Applied Physiology, Nutrition, and Metabolism
Physiologie appliquée, nutrition et métabolisme

The impact of replacing regular chocolate milk with the reduced-sugar option on milk consumption in elementary schools in Saskatoon, Canada

Journal:	<i>Applied Physiology, Nutrition, and Metabolism</i>
Manuscript ID	apnm-2015-0501.R1
Manuscript Type:	Article
Date Submitted by the Author:	10-Dec-2015
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Keyword:	Milk, children, reduced sugar, chocolate milk

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Title: The impact of replacing regular chocolate milk with the reduced-sugar option on milk consumption in elementary schools in Saskatoon, Canada

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Abstract

Objective: Excess sugar consumption in children has led to the removal of chocolate milk from some schools. Lower sugar formulations, if accepted, would provide benefits of milk consumption.

Design: In a cross-over trial, milk consumption was measured in eight schools over 6 weeks in two phases: Phase 1 provided standard 1% chocolate milk and plain 2% milk choices for the first 3 weeks and Phase 2 provided reduced-sugar 1 % chocolate milk and plain 2 % milk for the next 3 weeks.

Milk selection and milk wasted by gender and grade (1-8) were measured. Results: Children chose chocolate milk more often than white milk in both phases (Phase 1: $8.93 \pm 0.75\%$ vs. $0.87 \pm 0.11\%$ $p < 0.001$; Phase 2, $5.76 \pm 0.29\%$ vs. $0.78 \pm 0.14\%$ $p < 0.001$, respectively). Fewer children chose reduced-sugar chocolate milk in Phase 2 ($p < 0.001$). A greater percentage of younger (grades 1-4) than older (grades 5-8) students purchased milk in both phases (Phase 1: 11.10 ± 0.81 vs. $8.36 \pm 0.74\%$, Phase 2: 8.47 ± 0.43 vs. $4.62 \pm 0.40\%$ $p < 0.020$, respectively); older children drank more milk at lunch. Conclusions: School children preferred chocolate milk over plain milk even when a reduced sugar formula was offered, however, switching to reduced-sugar chocolate milk led to a decrease in the number of students choosing milk. Longer duration studies are required to determine if students would purchase reduced-sugar chocolate milk at the same rate as regular chocolate milk.

Key Words: Milk, children, reduced sugar, chocolate milk

Introduction

Milk is the primary source of calcium for children and adolescents (Phillips et al. 2004, Keast et al. 2013). Milk intake, especially in childhood and adolescence, is associated with better bone mineral density in adulthood (Teegarden et al. 1999, Kalkwarf 2003) and lower levels of obesity (Hasnain 2014). Milk, including chocolate milk, has been demonstrated to have a positive impact on protein, calcium and other micronutrient intakes in children (Murphy et al 2008, Fayet et al. 2013). Thirty-seven percent of all Canadian children 4-9 years of age, and 61% of boys and 83% of girls 10-16 years of age are not meeting their minimum recommended daily servings of milk products and the situation continues to get worse with age (Garriguet 2008). Canadian children consume less milk as they get older, while sweetened beverage (soft drinks and fruit drinks) consumption increases (Garriguet 2008). Replacement of milk with sweetened beverages is associated with the risk for diabetes, and cardiovascular diseases (Malik et al. 2010, Hu & Malik 2010).

For children and adolescents, taste preference and liking a food is a strong predictor of intake (Neumark-Sztainer et al. 2003). A taste preference for milk is associated with increased calcium intake among adolescents (Larson et al. 2006). When provided with a choice, approximately 2/3 of elementary school children choose chocolate milk over unflavoured milk (Condon et al. 2009, Quann & Adams 2013). Milk consumption by school-age children at a mid-day meal is a predictor for higher consumption of calcium and vitamins A and D in the overall diet (Quann & Adams 2013). Furthermore, only children who chose milk at lunch achieved the recommended intake for calcium in a study by Johnson et al. (2009).

