Intakes by Individuals, 1994-96</th>
<th>FGP for Young Children Daily Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male n = 135 Mean Servings/day&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Female n = 133 Mean Servings/day&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Male 2-5 yrs-olds Mean Servings/day</td>
</tr>
<tr>
<td>Dairy</td>
<td>2.7</td>
<td>2.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Fruit</td>
<td>2.9</td>
<td>2.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Vegetable</td>
<td>1.3</td>
<td>1.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Grain</td>
<td>5.5</td>
<td>5.1</td>
<td>6.5</td>
</tr>
<tr>
<td>Meat</td>
<td>2.4</td>
<td>2.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Fats and Sweets</td>
<td>1.7</td>
<td>1.7</td>
<td>NA</td>
</tr>
</tbody>
</table>

<sup>a</sup> Reference: USDA Continuing Survey of Food Intakes by Individuals, 1994-96.


<sup>c</sup> Mean FGP intake from 24h- Food Record shown to be able to compare with CSFII mean 2-day average intake.

NA: Data not available in FGP servings.
Hypothesis 2c.—Weight Status and Mealtime Habits

- BMI-for-age percentiles will be inversely associated with positive mealtime habits.

BMI-for-age percentiles of Tillamook County preschoolers were not inversely associated with positive mealtime habits. Linear regression of positive mealtime habits on BMI-for-age percentiles was not statistically significant—

BMI-for-age percentiles = 71.80 + 0.03 Meal Habits.
(SE = 11.91) (SE = 1.00)

n = 214  P = 0.9763  Rsquare = 0.0000

The hypothesis is rejected.

Table 16 shows quartiles of positive mealtime habits score by three weight status categories and gender. With a possible score range from 0 to 15, there was very little actual variation reported between the 25th percentile (10) and the 75th percentile (14). The five questions asked in this research were perhaps not specific enough or were too subjective to differentiate between weight categories by mealtime habits.

The mealtime habits questions encompassed parenting styles in the question, “I let my child decide how much or how little to eat”. Food availability was addressed by asking, “I offer my child a variety of foods every day”. Even modeling opportunities for the preschoolers were assessed by the following questions: “Our family eats meals together” and “I sit with my child when he or she
is eating”. Previous research found that parenting styles, food availability, and modeling of eating behavior was influential on preschoolers’ food intake (Birch & Fisher, 1998; Fisher & Birch, 2000; Zive, et al., 1998; Cutting, et al., 1999; Nicklas, et al., 2001; & Birch, et al., 2001). Young children are capable of regulating energy intake unless internal cues are disrupted by child-feeding practices that refocus the child from internal hunger and satiety cues to the external eating environment (Birch, et al., 2001).
Table 16—Quartiles of mealtime habits score\(^a\) for males and females by three weight status categories

<table>
<thead>
<tr>
<th></th>
<th>Healthy Weight</th>
<th>Risk of Overweight</th>
<th>Overweight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=126</td>
<td>n=43</td>
<td>n=43</td>
</tr>
<tr>
<td></td>
<td>Mealtime Habits Score</td>
<td>Mealtime Habits Score</td>
<td>Mealtime Habits Score</td>
</tr>
<tr>
<td>Quartiles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>n=68</td>
<td>n=20</td>
<td>n=24</td>
</tr>
<tr>
<td>25(^{th}) percentile</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>50(^{th}) percentile</td>
<td>12.0</td>
<td>12.0</td>
<td>11.5</td>
</tr>
<tr>
<td>75(^{th}) percentile</td>
<td>13.0</td>
<td>12.75</td>
<td>13.0</td>
</tr>
<tr>
<td>Female</td>
<td>n=58</td>
<td>n=23</td>
<td>n=19</td>
</tr>
<tr>
<td>25(^{th}) percentile</td>
<td>10.0</td>
<td>11.0</td>
<td>11.0</td>
</tr>
<tr>
<td>50(^{th}) percentile</td>
<td>12.0</td>
<td>11.0</td>
<td>13.0</td>
</tr>
<tr>
<td>75(^{th}) percentile</td>
<td>13.0</td>
<td>13.0</td>
<td>14.0</td>
</tr>
</tbody>
</table>

\(^a\)Mealtime habits score had a range from 0 – 15 with 0 being least positive and 15 being most positive.

- A Kruskal-Wallis test compared mealtime habits scores among weight status categories. The results were not statistically significant, \(P<.05\), for males, \(P=0.8404\) or for females, \(P=0.2828\).
Hypothesis 2d.—Weight status and meals eaten away from home

- BMI-for-age percentiles will increase with increasing frequency of meals and snacks eaten away from home.

BMI-for-age percentiles were not related to frequency of meals and snacks eaten away from home. Linear regression of meals and snacks eaten away from home on BMI-for-age percentiles was not statistically significant—

\[ \text{BMI-for-age percentiles} = 77.66 - 1.20 \text{Meals/ snacks eaten away from home} \]
\[ \text{(SE} = 4.23) \] \[ \text{(SE} = 2.31) \]

n=136   P Value = 0.6024   Rsquare = 0.0020

The hypothesis is rejected.

Table 17 compared BMI-for-age percentiles between preschoolers who ate fewer meals and snacks away from home with those who ate more meals and snacks away from home. There was no significant difference in BMI-for-age percentiles between the groups. In fact, the median and ranges of BMI-for-age percentiles were remarkably similar between the two groups.

A closer look at the question, “Where do Tillamook preschoolers eat their meals and snacks?” is detailed in Table 18. Daycare, preschool, and kindergarten played an important role for the preschoolers' food intake since 44% responded that they ate “two or more times each day” at these places. Another 30% checked “about one time each day” for meals or snacks eaten at daycare, preschool, or kindergarten. This corresponds to statistics that report 75% of children younger
than five-years-of-age were in some form of regular child-care arrangement during a usual week (U.S. Census Bureau, 2000) and that child-care centers typically provide one or two daily meals in addition to snacks (Nicklas, et al., 2001). Daycare and school likewise play an important role in meals and snacks eaten away from home for school-aged children. A study of children ages 7-17 years revealed that the top three locations for eating when away from home were, in descending order: work/school/day care, restaurants, and a friend’s home (Zoumas-Morse, et al., 2001).

Food eaten at restaurants tends to have more total fat, saturated fat, cholesterol, and sodium but less fiber, calcium, and iron (Stockmyer, 2001; Zoumas-Morse, et al., 2001) than food eaten at home. Ninety-five percent of the Tillamook preschoolers polled ate at a restaurant or fast-food eating place only one time each week or less. The depressed economy of Tillamook County and a limited number of eating places may have contributed to the limited frequency with which preschoolers ate out in restaurants. The study conducted by Zoumas-Morse and colleagues found that while restaurant meals accounted for only six percent of all reported eating, energy content of restaurant meals was 55% higher than meals eaten at home (Zoumas-Morse, et al., 2001).

The last eating place reviewed in relation to weight status was a relative’s or friend’s home. The majority—55.6%—of the Tillamook preschoolers in Phase Two ate at a relative’s or friend’s home one time each week or less and 28.6% did
not eat there at all. This was not a frequent eating place for meals or snacks and did not significantly affect BMI-for-age percentiles.

Thus, Tillamook County preschoolers most frequently ate meals and snacks away from home at daycare/ or school. They ate much less frequently at restaurants or at a relative’s or friend’s home.

