

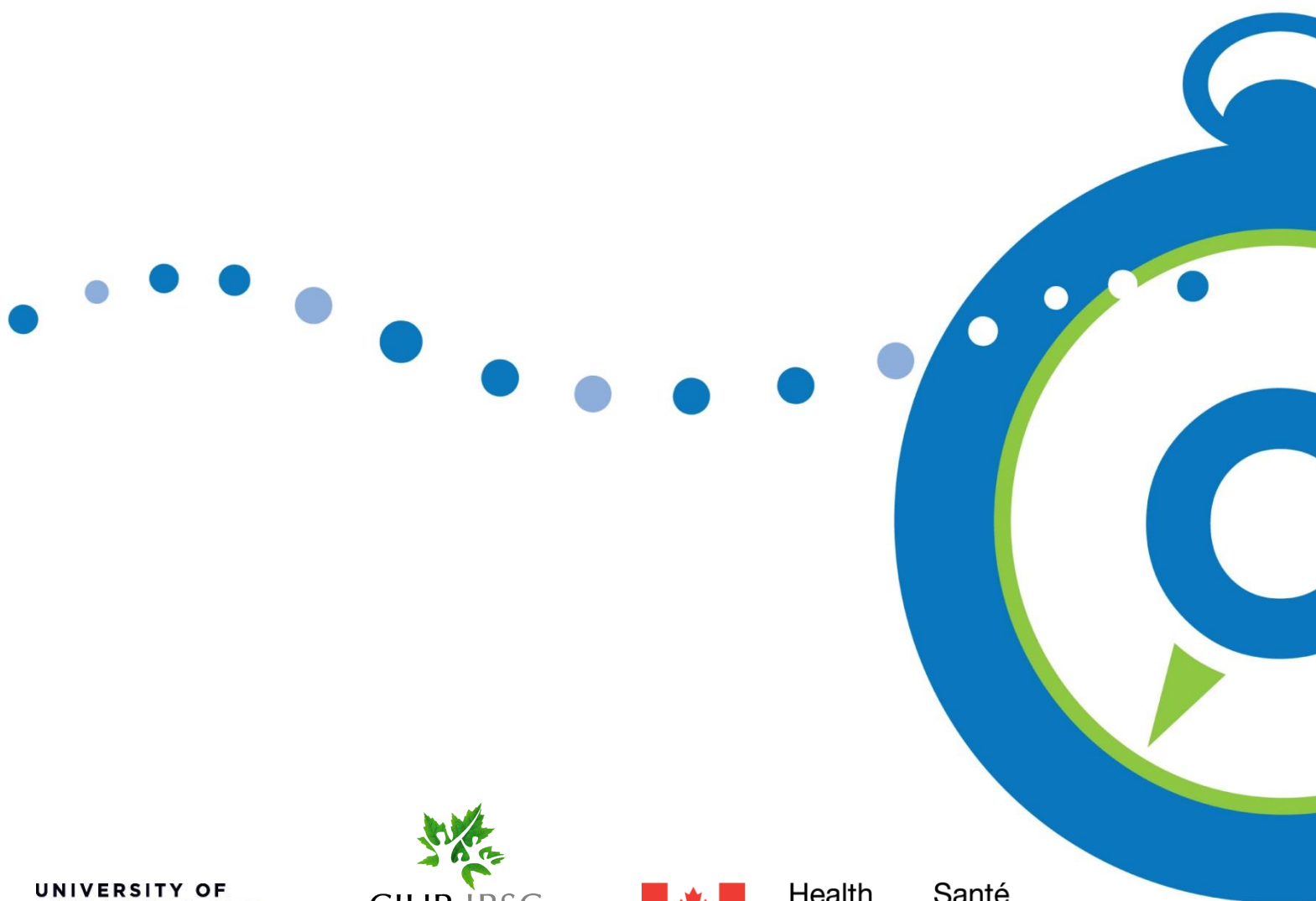


Cohort study evaluating how changes in school programs, policies, and resources impact youth health behaviours

Correlates of milk and milk alternative consumption among Canadian secondary school students, circa 2017/2018

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Conflicts of interest:

This study was supported by a grant from the Dairy Farmers of Canada (DFC). DFC did not have any role in the design nor analysis of this research. Under the conditions of this grant, the authors reserve the right to publish the results of the study and have the final decision on the content of papers and the journal(s) to which the papers are submitted (although DFC encourages publication in Canadian journals or those with a Canadian readership). As per the conditions of the grant, the researchers provided DFC with a copy of this manuscript before its submission; DFC did not provide comments on the manuscript.

SEM has served as a paid Expert on behalf of the Attorney General of Canada in legal proceedings, providing evidence on the public health risks and benefits of unpasteurized milk.