As children spend most of their active time in schools, the school environment is in a position to not only teach but to model healthy eating (CDC 2011). School health and wellness policies have been developed that have resulted in the removal of flavoured milk from a number of school programs (Pettersson & Saidel 2009). These were initiated due to concerns over an increased risk of obesity

given the added calories provided by added sugar in flavoured milks compared to unflavoured milk (Murry et al. 2015). Currently, the published data shows no adverse effect on body weight in children who consume flavoured over plain milk (Murphy et al. 2008, Fayet et al. 2013). The only exception is the longitudinal study by Noel et al. (2013), where they found a greater percent body fat in only overweight/obese girls who consumed flavored milk at age 13 years compared to 11 years, but not in boys. Moreover, the American Heart Association, in their Scientific Statement on Dietary Sugars Intake and Cardiovascular Health, point out that “*when sugars are added to otherwise nutrient-rich foods, such as sugar-sweetened dairy products like flavored milk and yogurt and sugar-sweetened cereals, the quality of children’s and adolescents’ diets improves and in the case of flavored milks, no adverse effects on weight status were found.*” (Johnson et al. 2009). The recent statement by the American Academy of Pediatrics reaches similar conclusions (Murry et al. 2015).

As a consequence of the aforementioned policies, in schools where flavoured milk has been removed completely or is available on limited days of the week there has been a 34% reduction in total milk consumption (Quann & Adams 2013). Recently flavoured milk has become available with reduced fat and/or sugar content in the US (Yon et al. 2012), and a lower sugar option is now also available in Canada. Therefore, whether children will accept this lower sugar chocolate milk option is important to know. To date no study has examined whether substituting regular chocolate milk with reduced-sugar chocolate milk has any impact on chocolate milk and total milk consumption by students in Canadian elementary schools. Given the popularity of choosing chocolate milk over plain milk through our previous study (Henry et al. 2015), we hypothesized that in a school setting, by substituting regular chocolate milk with a reduced-sugar chocolate milk, children would still prefer flavoured milk over plain milk.

Methods

Study Design

A two-phase cross-over plate waste study was conducted to assess through direct measurement, the acceptance of the introduction of a reduced-sugar (25% less) 1%-fat chocolate milk (140 kcal, 19 g sugar) with no artificial sweetener, that replaced the standard 1%-fat chocolate milk (160 kcal, 25g sugar) being offered to elementary school students in schools with established milk programs where students purchased milk at cost at lunchtime. The study was conducted in two 3-week phases between January and February 2014. In Phase 1, the routine milk consumption of plain 2%-fat milk and standard 1%-fat chocolate milk was determined. Over the next 3 weeks, in Phase 2, reduced-sugar chocolate milk was substituted for the standard chocolate milk, and again milk consumption was measured. The reduced-sugar milk cartons had a blue band with the reduced sugar notification. The plain, standard chocolate and sugar-reduced chocolate milks (per 250 mL serving) contained the following: 130, 160, and 140 kcal, and 12, 25, and 19 g sugar, respectively.

Participants

After receiving required consent by the school boards and parents, students from eight elementary schools (grades 1-8), located in Saskatoon, Saskatchewan, Canada, with established school milk programs prior to the study start date, were recruited to participate. Upon completion of the study, schools were reimbursed for the reduced-sugar chocolate milk as this product was not a standard offering of the schools and was imported just for the study. In participant schools, the program was open to all students who wanted to purchase milk. Students and their parents/guardians were aware of the change in the sugar content in the reduced-sugar chocolate milk carton. However, students were not encouraged to consume more milk and were unaware of the planned reimbursement. To follow the routine practices at school, there was no subsidies or free milk provided to students. No student was opted out from the study. Ethical approval was obtained from the University of Saskatchewan's

Behavioral Ethics Board. Permission was obtained from the Greater Saskatoon Catholic School Board, Saskatoon Public School District, participating schools, children, and caregivers of the children. A letter of information was sent home with each student informing families of the study and the temporary changes to be made to the milk program.