Table 17—BMI-for-age percentiles of preschoolers who ate low and high numbers of meals and snacks a away from home

<table>
<thead>
<tr>
<th>BMI-for-age percentile</th>
<th>Low Eating Out Scoreb n=71</th>
<th>High Eating Out Scorec n=65</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI-for-age percentile</td>
<td>83.34 (10.99 – 99.99)</td>
<td>83.78 ( 4.48 – 100.00)</td>
</tr>
</tbody>
</table>

a Responses to each of the three eating places away from home (1. daycare, preschool, or kindergarten; 2. restaurant or fast food eating place; and 3. relative’s or friend’s home) were coded as “0” for “not at all”; “.14” for “1 time each week or less”; “.43” for “About 2 to 4 times each week”; “1” for “About 1 time each”; and “2” for “2 or more times each day”.
Possible score range was 0 - 6. Actual response range was 0.00 – 4.14.
b Low eating out score—summed score of less than two.
c High eating out score—summed score of two or greater.
-Wilcoxon rank sum-test comparing the mean ranks found no significant difference, P<.05, P=0.8310.
Table 18—Frequency of preschoolers’ meals and snacks eaten at three eating places away from home

<table>
<thead>
<tr>
<th>Frequency of Eating</th>
<th>At Daycare, Preschool, or Kindergarten</th>
<th>At a Restaurant or Fast-Food Eating Place</th>
<th>At a Relative’s or Friend’s home</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=136&lt;sup&gt;a&lt;/sup&gt;</td>
<td>n=132&lt;sup&gt;a&lt;/sup&gt;</td>
<td>n=133&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>2 or more times each day</td>
<td>n=60</td>
<td>n=0</td>
<td>n=8</td>
</tr>
<tr>
<td></td>
<td>44.1%</td>
<td>0.0%</td>
<td>6.0%</td>
</tr>
<tr>
<td>About 1 time each Day</td>
<td>n=41</td>
<td>n=1</td>
<td>n=3</td>
</tr>
<tr>
<td></td>
<td>30.2%</td>
<td>0.8%</td>
<td>2.3%</td>
</tr>
<tr>
<td>About 2 to 4 times each week</td>
<td>n=22</td>
<td>n=6</td>
<td>n=10</td>
</tr>
<tr>
<td></td>
<td>16.2%</td>
<td>4.5%</td>
<td>7.5%</td>
</tr>
<tr>
<td>1 time each week or less</td>
<td>n=1</td>
<td>n=102</td>
<td>n=74</td>
</tr>
<tr>
<td></td>
<td>0.7%</td>
<td>77.3%</td>
<td>55.6%</td>
</tr>
<tr>
<td>Not at all</td>
<td>n=12</td>
<td>n=23</td>
<td>n=38</td>
</tr>
<tr>
<td></td>
<td>8.8%</td>
<td>17.4%</td>
<td>28.6%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<sup>a</sup> Phase two mailed survey, n=136. Four surveys left the restaurant eating place blank; three surveys left the relative’s or friend’s home eating place blank.
Hypothesis 3—Weight Status and Physical Activity

- Preschoolers who spend less time watching television or playing computer or video games and more time in active play will have lower BMI-for-age percentiles than children who spend more time watching television or playing computer or video games and less time in active play.

Table 19 shows that preschoolers who reported more activity (less television viewing or playing computer or video games and more active play-time) had lower BMI-for-age percentiles than children who reported less activity (more television viewing or playing computer or video games and less active play-time). The Wilcoxon rank sum test comparing the mean ranks of BMI-for-age percentiles between preschoolers of two activity levels showed significance, **P= 0.0011. The hypothesis is not rejected.

The median BMI-for-age percentile of those with more reported activity (median = 76.1) was in the healthy range; while, preschoolers reporting less activity had a median BMI-for-age percentile (median = 89.3) in the risk of overweight category.
Table 19—BMI-for-age percentile of preschoolers reporting two levels of physical activity for television viewing and activity questions combined

<table>
<thead>
<tr>
<th>BMI-for-age percentile</th>
<th>More Activity b</th>
<th>Less Activity c</th>
<th>P Value** d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=66</td>
<td>n=70</td>
<td></td>
</tr>
<tr>
<td>Median (Range)</td>
<td>76.07 (4.48 – 100)</td>
<td>89.31 (10.99 – 99.98)</td>
<td>0.0011</td>
</tr>
</tbody>
</table>

a Possible score range was 1 to 10.5.
b More Activity (less television viewing and more active play-time) = A score greater than 5

c Less Activity (more television viewing and less active play-time) = A score of 5 or less.
d Wilcoxon rank sum test comparing the mean ranks of BMI-for-age percentiles between preschoolers of two activity levels.

**P<.01, using the Modified Bonferroni procedure.
Also, a linear regression of Less TV + More Activity on BMI-for-age percentile was significant, *P= 0.0100, as observed in Figure 1. Less time spent watching television and playing computer or video games and more time spent in active play was inversely related to BMI-for-age percentiles.

**Figure 1—Linear regression of Less TV + More Activity on BMI-for-age percentile**

---

**Linear Fit**

BMI-for-age percentile = 94.82 - 3.39 TV+Activity  
(SE = 7.59)  (SE = 1.30)

n=136  P = 0.0100  Rsquare = 0.0485

SE = Standard Error  BMIPCT = BMI-for-age percentile
The physical activity question addressed both sedentary behaviors—time spent watching television or playing computer or video games—and active play-time. Table 20 compares BMI-for-age percentiles of preschoolers with three levels of television viewing/playing computer and video games. Tillamook County preschoolers who reportedly watched television or played computer or video games less than two hours each day had BMI-for-age percentiles significantly lower (median = 76.1) than preschoolers who watched more than three hours each day (median = 87.4). The median BMI-for-age percentile of those with the high television viewing time was in the risk of overweight category; whereas, preschoolers with low levels of television viewing time were in the healthy range. Risk of overweight in children is positively associated with hours of television viewing/playing computer and video games for this Tillamook County preschool population. A positive association between television viewing time and childhood obesity has also been documented in the literature (Gable, & Lutz, 2000; Anand, et al., 1999; Kohl, & Hobbs, 1998; Anderson, et al., 1998).
Table 20—BMI-for-age percentiles of preschoolers reporting three levels of television viewing/ playing computer and video games

<table>
<thead>
<tr>
<th>BMI-for-age percentile</th>
<th>Low TV Viewing</th>
<th>Moderate TV Viewing</th>
<th>High TV Viewing</th>
<th>P Value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (Range)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76.07 (8.10 - 99.61)&lt;sup&gt;x&lt;/sup&gt;</td>
<td>83.93 (4.48 – 100)&lt;sup&gt;xy&lt;/sup&gt;</td>
<td>87.42 (18.46 - 99.94)&lt;sup&gt;y&lt;/sup&gt;</td>
<td>0.0155*</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Levels of television viewing (and playing computer or video games) are the following:
- Low TV Viewing = less than 2 hours each day;
- Moderate TV Viewing = 2 to 3 hours each day;
- High TV Viewing = more than 3 hours each day.

<sup>b</sup> A Kruskal-Wallis test was applied to the rank data of BMI-for-age percentile among three levels of television viewing/ playing computer and video games. Values with different superscripts in the same row show differences between BMI-for-age percentiles, *P<.05, using Tukey-Kramer.

Active play-time was the second component of physical activity in Hypothesis 3. Since Phase Two was conducted in January and February when physical inactivity is usually higher than in summer months (Fulton, 2001) and Tillamook County’s weather is known to be wet and cold during winter months (Tillamook County, Oregon, 2000), parents were asked to consider the entire past year for the choice that best described their child’s activity. Also, because preschoolers’ physical activity expenditure is known to be highly variable (Fulton, et al., 2001) and difficult to assess (Salis, et al., 1993; Klesges, R., et al., 1990), activity time corresponding with a more active lifestyle (Goran, Hunter, Nagy, & Johnson, 1997) was considered. Outdoor play time, when weather permitted, was asked based on
direct observation results cited in the literature that found the strongest indicator of children’s physical activity at home to be how much time the preschooler spent outdoors (Sallis, Nader, Broyles, Berry, Elder, McKenzie, & Nelson, 1993; Klesges, R., Eck, Hanson, Haddock, & Klesges, L., 1990). The other two questions asked encompassed time spent in physical activity classes and/or team sports and active play-time at school in gym class or recess.

Table 21 compares BMI-for-age percentiles of preschoolers reporting two levels of physical activity. The difference in BMI-for-age percentiles approached significance in the predicted direction, $P=0.0645$, between Tillamook County preschoolers who were more active—BMI-for-age percentile median = 81.0—compared with preschoolers who were less active—BMI-for-age percentile median = 85.9. Other research has found physical activity levels to be inversely related to body fat in preschoolers (Atkin & Davies, 2000).