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Introduction

Adolescence is a critical time when individuals establish autonomy and adopt lasting health behaviors.(1) Poor diet developed during adolescence is typically maintained into adulthood (2) and is associated with a number of chronic diseases such as cardiovascular disease, type-II Diabetes mellitus, cancer, and bone disease.(3) Understanding factors that influence diet among adolescents is therefore essential for informing programs and policies designed to promote healthy eating, and ultimately, for preventing future chronic disease burdens.

One of the major food groups traditionally considered important for a healthy diet is milk and milk alternatives (MMAs), in part because adequate calcium and vitamin D intake are considered vital for lifelong bone health.(4–7) However, MMA consumption is declining, with an overall decrease since 2009,(8) and a decline that appears to begin in adolescence.(9) Although higher MMA consumption appears to be associated with factors such as higher household income,(8) lower BMI and body fat percentage (10), and healthy school environments,(11) MMA consumption patterns among Canadian secondary school students have not been fully explored.

In January 2019, Canada released the first amendment to its food guide since 2007. The 2007 version (most recently published as the 2011 “Eating Well with Canada’s Food Guide” (12)) recommended a minimum number of servings from four main food groups: fruits and vegetables, milk and milk alternatives, meat and meat alternatives, and grains. In contrast, the 2019 food guide (13) takes a holistic approach to healthy eating, for example recommending consumption of a variety of healthy foods each day, but does not explicitly recommend specific number of servings by food groups. Within this shifting landscape of food policy in Canada, the importance of developing and evaluating healthy eating habits among youth remains a public health priority.

The objective of this research was to quantify the number of MMAs consumed by students, and identify demographic and behavioural characteristics associated with MMA consumption, using the food guide in place at the time of data collection. Specifically, we examined characteristics that were associated with both the number of servings of MMAs consumed, and also with whether students consumed the recommended number of servings of MMAs as outlined in the 2011 Canada food guide.

Methods

2.1 Data source and sample

COMPASS is a prospective cohort study (2012-2021) designed to measure the impact of policy, programs, and resources on various youth health behaviours. Data collected include student, school and broader environment level data from participating secondary schools across Canada. This study analyzed the most recent wave of student-level data (2017-2018; prior to the 2019 changes made to Canada’s food guide), from participating secondary schools in the Canadian provinces of Quebec (n=37), Ontario (n=61), Alberta (n=8) and British Columbia (n=16). A complete description of the COMPASS methodology is available in print (14) and online (www.compass.uwaterloo.ca). COMPASS received ethics approval from a University of Waterloo Human Research Ethics Committee (ORE #: 30118) and all participating school boards; this analysis was conducted under that approval.

Data were collected from 66,434 grade 9-12 students attending 122 secondary schools that participated in the study. Students were purposefully recruited using an active-information passive-consent protocol (14) to ensure anonymity and response rate, and could refuse participation at any time. During class time, students completed the COMPASS student questionnaire,(14) a tool used to measure self-reported demographics, health behaviours and outcomes. Given 19 correlates were included in this exploratory analysis, we clustered similar correlates into five groups to improve the clarity and interpretation of the findings: demographics (5 variables), weight perception (2 variables), physical activity (2 variables), eating behaviours (7 variables), and substance use (3 variables).

2.2 Measures

Outcome: milk and milk alternatives (MMAs)

The outcome measure for this study, MMA consumption, was measured by asking students “Yesterday, from the time you woke up until the time you went to bed, how many servings of milk and milk alternatives did you have? One ‘food guide’ serving of milk or milk alternatives includes milk, fortified soy beverage, reconstituted powder milk, canned milk, yogurt or kefir (another type of cultured milk products), and cheese”. The survey also included an image, excerpted from the 2011 Canada food guide ((12); in place during the time of data collection), of the types of MMAs and descriptions of serving sizes to assist participants with determining the number of servings consumed. Daily MMA servings were measured as continuous, and response options included: none, 1 serving, 2 servings, 3 servings, 4 servings, 5 servings and 6 or more servings. Students were classified as meeting the guidelines for MMAs if they consumed at least 3 or more servings (the recommendation for youth between the ages of 14 and 18 (12)); those consuming 2 or fewer servings of MMAs were classified as not meeting the guidelines. Moderately high test-retest reliability (ICC 0.69) and fair validity (ICC 0.60) has been observed for the self-reported MMA consumption measure in the student questionnaire.(14)

Demographics

Within the student questionnaire, students reported their gender (female, male); ethnicity (White, Black, Asian, First Nations, Métis, Inuit, Latin American or Hispanic, Mixed/Other); and weekly spending money (\$0, \$1-\$5, \$6-\$10, \$11-\$20, \$21-\$40, \$41-\$100, More than \$100, Don’t know). Grade (9, 10, 11, 12) was used as a proxy for age given its relevance to school stakeholders and application of research findings for school-based program implementation.