Study Protocol

Undergraduate and graduate nutrition students were recruited and attended a 45 minute training session; thereafter, each student was assigned to one school for the full 6-week study to ensure consistency. Using “plate waste” method we measured milk consumption as milk sold minus milk discarded per student. The trained personnel conducted waste studies data collection daily using consistent measurement processes and tools across all schools. The amount of milk sold was also recorded throughout the trial. Data collection on each measurement day included the amount of milk sold (based on the number of 250 mL cartons) by flavour and the cumulative amount of milk discarded at lunch by flavour, grade and gender. This permitted calculation of the net amount of milk consumed (usage minus waste), by flavour, grade and gender.

All milk, in 250 mL cartons, was purchased by the schools from Dairyland, Saputo Inc., Saskatoon, Saskatchewan, and sold during lunchtime. To calculate milk wastage within the 15 consecutive school days in each phase, large trays were provided in each classroom so that there were trays by grade and for each grade, trays for gender. Students were instructed to place all used cartons right-side up into the appropriate (labelled) trays. After lunch the data collectors counted the number of cartons and then poured the waste into 2000 mL graduated cylinders to record the waste per student. We checked the numbers with daily school inventories to take to account potential missing milk cartons. Only a few cartons were missed (<1%).

The percentage of students who purchased milk (i.e. total, plain or flavoured) was calculated by taking the number of milk cartons sold (i.e. number of students who chose milk) and dividing by

the number of students in the school. This calculation adjusted for variations in school size. Each student who chose to consume milk at school was assumed to purchase only one carton of milk (250 ml) at lunchtime.

Statistical Analysis

Data were analyzed using Statistical Package for Social Science (SPSS) version 19 (SPSS Inc., Chicago, Ill., USA). Data analysis by grade was performed by combining grade levels into grades 1 to 4 and grades 5 to 8. Using Shapiro-Wilk's W test, it was found that the data were not normally distributed; thus, non-parametric tests were used for analyses. Wilcoxon test was performed to compare the intake across the 2 phases. Mann-Whitney U test was used to compare intake across grade and gender. In all statistical analyses, alpha was set at 0.05. Descriptive statistics include both parametric (i.e. mean, standard deviation (SD)) and non-parametric (i.e. median, interquartile range (IQR)) measures of central tendency.

Results

A total of 2124 students were available from the 8 schools, 51.5% were male and 49.5% female. The distribution by grade was 51.6% attending grades 1-4 and 49.4% attending grades 5-8. The schools are located in middle socio-economic area of the city of Saskatoon. The ethnic distribution children was diverse with the majority of Caucasian children as it is represented in the general population of Saskatoon. Overall, 9.8% of students in the eight schools participated in the lunchtime milk program. For all 8 schools, the average number of containers collected was 208 per day.

Students purchased chocolate milk more often than white milk in both study phases. In Phase 1, 91% of students chose to purchase chocolate milk over white milk and in Phase 2, 88% chose to purchase chocolate over white milk. The percentage of students choosing milk dropped from 9.8 % in

Phase 1, to 6.5% in Phase 2 (Table 1) when reduced-sugar milk was offered in place of regular chocolate milk ($p < 0.001$). The percentage of students purchasing plain milk did not change once the reduced sugar formulation was introduced (Table 1). An increase in milk wastage also occurred with students consuming a median of 220 mL per day in Phase 1 and 203 mL per day in Phase 2 (Table 2).

Gender was not a factor in amount of milk consumed per serving or percentage of students who purchased milk, for both chocolate and unflavoured milk choices, in either phase (Table 1 and 2). While plain milk was purchased by a small percentage of students ($<1\%$), a significant increase in plain milk wastage by both males and females (17 mL/student) was evident in Phase 2 ($p = <0.001$). A higher percentage of younger students (grades 1-4) purchased milk than older (grades 5-8) students in both Phases 1 and 2, (Phase 1: $11.10 \pm 0.81\%$ vs. $8.36 \pm 0.74\%$, Phase 2: $8.47 \pm 0.43\%$ vs. $4.62 \pm 0.40\%$ $p < 0.020$). Older children consumed approximately 20 mL more of the milk purchased compared to the younger children (Phase 1: 228 ± 1 vs. 246 ± 1 mL $p < 0.001$, Phase 2 218 ± 3 vs 239 ± 3 mL $p < 0.001$). The percentage of students purchasing chocolate milk (8.93 ± 0.75 vs. 5.73 ± 0.29 $p < 0.001$) in Phase 2 was significantly reduced for both older and younger students, with the older students (Grades 5-8) showing a greater drop, by one-half, (7.65 ± 0.78 vs. $3.99 \pm 0.35\%$ $p < 0.001$)) compared to younger students (Grades 1-4), by one-quarter (10.10 ± 0.78 vs. $7.52 \pm 0.39\%$ $p < 0.001$). The percentage of students in either age group choosing plain milk, approximately 1% or less, did not significantly change between Phase 1 and 2 (Grades 1-4: 1.01 ± 0.13 vs. $0.95 \pm 0.17\%$, Grades 5-8: 0.71 ± 0.11 vs. $0.63 \pm 0.14\%$ $p > 0.1$). Both age groups reduced the amount of milk they drank in Phase 2 compared to Phase 1 for both white and chocolate milk, for an overall drop of 10 mL for younger students ($p < 0.001$) and of 7 mL for older students ($p < 0.001$ (Table 2).