Active play-time alone did not differentiate BMI-for-age percentiles. Only television viewing/ playing computer and video games alone and the combination of the television viewing/ playing computer and video games question and the active play-time question were significant.
Table 21—BMI-for-age percentiles of preschoolers reporting two levels of active play-time

<table>
<thead>
<tr>
<th>BMI-for-age percentile</th>
<th>More Active Play-time</th>
<th>Less Active Play time</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=66</td>
<td>n=70</td>
<td></td>
</tr>
<tr>
<td>Median (Range)</td>
<td>Median (Range)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80.97 (4.48 – 100)</td>
<td>85.92 (10.99 – 99.98)</td>
<td>0.0645</td>
<td></td>
</tr>
</tbody>
</table>

Active play-time was coded as “0” for “not at all”, “0.5” for “less than 1 hour each day”, “1.5” for “1-2 hours each day”, and “2.5” for “more than 2 hours each day” to the following three active play-time questions:
- plays outdoors at home with friends or family when weather permits;
- participates in physical activity classes such as swimming, gymnastics, or plays team sports;
- plays actively at school during gym class or recess.
Possible score range was 0 - 7.5.
More Active play-time score = less than 3.5.
Less Active play-time score = 3.5 or greater.
Wilcoxon rank sum test comparing the ranks of BMI-for-age percentile between preschoolers of two activity levels found no significant differences, P<.05.
Hypothesis 4a.—Weight Status and Blood Hemoglobin

- Underweight preschoolers will have lower hemoglobin levels than preschoolers of other weight status levels.

Hypothesis 4a. was not able to be tested as written since the sample included only one underweight male and one underweight female. A comparison of hemoglobin levels between healthy weight preschoolers and above healthy weight preschoolers is shown in Table 22. Males above healthy weight did have significantly higher blood hemoglobin levels than healthy weight males but both were in the normal range. No differences in hemoglobin levels were found between females of different weight status.

Table 22—Mean blood hemoglobin* levels of preschool children who are healthy weight and at risk of overweight/overweight

<table>
<thead>
<tr>
<th>Hemoglobin (g/dL)</th>
<th>Healthy Weight</th>
<th>At Risk of Overweight/Overweight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean±SE</td>
</tr>
<tr>
<td>Male</td>
<td>84</td>
<td>12.3±0.1</td>
</tr>
<tr>
<td>Female</td>
<td>79</td>
<td>12.6±0.1</td>
</tr>
</tbody>
</table>

* A hemoglobin level of <11.1 g/dL is considered low in children ages 2 - <5 years-old; a hemoglobin level of < 11.5 g/dL is considered low in children 5 - <8 years-old (Centers for Disease Control and Prevention, 1998).

b SE=standard error.

c Independent group t test comparing the means of blood hemoglobin levels between preschoolers who are healthy weight and above healthy weight.

*P<.05, using the Modified Bonferroni procedure.
A question of health significance—"Are BMI-for-age percentiles related to anemia?" was addressed for the Tillamook County preschoolers in Table 23. The cutoff value for anemia is a hemoglobin level of <11.1 g/dL in children ages 2 - <5 years-old and a hemoglobin level of <11.5 g/dL in children 5 - <8 years-old (Centers for Disease Control and Prevention, 1998). BMI-for-age percentiles were no different for preschoolers who were anemic than preschoolers who were not anemic.

Table 23—Median BMI-for-age percentile of preschoolers, by age-cutoff values for anemia

<table>
<thead>
<tr>
<th>BMI-for-age percentile</th>
<th>Anemic n = 21</th>
<th>Not Anemic n=261</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (range)</td>
<td>83.44 (16.03-99.99)</td>
<td>80.72 (1.15-100.00)</td>
</tr>
</tbody>
</table>

*A hemoglobin level of <11.1 g/dL is considered low in children ages 2 - <5 years-old; a hemoglobin level of < 11.5 g/dL is considered low in children 5 - <8 years-old (Centers for Disease Control and Prevention, 1998). Wilcoxon rank-sum test comparing the mean ranks of BMI-for-age percentiles between anemia categories was not statistically significant, P<.05, P = 0.4956.

Although BMI-for-age percentiles were not found to be related to anemia in this study, the level of anemia of the Tillamook County preschool population is important to monitor. Overall, 7.4% of all of the Tillamook County preschoolers screened were in the anemic category; 6.2% of three- to four-year-olds were
considered anemic; and 9.6% of five-year olds were in the anemic category. Current and appropriate reference data is limited to make an accurate comparison of the Tillamook County preschool anemia figures to national levels. The prevalence of iron-deficiency anemia during 1988 – 1994 was <1% for three- to-five year-olds based on NHANES III data (Centers for Disease Control and Prevention, 1998). The 1997 PedNSS anemia figures for children aged two to less than five years (15.2% for white children, 18.4% for Hispanics, and 16.9% for the children overall) are much greater than this population. Some possible reasons are:

- PedNSS preferentially enrolls low-income children and children with anemia; thus, their anemia rate is higher than would be expected for a cross-sectional population study; and

- The criteria used for the PedNSS assessment was a hemoglobin level of <11.2 g/dL, the CDC level prior to 1998 (Centers for Disease Control, 1997). At this level, the Tillamook study would have a higher percentage of its three- and four-year-olds with anemia—9.0% compared with 6.2% using the current maximum hemoglobin concentration for anemia of <11.1 g/dL (Centers for Disease Control and Prevention, 1998).

In terms of diet, iron absorption and metabolism is affected by the iron content of foods, the form of iron in those foods, and absorption enhancing/or inhibiting factors (Whitney & Rolfes, 1999). Also, vitamin supplements with iron may be a confounding factor in the preschoolers’ anemia status. Parents were asked to circle whether vitamins, iron, fluoride, or nothing were taken by their child on the reverse
side of the 24-hour Food Record. Although the vitamin formulation regarding iron level, consistency of intake, or whether the recommendation to give their child a supplement was made by a health professional was not available, Table 24 lists the median hemoglobin levels for vitamin supplement users and nonusers. There was no significant difference in hemoglobin levels between preschoolers who reported taking a vitamin with preschoolers who indicated no vitamin supplement. Of interest is the number of preschoolers considered vitamin supplement users—76.1%.

Table 24—Median hemoglobin\textsuperscript{a} levels of preschoolers who did and did not report taking vitamin supplements\textsuperscript{b}

<table>
<thead>
<tr>
<th></th>
<th>Vitamin Supplement Users n=162</th>
<th>Vitamin Supplement Nonusers n=51</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hemoglobin (g/dL)</strong></td>
<td>12.5 (7.1 – 14.9)</td>
<td>12.4 (8.9 – 14.6)</td>
</tr>
</tbody>
</table>

\textsuperscript{a} A hemoglobin level of <11.1 g/dL is considered low in children ages 2 - <5 years-old; a hemoglobin level of < 11.5 g/dL is considered low in children 5 - <8 years-old (Centers for Disease Control and Prevention, 1998).

\textsuperscript{b} Vitamin formulation regarding iron level, consistency of intake, or whether recommendation was made by a health professional was not available.

Wilcoxon rank sum-test comparing the mean ranks of blood hemoglobin levels between preschoolers whose form indicated a positive vitamin response with preschoolers whose form indicated no vitamin intake found no significant differences in hemoglobin levels, P<.05, P= 0.8419.
Hypothesis 4a.—Weight Status and Blood Lead

- Underweight preschoolers will be more likely to have blood lead levels higher than 10.0 μg/dL than preschoolers of other weight status levels.

It was not possible to assess blood lead levels of underweight children due to having only two underweight preschoolers and only one child with a blood lead level higher than 10.0 μg/dL. Table 25 shows the blood lead level distribution among the Tillamook County preschoolers who had them recorded.

The incidence of elevated blood lead levels (10.0 or greater μg/dL) for U.S. children between the ages of three- to five-years of age was at 5.1% during 1988-1994 (Kaufmann, et al., 2000). Tillamook County preschoolers screened in this Health Screen fortunately do not suffer from lead poisoning. Screening continues to be an effective tool to identify children at risk of lead poisoning especially if they are living in an older home, are of a minority race/ethnicity, if the head of their household has less than twelve years of education, if they reside in the Northeast or Midwest regions of the United States, or if they have a history of anemia (Kaufmann, et al., 2000).
Table 25—Blood lead level\textsuperscript{a} distribution\textsuperscript{b} among preschoolers

<table>
<thead>
<tr>
<th>Blood Lead Levels</th>
<th>n = 196</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\leq 1.4 \mu g /dL)</td>
<td>143</td>
<td>73.0%</td>
</tr>
<tr>
<td>1.5 – 5.5 (\mu g /dL)</td>
<td>45</td>
<td>23.0%</td>
</tr>
<tr>
<td>5.6 – 9.9 (\mu g /dL)</td>
<td>7</td>
<td>3.5%</td>
</tr>
<tr>
<td>(\geq 10.0 \mu g /dL)</td>
<td>1</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Blood lead levels of \(\geq 10.0 \mu g /dL\) are considered elevated according to CDC guidelines for children under six-years-of-age (Centers for Disease Control and Prevention, 2000).

\textsuperscript{b} Only 68.5\% of Phase One participants had recorded blood lead levels.
Hypothesis 4a.—Weight Status and Blood Pressure

- Blood pressure levels will increase progressively with an increasing BMI-for-age percentile.

Linear regression of BMI-for-age percentile on systolic blood pressure was significant for both males and females as illustrated in Figures 2 and 3, respectively.

Male systolic blood pressure = \(87.64 + 0.10\) BMI-for-age percentile
\((\text{SE} = 2.74)\) \((\text{SE} = 0.03)\)
\(n = 140\) \(P = 0.0057\) \(\text{Rsquare} = 0.0542\)

Female systolic blood pressure = \(87.79 + 0.08\) BMI-for-age percentile
\((\text{SE} = 2.14)\) \((\text{SE} = 0.03)\)
\(n = 136\) \(P = 0.0036\) \(\text{Rsquare} = 0.0617\)

Likewise, linear regression of BMI-for-age percentile on diastolic blood pressure was significant for both males and females as illustrated in Figures 4 and 5, respectively.

Male diastolic blood pressure = \(56.41 + 0.07\) BMI-for-age percentile
\((\text{SE} = 2.15)\) \((\text{SE} = 0.03)\)
\(n = 140\) \(P = 0.0075\) \(\text{Rsquare} = 0.0506\)

Female diastolic blood pressure = \(57.63 + 0.07\) BMI-for-age percentile
\((\text{SE} = 1.69)\) \((\text{SE} = 0.02)\)
\(n = 136\) \(P = 0.0028\) \(\text{Rsquare} = 0.06\)
The hypothesis is not rejected—systolic and diastolic blood pressure increase progressively with increasing BMI-for-age percentiles for both genders.

Table 26 lists the mean systolic and diastolic blood pressure by three weight status categories for both males and females. Male systolic and diastolic blood pressure were significantly higher for overweight Tillamook preschoolers than healthy weight preschoolers. Female systolic blood pressure was higher for preschoolers at risk of overweight than for healthy weight preschoolers. Female diastolic blood pressure was significantly higher for both at risk of overweight and overweight preschoolers compared with healthy weight Tillamook preschoolers.

This Tillamook blood pressure data correspond with previous research findings of increased systolic and diastolic blood pressure with increasing BMI levels for young children (He, Ding, Fong, & Karlberg, 2000). Thus, even at preschool ages, overweight is associated with increases in blood pressure. Since childhood blood pressure and change in BMI are considered to be the most significant predictors of adult blood pressure, children’s weight status may have long-lasting health implications (Dietz, 1998; Sinaiko, 2001).
Figure 2—Linear regression of BMI-for-age percentile on systolic blood pressure — males

Linear Fit
systolic = 87.64 + 0.10 BMIPCT
(SE = 2.74) (SE = 0.03)

n = 140
Rsquare = 0.0542
P = 0.0057

Systolic BP is expressed in mm Hg
SE = Standard Error
BMIPCT = BMI-for-age percentile
Figure 3—Linear regression of BMI-for-age percentile on systolic blood pressure—females

**Linear Fit**

$$\text{systolic} = 87.79 + 0.08 \text{BMIPCT}$$  
(SE = 2.14)  (SE = 0.03)

n = 136  
Rsquare = 0.0617  
P = 0.0036

Systolic BP is expressed in mm Hg  
SE = Standard Error  
BMIPCT = BMI-for-age percentile
Figure 4—Linear regression of BMI-for-age percentile on diastolic blood pressure — males

Linear Fit  diastolic = 56.41 + 0.07 BMIPCT
(SE = 2.15)  (SE = 0.03)

n = 140
Rsquare = 0.0506
P = .0075

Diastolic BP is expressed in mm Hg.
SE = Standard Error
BMIPCT = BMI-for-age percentile
Figure 5—Linear regression of BMI-for-age percentile on diastolic blood pressure —females

Linear Fit  \( \text{diastolic} = 57.63 + 0.06 \text{BMIPCT} \)  
\( (SE = 1.69) \)  \( (SE = 0.02) \)

\( n = 136 \)  
\( R^2 = 0.0646 \)  
\( P = 0.0028 \)

Diastolic BP is expressed in mm Hg.  
SE = Standard Error  
BMIPCT = BMI-for-age percentile
Table 26—Mean of systolic\textsuperscript{a} and diastolic\textsuperscript{b} blood pressure by weight category for males and females

<table>
<thead>
<tr>
<th></th>
<th>Healthy Weight</th>
<th>At Risk of Overweight</th>
<th>Overweight</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=79</td>
<td>n=28</td>
<td>n=32</td>
<td></td>
</tr>
<tr>
<td>Mean±SE\textsuperscript{c}</td>
<td>Mean±SE</td>
<td>Mean±SE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic mm Hg</td>
<td>93±1.1\textsuperscript{x}</td>
<td>95±1.9\textsuperscript{xy}</td>
<td>99±1.8\textsuperscript{y}</td>
<td>0.0270*\textsuperscript{d}</td>
</tr>
<tr>
<td>Diastolic mm Hg</td>
<td>61±0.9\textsuperscript{x}</td>
<td>61±1.5\textsuperscript{xy}</td>
<td>65±1.4\textsuperscript{y}</td>
<td>0.0329*\textsuperscript{d}</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=77</td>
<td>n=31</td>
<td>n=27</td>
<td></td>
</tr>
<tr>
<td>Mean±SE</td>
<td>Mean±SE</td>
<td>Mean±SE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic mm Hg</td>
<td>92±1.0\textsuperscript{x}</td>
<td>97±1.6\textsuperscript{y}</td>
<td>96±1.8\textsuperscript{xy}</td>
<td>0.0129*\textsuperscript{d}</td>
</tr>
<tr>
<td>Diastolic mm Hg</td>
<td>61±0.8\textsuperscript{x}</td>
<td>65±1.3\textsuperscript{yz}</td>
<td>65±1.4\textsuperscript{z}</td>
<td>0.0059**\textsuperscript{e}</td>
</tr>
</tbody>
</table>

\textsuperscript{a} A systolic blood pressure of ≥116 mm Hg is classified as significant hypertension in three-to-five-year-olds (Report of the Second Task Force on blood pressure control in children, 1987).

\textsuperscript{b} A diastolic blood pressure of ≥76 mm Hg is classified as significant hypertension in three-to-five-year-olds (Task Force on Blood Pressure Control in Children. (Report of the Second Task Force on blood pressure control in children, 1987).

\textsuperscript{c} SE=standard error.

\textsuperscript{d} Analysis of Variance comparing means of blood pressure among weight categories is significant, * P<.05.

\textsuperscript{e} Welch Anova comparing means of blood pressure among weight categories is significant, **P<.01.

\textsuperscript{xyz} Means with different superscripts in the same row show differences significantly different from zero using Tukey-Kramer HSD.
Hypothesis 4b.—Dairy Food Intake and Blood Hemoglobin

- Preschoolers who consume more than four servings of dairy foods per day will have lower hemoglobin levels than children who eat four or fewer servings of dairy foods daily.

There was no difference between hemoglobin levels of children who consume more than four servings of dairy foods per day and children who eat four or fewer servings of dairy foods daily. The hypothesis is rejected.

Table 27 compares hemoglobin levels of preschoolers consuming four or less dairy servings per day with those consuming greater than four servings. The preschoolers consuming more than four dairy servings daily only made up 8.3% of the population studied.

Milk anemia is more prevalent at one-to two-years-of-age than for children over three-years-old (Story, et al., 2000; Centers for Disease Control and Prevention, 1998). The three- to five-year-olds in this study, therefore, would not be expected to experience lower hemoglobin levels based on dairy intake if the diet is diversified such as with meats, fortified cereals, foods high in Vitamin C eaten with the iron foods, and when vitamin supplements containing iron are routinely consumed. Also, another study found that hemoglobin levels of three-to-five year-old children did not differ significantly after adaptation to high- and low-calcium intakes (Ames, 1999). Even when dairy consumption exceeded the recommended level of two servings per day (United States Department of Agriculture, 1999),
hemoglobin levels were not adversely affected in this Tillamook County preschool population.