Discussion

There is no established school lunch program in most urban Canadian schools including the schools that participated in our study. No other beverages for purchase except for milk are provided at

the schools. Milk is sold either through a canteen window or the orders are taken in the morning and student representatives from the classes take the milk back to the classrooms. Students eat their lunch in their class rooms where we conducted the plate waste study. Chocolate milk continued to be the milk flavour of choice for students even after the reduced sugar chocolate milk was introduced. However, providing reduced-sugar chocolate milk resulted in a reduction in in the milk purchase and consumption. The change from a regular chocolate milk to a reduced sugar chocolate milk did not result in more students choosing plain milk during our three week study.

A reduction in milk intake at school could have adverse effects on nutrient intakes of children. In one study, flavoured milk drinkers were 1.7 times more likely than plain milk drinkers to meet the EAR for calcium especially for the 9-16 year old age group (Fayet et al. 2013). We (Henry et al. 2015) and others (Quann & Adams 2013, Hanks et al. 2014) have shown a significant reduction in the number of children choosing milk at school when chocolate milk is removed from schools. Thus, not offering chocolate milk to this age group could result in fewer children meeting their daily calcium requirements (Quann & Adams 2013, Hanks et al. 2014). A qualitative study of US School Nutrition Directors demonstrated that schools recognise that offering the low-sugar chocolate milk is a compromise; reducing the amount of sugar consumed by students while continuing to offer them the product they prefer (Yon et al. 2013). Thus, providing the lower-sugar chocolate milk may be a better choice than eliminating all flavoured milk in schools (CDC 2010).

Studies in the US where schools changed the sugar and/or fat content of the milk they offered showed with time, milk intake levels that initially dropped in subsidized programs gradually returned to their previous amounts (Yon & Johnson 2014, CDC 2010). In New York City, for example, removing whole milk from public schools initially caused a 2 year decline of 8% in milk shipments, and it took five years for milk consumption to return to the previous level (CDC 2010). The impact on milk shipments and participation in the National School Lunch Program in the US of switching from

standard to lower-calorie chocolate milk in elementary and middle schools were investigated by Yon et al. who saw an initial drop in participation in the subsidized program of 2.7% that took over 12 months to return to previous levels (Yon & Johnson 2014). Our study examined a relatively short time for acceptance of the new product in a situation where children made their own purchase decisions. It is apparent that a long time is needed for students to adapt to changes in type of milk offered at schools. We have no data on how milk changes influence longer term purchasing of milk by children in Canada.

The current study found no gender differences in the numbers of males and females choosing milk or the amount consumed by them. However, in the National School Lunch Program study, boys were more likely to drink most of their milk than girls in grades 3-5 (Yon et al. 2012). The difference in findings could be, partly, due to the students in our study having to purchase milk whereas in the US study by Yon et al. (2012) where milk was provided for free.

Limitations of this study include that our findings are based on a relatively small convenience sample of schools in one Canadian city, therefore, may not be representative of all school children in Canada. We did not consider a set control schools for comparison. Further, the short timelines of the study did not for a reasonable run in period for Phase two where the reduced-sugar chocolate milk was provided. Additionally, one assumption was made that each child consumed only one carton and that the milk was not shared.