Table 27—Mean of hemoglobin levels of preschoolers, by two levels of dairy food intake

<table>
<thead>
<tr>
<th></th>
<th>4 or less Dairy Servings/ Day n=242</th>
<th>&gt; 4 Dairy Servings/ Day n=22</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hemoglobin (g/dL)</strong></td>
<td>12.5±0.1</td>
<td>12.6±0.2</td>
</tr>
</tbody>
</table>

*SE=Standard Error.

- Independent group *t* test comparing the means of blood hemoglobin levels between preschoolers who consume more than four servings of dairy foods per day with children who eat four or fewer servings of dairy foods daily found no significant difference, *P*<.05, *P*= 0.7786.
Hypothesis 4b.—Dairy Food Intake and Blood Lead

- Preschoolers who eat less than the FGP dairy product recommendation of two servings per day are more likely to have higher blood lead levels.

There was no difference between blood lead levels of preschoolers who consume less than two servings of dairy foods per day and children who eat two or more servings of dairy foods per day, P<.05, P = 0.6845. The hypothesis is thus rejected.

Table 28 compares median blood lead levels for two levels of dairy food servings reported in the 24-hour Food Record. Table 26 showed the positively skewed distribution of blood lead levels among the Tillamook County preschoolers. Consequently, the median blood levels are similar for the two levels of dairy servings.

A meta-analysis reviewing calcium’s role in reducing lead toxicity in children reviewed studies that found a negative association between calcium intake and blood lead concentration. However, an equal number of studies reviewed found no protective effect of dietary calcium on blood lead concentrations in children (Ballew & Bowman, 2001). Tillamook County preschoolers fortunately do not experience the significant public health concern of lead poisoning.
Table 28—Median blood lead levels\textsuperscript{a} of preschoolers reporting two levels of dairy servings

<table>
<thead>
<tr>
<th>Blood Lead Level ((\mu g /dL))</th>
<th>&lt;2 Dairy Servings/ Day</th>
<th>(\geq 2) Dairy Servings/ Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (Range)</td>
<td>&lt;1.4 (&lt;1.4 – 8.7)</td>
<td>&lt;1.4 (&lt;1.4 – 11.1)</td>
</tr>
<tr>
<td>n=55</td>
<td>n=132</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}Blood lead levels were coded as 1.4 \(\mu g /dL\) for the recorded level of < 1.4 \(\mu g /dL\) or as the specific number for higher levels. Blood lead levels of \(\geq\)10.0 \(\mu g /dL\) are considered elevated according to CDC guidelines for children under six-years-of-age (Centers for Disease Control and Prevention, 2000).

- Wilcoxon rank-sum test comparing the mean ranks of blood lead levels between preschoolers who consume less than two servings of dairy foods per day with children who eat two or more servings of dairy foods per day found no significant difference, \(P<.05\), \(P = 0.6845\).
Hypothesis 4b.—Dairy Food Intake and Blood Pressure

- The number of daily servings of dairy foods will be inversely related to blood pressure levels.

Systolic and diastolic blood pressure were unrelated to FGP dairy servings eaten daily for males. The hypothesis is rejected.

**Male n=129**

Systolic = 95.38 - 0.23 FGP Dairy  
(SE = 1.74)  (SE = 0.56)  
P = 0.6806  Rsquare = 0.0013

Diastolic = 62.78 - 0.38 FGP Dairy  
(SE = 1.43)  (SE = 0.46)  
P = 0.4195  Rsquare = 0.0051

Systolic and diastolic blood pressure were unrelated to FGP dairy servings eaten daily for females. The hypothesis is rejected.

**Female n=129**

Systolic = 95.01 - 0.55 FGP Dairy  
(SE = 1.84)  (SE = 0.72)  
P = 0.4478  Rsquare = 0.0045

Diastolic = 61.69 + 0.31 FGP Dairy  
(SE = 1.47)  (SE = 0.58)  
P = 0.5927  Rsquare = 0.0023
A three-year Dietary Intervention Study in Children (DISC) found both systolic and diastolic blood pressure to be inversely associated with calcium intake in eight-to-eleven year-old children (Simons-Morton, et al., 1997). The Framington Children's Study of three-to-six year-olds showed a negative association only for systolic blood pressure with dietary calcium; no association for diastolic blood pressure and dietary calcium was noted (Gillman, et al., 1992). Eight observational and one intervention study examined in a meta-analysis regarding dietary calcium and blood pressure in children and adolescents were inconclusive (Simons-Morton & Obarzanek, 1997).
LIMITATIONS

Several limitations of this study are recognized. The first limitation is that results documented in this research may not be generalizable to other populations of preschoolers. This subject population is comprised of Tillamook County, Oregon preschoolers. Dissimilar socioeconomic status or ethnicity may alter responses in other populations. Also, the potential role of Tillamook’s local dairy industry and the rural setting of this Oregon County may be unique to the study’s preschoolers.

The pre-kindergarteners in this county had higher rates of BMI-for-age percentiles in the at risk for overweight and overweight ranges than children their age nationwide. Other population studies may not have the same prevalence of above healthy weight range as preschoolers in this study; thus, results may be dissimilar.

Another limitation to the study is that a 24-hour Food Record was relied on for data on number of servings from each FGP group eaten. Assessment of food intake in free-living populations is difficult and inherently has limitations (Lee & Nieman, 1996) including the following:

- One 24-hour food record does not account for day to day variations in food intake; thus, it may not be representative of actual intake;
- Instructions for completing the Food Record were not verbally explained prior to the parents’ completion of the form;
• Inaccurate reporting by omission of foods, listing incorrect amounts, or providing an incomplete description of the foods would alter the results;

• The food record places a high response burden on the parents. It was subject to recall bias if the foods were not recorded immediately upon eating. Many children attended school or daycare during the 24-hour period and the parents may not have accurate records of amounts or types of foods eaten when they were not with the children. The children, especially the older preschoolers, may have helped themselves to foods or beverages without the foods being recorded;

• Consistent coding of the Food Record into number of FGP servings according to the Food Guide Pyramid for Young Children (USDA, 1999) is subject to human error; and

• FGP food groups are not specific in terms of calories or nutrients. For example, French fries and tomatoes are both in the vegetable group; ice cream and skim milk are included in the dairy foods group (United States Department of Agriculture, 1999). Thus, an observation based upon a food group is not precise in terms of the caloric level or nutrient content.

Another limitation was that the mealtime habits questions and the vitamin/iron supplement questions were not translated into Spanish by the Tillamook County Health Department; thus, responses from the Hispanic population were not able to be included for either of these items. Every effort was made to encourage response by these Spanish-speaking parents for Phase Two by providing a Spanish-version
of the following: the mailed questionnaire, the reminder postcard, the follow-up note with the second questionnaire, and the incentive. A Spanish-speaking nutrition graduate student followed up with a telephone interview as the researcher did for the English-speaking parents to encourage participation in Phase Two.

Phase Two’s mailed survey was not without limitations including the following:

- Phase Two’s mailed survey was sent out at the beginning of January of 2002 approximately seven months after Phase One. During this time lapse, many people moved (their phones were disconnected and mail was returned to sender), their enthusiasm for the research may have waned, and the country had a different focus than it had during the May Health Screen. Despite this, 62.7% of those parents who signed a consent form in May completed the mailed questionnaire.

- The January/February time-frame when the Phase Two questionnaires were being completed posed another problem due to wet and cold weather. Physical activity is generally less in the winter than in the summer months (Fulton, 2001; Tillamook County, Oregon, 2000).

- Phase Two’s survey questions are considered preliminary since they were not validated.

- For all of the questions asked in Phase Two, the information was subjective. Parents would not be with the child all day if the children were in preschool, kindergarten, or day care. Thus, the number of hours per day that the child watches television and videos may have been under or over-reported or the
response for the type of dairy foods consumed in the last week may not have been complete.

- Interpretation of the questions also may not be consistent for each parent. For example, the activity question asks parents to think about the entire past year regarding their child’s activity. Another assessment required for this question is for the parents to determine how much time was actually spent “playing actively at school during gym class or recess”. Each parent’s understanding of the question, their involvement with their children, and their willingness to be objective (not concerned with their own or their child’s image if the higher level of television is reported) may be variable and would affect the outcome of the research.
CONCLUSIONS

This cross-sectional population study of a county’s preschool population provides representative data for this age-group. Four significant findings were documented in this research.

Tillamook County preschoolers had a lower prevalence of healthy weight and a higher prevalence of at risk of overweight and overweight levels than children their age nationwide in 1988 - 1994. BMI-for-age percentiles derived from the 2000 CDC-US growth charts provided reference values to measure overweight differently than it has been assessed before. The most dramatic finding was the percent of preschoolers in the overweight category, or at the $\geq 95^{\text{th}}$ BMI-for-age percentile. Overweight prevalence for the Tillamook County preschoolers screened was 21.9% for males and 19.3% for females compared to 1988 – 1994 national rates of 6.2% for males and 8.2% for females for (Flegal, et al., 2001).

Also, both systolic and diastolic blood pressure increased with increasing BMI-for-age percentiles for males and females.

Preschoolers who reported more activity (less television viewing or playing computer or video games and more active play-time) had lower BMI-for-age percentiles than children who reported less activity (more television viewing or playing computer or video games and less active play-time). Hours spent viewing television—sedentary behavior—was positively related to BMI-for-age percentiles.
Fourthly, Tillamook County preschoolers who were above the healthy weight range ate more FGP servings of concentrated fats/sweets than children in the healthy weight range.

Data that were not strong enough to reach conclusions about weight status related to the following:

- Dairy product consumption;
- Fat content of dairy products;
- Mealtime habits;
- Meals eaten away from home;
- Blood hemoglobin; and
- Blood lead.

The assessment of dairy food intake with blood hemoglobin, blood lead, and blood pressure also revealed no significant associations.

Even at preschool ages, physical activity and diet are important to assess when increasing rates of overweight levels and associated increases in blood pressure are being investigated.
RECOMMENDATIONS

This research provided a wonderful opportunity for an initial assessment of a preschool population. Recommendations for future dietary evaluations in Tillamook’s annual preschool Health Screen as well as ideas for epidemiologic surveillance and public health nutrition practices are enumerated as follows:

The limitations of the dietary data in this study could be significantly reduced by assessing the preschoolers’ diets with a three-day food record instead of only one day. Detailed written instructions explaining the purpose of the Food Record and encouraging parents to verify their child’s food intake with teachers and child-care providers needs to be mailed with the Food Record. In addition, pictorial serving sizes as used in the Block Dietary Data Systems (Block Dietary Data Systems, 1998) could also be sent to provide a visual example regarding portion sizes. The Registered Dietitians would then need to spend more time reviewing the Food Records with each parent in terms of accuracy of amounts and clarifying the foods listed. The CSFII Multiple Pass method (Moshfegh, Borrud, Perloff, & LaComb, 1999) provides standardized questions to reduce the number of forgotten foods. Only when these steps are in place would it be appropriate to analyze the preschoolers’ diets in terms of nutrient and energy content with diet analysis software.

A questionnaire mailed with the Food Record could obtain additional information that would benefit research regarding weight status and health issues.
Parents’ and other siblings’ height and weight data; ethnic, educational level, and income information; and the parents’ perceptions of their child’s weight would be of interest. Also, where the preschoolers eat their meals and snacks would provide the Food Record with further detail. Physical activity assessment conducted by direct observation at the child’s home, school, or day care location or by having the preschoolers use monitoring devices would be ideal (Fulton, et al., 2001). An additional biochemical analysis—serum lipid assay—would be important to investigate with respect to dietary patterns and atherosclerosis prevention (Rasanen, et al., 2002).

Currently, Tillamook County offers an exceptional and opportune resource for its preschool population. The annual preschool health exam allocates time and resources for the parents to be counseled regarding their preschoolers’ weight status, their anemia status, and general eating habits by Registered Dietitians. A comprehensive health assessment is conducted by a health care team and qualified volunteers. The children’s physicians are then sent the health information following the preschool Health Screen.

The Expert Committee on pediatric obesity evaluation and treatment recommends weight maintenance for two- to-seven-year-old children who are in the at risk of overweight category and for children who suffer no complications in the overweight category. However, weight loss is recommended even for preschoolers if they are in the overweight category and have complications of mild hypertension, dyslipidemias, and insulin resistance (Barlow & Dietz, 1998).
Follow-up for the parents of overweight preschoolers with health complications is recommended with a qualified dietetics professional. A familial approach in the treatment of childhood obesity—emphasizing a healthy lifestyle for the whole family with the parents as the change agents—is likewise essential in the treatment of pediatric obesity (Lucas, 2001; Golan & Weizman, 2001; Barlow & Dietz, 1998). Annual screening of weight status is also recommended (Barlow & Dietz, 1998).

Epidemiologic surveillance would be possible for Tillamook County since the annual comprehensive health exam is already in place. The Tillamook County Health Department holds in its archives heights, weights, ages, and blood hemoglobin levels of preschoolers for over the past fifteen years. A comparison of weight status among preschool cohorts over time using the new BMI-for-age percentiles and review of anemia levels would be possible. These data would answer the questions, “Are Tillamook County preschoolers becoming more overweight?” and “What trend is there regarding anemia status?”

Longitudinal studies to follow weight trends of individuals and investigate dairy product/calium intake in relationship to body fat levels, hemoglobin, and blood pressure are other recommendations based upon this initial research. Studies with other age-groups also would be of interest in determining the nutritional status of the community.

A public-health approach in the assessment and improvement of the nutritional status of Tillamook County children is another important step. Community
programs that teach family nutrition skills, encourage physical activity programs for all ages, and provide safe/affordable/ and accessible play areas for the children are needed. The Tillamook Dairy Association could hold recipe contests promoting low-fat dairy products. Through age-appropriate nutrition lessons and providing healthful foods, preschools, day care, and schools also can encourage healthy eating that includes less fats and sweets, regular meals and snacks, and maintaining nutritional adequacy of the diet. Schools and daycare can promote less television viewing and include physical activities that the children enjoy to increase a more physically active life-style.

Current health status (such as anemia and overweight status), habits (including television viewing and physical activity), and food intake are especially important at this preschool age since lifelong consequences (for example, Type II diabetes, hypertension, and cardiovascular disease) may result. Identifying the health concerns of this Tillamook County preschool population is only the initial step in facilitating positive and long-term healthful behavior.
REFERENCES


APPENDIX A—Oregon State University Institutional Review Board Approval Phase One

May 22, 2001

Principal Investigator:

The following project has been approved for exemption under the guidelines of Oregon State University’s Institutional Review Board (IRB) and the U.S. Department of Health and Human Services.

Principal Investigator(s): Connie Georgiou

Student’s Name (if any): Sandra Frank

Department: Nutrition and Food Management

Source of Funding: New BMI Growth Charts: Use with a Screening Tool to Identify Preschoolers at Risk for Obesity (Phase I)

Comments:

This approval is valid for one year from the date of this letter. A copy of this information will be provided to the Institutional Review Board. If questions arise, you may be contacted further.

Sincerely,

Laura K. Lincoln
IRB Coordinator
September 6, 2001

Principal Investigator:

The following project has been approved for exemption under the guidelines of Oregon State University's Institutional Review Board (IRB) and the U.S. Department of Health and Human Services.

Principal Investigator(s): Connie Georgiou

Student's Name (if any): Sandra Frank

Department: Nutrition and Food Management

Source of Funding:

Project Title: Dairy Food Intake and Activity Habits of Tillamook County Preschoolers (Phase II)

Comments:

This approval is valid for one year from the date of this letter. A copy of this information will be provided to the Institutional Review Board. If questions arise, you may be contacted further.

Sincerely,

Laura K. Lincoln
IRB Coordinator
APPENDIX C— Tillamook County Health Department Approval

MAY-14-2001 10:30 AM TILLAMOOK CO HEALTH DEPT  FAX NO. 5038423903  P. 02

Kathy P. Ellis, MS, RD, LD
Dietitian/Public Health Nutritionist

TILLAMOOK COUNTY HEALTH DEPARTMENT
P.O. BOX 489
801 PACIFIC
TILLAMOOK, OR 97141

5-14-01
To: Institutional Review Board, Oregon State University
Re: Proposal for Research Project for Sandra Frank, RN

The Tillamook County Health Dept. approves the use of the data obtained from the multi-modular preschool exams for Sandra Frank's thesis research project. We will be asking her to sign an agreement regarding confidentiality.