Conclusion

This study indicates chocolate milk as a milk choice in school children. Even when replaced by a reduced sugar formula, it is still the preferred milk choice. However, students purchased less of the reduced-sugar chocolate milk, and those who did waste more of it. Furthermore, they did not compensate by choosing plain milk. Therefore, schools that switch to a reduced-sugar chocolate milk can expect an initial drop in the number of students choosing milk. Further research, with longer

duration, larger sample sizes and more schools in different parts of the country, is required to determine whether Canadian students who participate in milk programs would eventually adapt to the reduced-sugar chocolate milk availability in schools.

Conflict of Interest: None

Author contributions:

C.H. led the project as Principal Investigator, overseeing all stages of study design, data collection and analysis. C.H., S.J.W., G.A.Z. and H.V. contributed to study design. S.L.F. led data collection, and S.L.F and H.V performed data analysis. All authors contributed to the manuscript content and revisions and have read and approved the final version.

Ethics of human subject participation: The study was conducted according to the guidelines specified in the Declaration of Helsinki and ethical approval was obtained from the University of Saskatchewan's Behavioural Ethics Board. Permission was obtained from the Greater Saskatoon Catholic Board and the Saskatoon Public School Division, participating schools, and children. Written consent was not required for the milk waste measurement.

Acknowledgements

The authors would like to acknowledge the Greater Saskatoon Catholic School Division and the Saskatoon Public School Division staff and students for their support and participation in this research project,

Financial Support

This work was supported by Dairy Farmers of Canada who had no role in the study design, interpretation and publication of the data.

Draft

References

- Centers for Disease Control and Prevention (CDC). 2010. Effects of switching from whole to low-fat/fat-free milk in public schools - New York city, 2004-2009. *MMWR Morb Mortal Wkly Rep* **29**, 70-3.
- Centers for Disease Control and Prevention (CDC). 2011. School Health Guidelines to Promote Healthy Eating and Physical Activity. *MMWR Morb Mortal Wkly Rep* **60**, 1-2.
- Condon EM, Crepinsek MK, Fox MK. 2009. School meals: types of foods offered to and consumed by children at lunch and breakfast. *J Am Diet Assoc* **109**(2 Suppl), S67-78.
- Fayet F, Ridges LA, Wright JK, Petocz P. 2013. Australian children who drink milk (plain or flavored) have higher milk and micronutrient intakes but similar body mass index to those who do not drink milk. *Nutr Res* **33**, 95-102.
- Garriguet D. 2008. Overview of Canadians' Eating Habits. Nutrition: Findings from the Canadian Community Health Survey. Report no. 82-620-MIE – No. 2. Ottawa, ON: Statistics Canada.
- Garriguet D. 2008. Beverage consumption of children and teens. *Health Rep* **19**, 17-22.
- Hanks AS, Just DR, Wansink B. 2014. Chocolate milk consequences: a pilot study evaluating the consequences of banning chocolate milk in school cafeterias. *PLoS One* **9**, 91022.

Henry CJ, Whiting SJ, Phillips T, Finch SL, Zello GA, Vatanparast H. 2015. Impact of the removal of chocolate milk from school milk programs for school-aged children in Saskatoon Canada. *Appl Physiol Nutr* **40**, 245-50.

Hasnain SR, Singer MR, Bradlee ML, Moore LL. 2014. Beverage intake in early childhood and change in body fat from preschool to adolescence. *Child Obes* **10**, 42-9.

Hu FB & Malik VS. 2010. Sugar-sweetened beverages and risk of obesity and type 2 diabetes: epidemiologic evidence. *Physiol Behav* **100**, 47-54.

Johnson RK, Appel LJ, Brands M, Howard BV, Lefevre M, Lustig RH et al. 2009. American Heart Association Nutrition Committee of the Council on Nutrition, Physical Activity, and Metabolism and the Council on Epidemiology and Prevention. Dietary sugars intake and cardiovascular health: a scientific statement from the American Heart Association. *Circulation* **120**, 1011-20.