Please contact me or my supervisor, Anna Kleeman, RN, Clinic Manager, if you have any questions: (503) 842-3900.

[Signature]
Anna Kleeman, RN
Clinic Manager
Informed Consent

Oregon State University graduate student, Sandra Frank, R.D., is working on her graduate research project—"What Affects Preschooler's Weight?" This Fall, a mailed questionnaire will be randomly sent to parents of the preschoolers who participated in the May, 2001, Tillamook Health Screening. The purpose of the questionnaire is to find out additional information such as how much television does your child watch or what is the height and weight of any siblings that may have an impact on your preschooler's weight.

There are no perceivable risks involved in answering the questionnaire. You not only will have the opportunity to assist Sandra in her thesis, but you will also be contributing to the understanding of what affects preschooler's weight.

The answers you provide are strictly confidential and special precautions have been established to protect the confidentiality of your responses. The number on your questionnaire will be removed once your questionnaire has been returned. We use the number to contact those who have not returned their questionnaire, so we do not burden those who have responded. Your questionnaire will be destroyed once your responses have been tallied.

If you have any questions about the questionnaire, please contact me through the Nutrition and Food Department at OSU—(541) 737-3561 or Dr. Connie Georgiou, R.D. at (541) 737-0965. If you have questions about your rights as a research subject, please contact the IRB Coordinator, OSU Research Office, (541) 737-3437.

Your participation in this study is voluntary and you may refuse to answer any questions. Only a small sample of parents will receive the questionnaire, so your participation is vital to the study.

My signature below indicates that I have read and that I understand the procedure described above and give my informed and voluntary consent to participate in this study. I understand that I will receive a signed copy of this consent form.

Signature of subject (or subject's legally authorized representative)               Name of subject

Date Signed ___________________________   Subject's Present Address :

Signature of Principal Investigator (optional)   Date Signed
## APPENDIX E—Health Exam Form

### NORTHWEST REGIONAL ESD

#### TILLAMOOK SERVICE CENTER

- **Health Exam**

#### TILLAMOOK COUNTY HEALTH DEPARTMENT

**Health Exam Form**

**Name of Child:**

**Age:**

**Date of Exam:**

**Family Physician Name & Address:**

**Address:**

**Phone (Home or Neighbor):**

### REQUEST AND AUTHORIZATION FOR RELEASE OF INFORMATION

I hereby request and authorize the physician of this examination to release my child's medical records to my child's school (including Head Start) and doctor. I acknowledge and consent to have the results of this examination analyzed by computer means and made available to health professionals who will provide follow-up diagnosis, treatment and/or education.

**Date:**

**Witness:**

**Signature of Parent (Guardian) of Child:**

### DENTAL

- **No cavities or defects:**
- **Dental care needed:**
- **Other:**

### SPEECH

- **Test:**
- **Unable to Test:**
- **Normal:**
- **Needs further evaluation:**

### VISION

- **Acuity:** Near Far
  - **Ft. 20/20**
  - **Lt. 20/20**
- **2-Eyed Test:** Pass Other
- **Near:** Pass Other
- **Far:** Pass Other
- **Glasses worn:** Near
- **Last eye exam:**
- **Other:**
- **Low Test Reliability?**
- **Unable to Test?**

**Summary:**

**Exam Recommended:**

**Signature:**

### LABORATORY

- **Lead:**
- **Previous test:** Y N
- **Urinalysis:** Hemoglobin
  - **Leukocytes:** Ketone
  - **Protein:** Estrogen
  - **Pn:** Glucose

**Reason:**

**Exam recommended:**

**Signature:**

### BODY MEASUREMENTS

- **Height:**
- **Weight:**
- **Blood Pressure:**

**Signature:**

### ASSESSMENT

<table>
<thead>
<tr>
<th>General Inspection</th>
<th>Noses, Ears, Mouth &amp; Throat</th>
<th>Chest &amp; Lungs</th>
<th>Heart</th>
<th>Abdomen</th>
<th>Genitalia</th>
<th>Muscular Skeletal</th>
<th>Neurological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Abn</td>
<td>Assessment</td>
<td>Plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F—24-Hour Food Record

Tell us everything your child ate or drank in the last 24 hours.

1. Write down the time of each meal or snack.
2. Write the foods you offered your child.
3. Write the amount your child ate (cups, spoons, ounces).

<table>
<thead>
<tr>
<th>Time</th>
<th>Foods you offered your child</th>
<th>Amount child ate (cups, spoonful, oz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Servings Eaten: 6

Please answer the following questions. Circle the answers that best tell us about you and your child.

1. Are these the foods your child usually eats? Yes No

2. Circle all that your child drinks.

- Whole milk
- 2% milk
- 1% or skin/non-fat milk
- Breastmilk
- Raw milk
- Goat's milk
- Water
- Formula
- Juice
- Tea
- Sweetened drinks
- Other:

Child's Name: ____________________________ Date: ____________________________

57-004-EN (08/00) PLEASE TURN THE PAGE OVER
APPENDIX G—Vitamin and Mealtime Questions

Please answer the following questions. (Circle) the answers that best tell us about you and your child.

3. Circle what your child takes. 
   - Vitamins
   - Fluoride
   - Iron
   - Nothing

4. Does your child drink from a bottle? 
   - No
   - Yes, during the day
   - Yes, takes bottle to bed
   If yes, what is in the bottle? ____________________________

5. Are there any foods you do not let your child eat for health or other reasons? 
   - Yes
   - No
   If yes, explain: _______________________________________

6. How would you describe mealtimes at your house? (Circle your answers.)
   - Our family eats meals together. Always Most of the time Sometimes Never
   - I sit with my child when he or she is eating. Always Most of the time Sometimes Never
   - I let my child decide how much or how little to eat. Always Most of the time Sometimes Never
   - I offer my child a variety of foods every day. Always Most of the time Sometimes Never
   - My child can feed himself or herself. Always Most of the time Sometimes Never

7. Write one thing you really like about your child’s eating and one thing you would like to change:
   One thing I like ______________________________________
   One thing I would change ______________________________________

8. Circle any foods your child eats:
   - Clay
   - Dirt
   - Peeling paint
   - Printed paper
   - Large amounts of ice
   - Chalk
   - Anything else not food: What? __________________________

9. What concerns or questions do you have about feeding your child? __________________________

If you need this form in alternate format please contact (503) 731-4022.
The USDA is an equal opportunity provider and employer.
APPENDIX H—Phase Two: Mailed Survey English Version

COVER PAGE

Dairy Food Intake and Activity Habits
Of Tillamook County Preschoolers

Please return the questionnaire to:
Sandy Frank, R.D.
108 Milam Hall
Oregon State University
Corvallis, OR 97331-5103
CONSENT PAGE

Thank you for taking a few minutes to answer questions for my study. I am Sandy Frank, a Registered Dietitian. I helped at the Tillamook County Health Department preschool health screen on May 23-25th, 2001. You may have seen me or talked with me about your child's eating.

I am working on my graduate research thesis for Oregon State University and the Tillamook County Health Department. This survey will help us learn more about dairy product intake, activity levels, and where preschoolers eat their meals and snacks.

Participation in this study is voluntary and by returning the survey, you give your consent to include your responses. All of your answers will be confidential. Only the group’s answers can be used, not individual ones. If you wish to add more information, please feel free to make comments on your survey. The entire questionnaire should take about 5 minutes to complete.

If you have any questions about the questionnaire, please contact me through the OSU Nutrition and Food Management Department at (541) 737-3561 or Dr. Connie Georgiou, R.D. at (541) 737-0965. If you have any questions about your rights as a research subject, please contact the IRB Coordinator, OSU Research Office at (541) 737-3437.

Sandy Frank, R.D.
APPENDIX H—Phase Two: Mailed Survey English Version (Continued)

MILK INTAKE AND DAIRY PRODUCTS

Milk Intake

What kinds of milk does your child drink? Please check (✓) each kind of Milk (child’s first name handwritten here) drank in the last week.

___ Whole milk

___ 2% milk

___ 1% or skim milk

Dairy Products

Children eat many forms of Dairy Products. Please check (✓) each kind of Dairy Product your child ate in the last week.