Murray R, Bhatia J, Okamoto J, Allison M, Ancona R, Attisha E et al. 2015. Snacks, Sweetened Beverages, Added Sugars, and Schools. *Pediatrics, Am Acad Pediatrics*.

Kalkwarf HJ, Khoury JC, Lanphear BP. 2003. Milk intake during childhood and adolescence, adult bone density, and osteoporotic fractures in US women. *Am J Clin Nutr* **77**, 257-65.

Keast DR, Fulgoni VL 3rd, Nicklas TA, O'Neil CE. 2013. Food sources of energy and nutrients among children in the United States: National Health and Nutrition Examination Survey 2003–2006. *Nutrients* **22**, 283-301.

Larson NI, Story M, Wall M, Neumark-Sztainer D. 2006. Calcium and dairy intakes of adolescents are associated with their home environment, taste preferences, personal health beliefs, and meal patterns. *J Am Diet Assoc* **106**, 1816-2431.

Malik VS, Popkin BM, Bray GA, Després JP, Hu FB. 2010. Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. *Circulation* **121**, 1356-64.

Murphy MM, Douglass JS, Johnson RK, Spence LA. 2008. Drinking flavored or plain milk is positively associated with nutrient intake and is not associated with adverse effects on weight status in US children and adolescents. *J Am Diet Assoc* **108**, 631-9.

Neumark-Sztainer D, Wall M, Perry C, Story M. 2003. Correlates of fruit and vegetable intake among adolescents. Findings from Project EAT. *Prev Med* **37**, 198-208.

Noel SE, Ness AR, Northstone K, Emmett P, Newby PK. 2013. Associations between flavored milk consumption and changes in weight and body composition over time: differences among normal and overweight children. *Eur J Clin Nutr* **67**, 295-300.

Petterson J & Saidel M. 2009. The removal of milk in schools results in a reduction in total milk purchases in grades K-12. *J. Am Diet Assoc* **109**, A97.

Phillips S, Jacobs Starkey L, Gray-Donald K. 2004. Food habits of Canadians: food sources of nutrients for the adolescent sample. *Can J Diet Pract Res* **65**, 81-4.

Quann EE & Adams D. 2013. Impact on Milk Consumption and Nutrient Intakes from Eliminating Flavored Milk in Elementary Schools. *Nutr Today* **48**, 127-134.

Teegarden D, Lyle RM, Proulx WR, Johnston CC, Weaver CM. 1999. Previous milk consumption is associated with greater bone density in young women. *Am J Clin Nutr* **9**, 1014-7.

Yon B & Johnson RK. 2014. Elementary and middle school children's acceptance of lower calorie flavored milk as measured by milk shipment and participation in the National School Lunch Program. *J Sch Health* **84**, 205-11.

Yon Ba, Johnson RK, Berlin L. 2013. School Nutrition Directors' Perspectives on Flavored Milk in Schools. *J Child Nutr and Mngt* 37 – 39.

Yon BA, Johnson RK, Stickle. T.R. 2012 School children's consumption of lower-calorie flavored milk: a plate waste study. *J Acad Nutr Diet* **112**, 132-6.

Table 1: Percentage of students who purchased milk*at school by phase, gender and grade**

Subject Characterization	Phase 1						Phase 2					
	Plain		Standard Chocolate		Total		Plain		Reduced-Sugar Chocolate		Total	
All students (n=2124)												
Median, IQR	0.42	0.00-1.27	7.98 ^a	4.79-10.43	8.02 ^b	5.51-11.31	0.27	0.00-0.92	5.34 ^a	4.03-7.39	5.70 ^b	4.26-8.49
Mean, SD	0.87	0.11	8.93	0.75	9.80	0.80	0.78	0.14	5.73	0.29	6.51	0.34
Males (n=1094)												
Median, IQR	0.00	0.00-1.07	0.73 ^a	3.35-11.17	7.94 ^b	3.93-11.92	0.00	0.00-0.79	5.21 ^a	3.13-6.82	5.41 ^b	3.58-7.39
Mean, SD	0.80	0.12	8.22	0.73	9.01	0.79	0.75	0.15	5.41	0.32	6.16	0.39
Females (n=1030)												
Median, IQR	0.00	0.00-1.19	9.09 ^a	4.76-11.88	9.09 ^b	5.53-12.15	0.00	0.00-1.00	5.71 ^a	2.86-8.57	6.36 ^b	3.81-9.20
Mean, SD	0.94	0.14	9.80	0.81	10.74	0.68	0.82	0.16	6.10	0.41	6.92	0.43

Grade 1-4

(n=1085)

Median, IQR	0.00	0.00-1.50	8.63 ^{a, d}	5.14-12.90	9.05 ^{b, e}	6.94-13.64	0.00 ^f	0.00-1.20	7.29 ^{a, g}	4.80-9.71	8.13 ^{b, h}	5.65-11.39
Mean, SD	1.01	0.13	10.10	0.78	11.10	0.81	0.95	0.17	7.52	0.39	8.47	0.43

Grade 5-8

(n=1029)

Median, IQR	0.00	0.00-0.88	6.71 ^{a, d}	2.53-10.62	7.15 ^{b, e}	2.65-11.50	0.00 ^f	0.00-0.88	3.14 ^{a, g}	1.25-6.33	3.96 ^{b, h}	1.40-7.08
Mean, SD	0.711	0.11	7.65	0.78	8.36	0.74	0.63	0.14	3.99	0.35	4.62	0.40

* Plain milk: 2%-fat milk, Standard chocolate milk 1%-fat chocolate milk, Reduced-sugar chocolate milk: standard 1%-fat chocolate milk (160 kcal, 25g sugar)

** Pair wise values in rows with same symbols (*a, b, c*) show a significant difference ($P < 0.05$) due to phase. Values in columns (males vs. females, grade 1-4 vs. 5-8) with same symbol (*d, e, f, g, h*) show a significant difference ($P < 0.05$) by characterization. Analyses conducted using Mann-Whitney U test.

Table 2: Serving (mL) of milk consumed* per day at school per student participating in the milk program by phase and by gender and grade**

Subject Characterization		Phase 1					Phase 2					
		Plain		Standard Chocolate		Total	Plain		Reduced-Sugar Chocolate		Total	
All students (n=2124)												
Median, IQR	228 ^a	231-250	218 ^b	230-249	220 ^c	230-246	206 ^a	200-250	201 ^b	212-245	203 ^c	214-240
Mean, SD	236	3	237	1	237	2	219	6	225	2	225	2
Males (n=1094)												
Median, IQR	250 ^a	250-250	217 ^b	227-250	217 ^c	227-250	230 ^a	211-250	203 ^b	209-250	205 ^c	210-250
Mean, SD	237	19	240	22	237	2	219	8	227	3	227	3
Females (n=1030)												
Median, IQR	232 ^a	226-250	216	228-250	213	225-247	239	190-250	190	213-250	194	210-248

Mean, SD	230	4	236 ^b	2	234 ^c	2	216 ^a	8	223 ^b	3	222 ^c	3
Grade 1-4 (n=1085)												
Median, IQR	218 ^{a,d}	218-250	210 ^{b,e}	219-249	209 ^{c,f}	219-246	194 ^{a,g}	186-250	188 ^{b,h}	197-243	190 ^{c,i}	119-241
Mean, SD	228	2	229	1	228	1	207	8	218	3	218	3
Grade 5-8 (n=1029)												
Median, IQR	250 ^{a,d}	250-250	242 ^{be}	246-250	242 ^{c,f}	246-250	232 ^{a,g}	250-250	232 ^{b,h}	238-250	231 ^{c,i}	238-250
Mean, SD	249	2	245	1	246	1	246	2	238	3	239	3

* Plain milk: 2%-fat milk, Standard chocolate milk 1%-fat chocolate milk, Reduced-sugar chocolate milk: standard 1%-fat chocolate milk (160 kcal, 25g sugar)

** Pair wise in rows values with same symbols (*a*, *b*, *c*) show a difference due to phase. Values in columns (males vs. females, grade 1-4 vs. 5-8) with same symbol (*d*, *e*, *f*, *e*) show difference by characterization. Analyses conducted using Mann-Whitney U test.