___ Ice cream, ice cream bars, and milkshakes

___ Frozen yogurt or flavored yogurt

___ Regular cheese such as Colby, Cheddar, American or Cottage Cheese

___ Low fat cheese such as string cheese, mozzarella, or low fat cottage cheese
APPENDIX H—Phase Two: Mailed Survey English Version (Continued)

EATING MEALS AND SNACKS

How often does your child eat meals or snacks at each place listed below? For example, if they eat a snack and lunch at daycare, preschool, or kindergarten each day, check (✓) “2 or more times each day”. Also, if you go to a restaurant or fast-food eating place once each week, check (✓) “1 time each week or less”.

**EXAMPLE:**

<table>
<thead>
<tr>
<th></th>
<th>2 or more times each day</th>
<th>About 1 time each day</th>
<th>About 2 to 4 times each week</th>
<th>1 time each week or less</th>
<th>Not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Daycare, Preschool, or Kindergarten</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At a Restaurant or Fast-Food</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please check (✓) how often your child usually eats something (including meals and snacks) **at each place** listed below.

<table>
<thead>
<tr>
<th></th>
<th>2 or more times each day</th>
<th>About 1 time each day</th>
<th>About 2 to 4 times each week</th>
<th>1 time each week or less</th>
<th>Not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Daycare, Preschool, or Kindergarten</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At a Restaurant or Fast-Food Eating Place</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At a Relative’s or Friend’s Home</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H—Phase Two: Mailed Survey English Version (Continued)

ACTIVITY HABITS

Please check (✓) the choice that BEST describes how many hours during a usual day your child watches television and videos AND plays computer or video games.

___ Less than 2 hours each day

___ 2-3 hours each day

___ More than 3 hours each day

Thinking about the entire past year, please check (✓) the choice that BEST describes how many hours during a usual day your child participated in the following activities:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Not at all</th>
<th>Less than 1 hour each day</th>
<th>1-2 hours each day</th>
<th>More than 2 hours each day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plays outdoors at home with friends or family when weather permits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participates in physical activity classes such as swimming or gymnastics or plays team sports</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plays actively at school during gym class or recess</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Thank you for being part of this study!

When you have finished answering the questions, please return the survey to me this week in the enclosed, stamped envelope.

When I receive your completed survey, I will send you a set of heart-healthy dessert recipes and ideas that use low fat dairy products. I will also send you a grocery list note pad displaying “Got Milk?”.
Conjunto Diario de Leche y Hábitos de Actividad de Pre-escolares en el condado de Tillamook

Favor de devolver el cuestionario a:
Sandy Frank, R.D.
108 Milam Hall
Oregon State University
Corvallis, OR 97331-5103

Hasta el 25 de Enero del 2002
Gracias por usar unos minutos para responder unas preguntas para mi estudio. Me llamo Sandy Frank, soy una dietista registrada (especializada en guiar hábitos alimenticios). He ayudado en el departamento de salud del condado de Tillamook para el examen de salud durante los días 23 al 25 de Mayo, 2001. Tal vez me han visto o me han hablado sobre la manera de comer de su niño.

Estoy trabajando en mi investigación de tesis en la Universidad de Oregon State y en el departamento de salud del condado de Tillamook. Esta encuesta nos ayudara a aprender más acerca del consumo de productos lácteos, niveles de actividad, y donde los pre-escolares comen sus alimentos y snacks.

La participación en esta encuesta es voluntaria y al retornar sus respuestas me permitirán incluirlas en la evaluación general. Todas las respuestas serán confidenciales. Si desea dar mayor información, incluya sus comentarios en la encuesta, estos serán de gran ayuda para mi. El cuestionario demora 5 minutos en ser llenado.

Si usted tiene cualquier pregunta, por favor llame al (541) 737-3561 o comuníquese con Dr. Connie Georgiou, R.D. con el número (541) 737-0965. Si tiene alguna pregunta acerca de sus derechos como sujeto de estudio, favor de llamar al coordinador del IRB, en la oficina de investigación de la universidad de Oregon State al teléfono (541) 737-3437.

Sandy Frank, R.D.
APPENDIX I—Phase Two: Mailed Survey Spanish Version (Continued)

MILK INTAKE AND DAIRY PRODUCTS

Consumo de Leche

¿Qué tipo de leche toma su niño? Marque check (✓) en cada tipo de leche que su hijo haya tomado en la última semana:

___ Leche pura

___ Leche con 2% de grasa

___ Leche con 1% de grasa

Productos de Leche

Los niños comen muchos tipos de productos lácteos. Favor de marcar con un check (✓) con qué frecuencia come su niño cada tipo de producto lácteo en la siguiente lista?

___ Helado

___ Yogurt

___ Queso Regular como Cheddar, American

___ Queso con menos grasa como mozzarella
EATING MEALS AND SNACKS

Comiendo comidas y brocades

Con qué frecuencia come su niño comidas alimentos en cada lugar de la lista de abajo? Por ejemplo, si come un bocadillo en la escuela cada día, marque con un check (✓) en el espacio "mas que una vez cada día." Además, si va al restaurante incluyendo comida rápida una vez por semana, marque "una vez o menos por semana"

**Ejemplo:**

<table>
<thead>
<tr>
<th></th>
<th>Mas de dos veces al día</th>
<th>Una vez al día</th>
<th>2 a 4 veces cada semana</th>
<th>1 o menos veces cada semana</th>
<th>Casi nunca</th>
</tr>
</thead>
<tbody>
<tr>
<td>En la escuela</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>En el restaurante</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Favor de marcar con un check (✓) cuantas veces al día (child’s first name handwritten here) usualmente come (incluyendo comidas y bocadillos) en cada lugar en la lista abajo.

<table>
<thead>
<tr>
<th></th>
<th>Mas de dos veces al día</th>
<th>Una vez al día</th>
<th>2 a 4 veces cada semana</th>
<th>1 o menos veces cada semana</th>
<th>Casi nunca</th>
</tr>
</thead>
<tbody>
<tr>
<td>En la escuela</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>En la restaurante</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>En casa de parientes o amigo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I—Phase Two: Mailed Survey Spanish Version (Continued)

ACTIVITY HABITS

Habitos de Actividad

Favor de marcar con un check (✓) la selección que describe mejor cuantas horas su niño mira la television videos y juega los juegos de video o computadora.

___ menos de 2 horas al dia

___ 2-3 horas al dia

___ 3 horas o mas al dia

Pensando en relacion al año pasado, favor de marcar con un check (✓) la selección que describe lo major, cuantas horas pasa su niño jugando al aire libre en un dia.

<table>
<thead>
<tr>
<th>Juega afuera de casa con amigos o familiares cuando el clima lo permite</th>
<th>Casa nunca</th>
<th>Menos de 1 hora al dia</th>
<th>1-2 horas cada dia</th>
<th>Mas de 2 horas cada dia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participa de actividad fisica como por ejemplo: natacion, gimnasia, o juegos en equipo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juega activamente en la escuela durante la clase de gimnasia o recreo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Gracias por tomar parte en este estudio!

Cuando haya terminado de responder a las preguntas, favor de devolver el cuestionario en este semana dentro del sobre adjunto.

Cuando reciba su encuesta, le enviare informacion util acerca de nutricion para ninos y un novedoso cuaderno de apuntes.
APPENDIX J—Phase Two: Mailed Survey Follow-up Postcard

FOLLOW-UP POST CARD—ENGLISH VERSION

Thank you for agreeing last spring at the Tillamook County Health Department Preschool Health Screen to participate in my study! The information you provide by filling out and returning the questionnaire “Dairy Food Intake and Activity Habits of Tillamook County Preschoolers” is very important to this research about children’s health. Your child is one of a small sample for this study and cannot be replaced by another child.

I hope you can complete and return your survey this week. When I receive your completed survey, I will send you heart-healthy dessert recipes and a note pad displaying, “Got Milk?”

Thank you for your participation,

Sandy Frank, R.D.
Oregon State University

FOLLOW-UP POST CARD—SPANISH VERSION

Gracias por aceptar en participar en la evaluacion de salud pre-escolar en el Departamento de salud del condado de Tillamook. La informacion que dieron al llenar y retornar el cuestionario acerca del consumo de productos lacteos y actividades de los pre-escolares del condado de Tillamook. La informacion de su niño forma parte de nuestra muestra para este estudio y no sera reemplazada por otra informacion.

Espero que usted pueda completar y retornar la encuesta esta semana. Cuando reciba su encuesta, le enviare informacion nutricional infanital y una libreta de notas “Got Milk?”

Gracias por su participacion,

Sandy Frank
Oregon State University