Weight perception

Consistent with other national youth surveillance systems (15,16), BMI was measured via the survey using self-reported height and weight. Students were categorized as underweight, healthy weight, overweight, obese, and unknown in accordance with the International Obesity Task Force BMI classification system.(17) High reliability (ICC 0.95) and substantial validity (ICC 0.84) has been observed for the self-reported BMI measure in the student questionnaire.(18) Additionally, self-reported weight goals were measured by asking students to report: “What are you trying to do with your weight”. Available answers were: “lose weight”, “gain weight”, “stay the same weight” and “do nothing”.

Physical activity

Students were asked to report how many minutes of moderate and hard physical activity they engaged in over the past 7 days to assess whether students met the physical activity guidelines. Based on Canadian 24-hour movement guidelines (19), students were classified as being physically active if they reported 60 minutes of moderate and hard physical activity daily over the past 7 days. Students who reported less than 60 minutes of daily physical activity were categorized as not physically active. All measures have been previously validated.(16,18) We also measured team sport and intramural involvement by asking students: “Do you participate in competitive school sports teams that compete against other schools? (e.g., junior varsity or varsity sports),”; “Do you participate in league or team sports outside of school?”, and; “do you participate in before-school, noon hour, or after-school physical activities organized by your school?”. All three variables were combined to represent overall *sports participation*. Students reporting “yes” to at least one of the three questions were classified as participating on a sports team. Students that reported “no” to all three questions were classified as not being involved.

Eating behaviours

Students were asked to report how many minutes of moderate and hard physical activity they engaged in over the past 7 days to assess whether students met the physical activity guidelines. Based on Canadian 24-hour movement guidelines (19), students were classified as being physically active if they reported 60 minutes of moderate and hard physical activity daily over the past 7 days. Students who reported less than 60 minutes of daily physical activity were categorized as not physically active. All measures have been previously validated.(16,18) We also measured team sport and intramural involvement by asking students: “Do you participate in competitive school sports teams that compete against other schools? (e.g., junior varsity or varsity sports),”; “Do you participate in league or team sports outside of school?”, and; “do you participate in before-school, noon hour, or after-school physical activities organized by your school?”. All three variables were combined to represent overall *sports participation*. Students reporting “yes” to at least one of the three questions were classified as participating on a sports team. Students that reported “no” to all three questions were classified as not being involved.

Substance use behaviours

For all substance use items, students were categorized as current and non-current users, consistent with previous research.(20) Current smokers were classified as students who reported smoking one or more cigarettes in the past month, current binge drinkers were classified as students who reported having five drinks of alcohol or more on one occasion at least once in the last month, and current cannabis users were classified as students who reported having used cannabis in the last month.

2.3 Data Analysis

Of the 66,434 students that participated in the student questionnaire, 49,486 had complete data on the number of MMA servings consumed, and the analysis was completed on these students. Mean MMA consumption was calculated for sub-groups of students by characteristic; characteristics of students who met the food guide requirements versus students who did not were compared using χ^2 tests. Logistic

regression analyses were conducted to evaluate associations between student characteristics and the odds of meeting the guidelines for MMA consumption. Linear regressions were performed to examine associations between the number of daily MMA servings consumed, and student characteristics. Given the large sample size of this study, a p value of ≤ 0.01 was used to determine statistical significance in order to reduce the probability of type I error. Regression models adjusting for school-level clustering were also run; since these models produced similar results (suggesting minimal school-level variability) and there is no universal measure of absolute fit of models controlling for clustering, non-clustered models were reported here to illustrate overall model fit. We used SAS 9.4 (21) to conduct all analyses. For both the logistic and linear regression models, all first order interactions were run between all the other variables and (i) grade and (ii) gender.

Results

3.1 Sample characteristics

Overall, 66.9% of the sample did not meet Canada's 2011 guidelines for MMA consumption, and on average, students consumed 2.03 [SD: 1.41] servings of MMAs a day (Table 1). Students in Alberta and British Columbia consumed a lower average number of servings of MMAs a day than students in Ontario and Quebec. Students who met the MMA guidelines more commonly reported being male (61.5% versus 38.5%) and males also consumed a higher daily number of servings (2.36 [SD: 1.47]) than females (1.73 [SD: 1.27]). As grade-level increased, the mean number of servings of MMAs consumed decreased. Students who identified as white consumed the highest mean number of servings per day (2.14 [SD: 1.42]) compared to all other reported ethnicities. Students who reported having any amount of spending money or did not know how much spending money was available to them consumed a higher daily number of MMA servings than students who had no spending money. Students who reported a BMI that was underweight (2.09 [SD: 1.45]) or obese (2.14 [SD: 1.48]) consumed a higher daily number of MMA servings than students who were a healthy weight (2.07 [SD: 1.39]), overweight (2.05 [SD: 1.42]) or had an unknown BMI (1.89 [SD: 1.40]). Students reporting trying to lose weight consumed fewer mean servings of MMAs compared to students who were trying to gain weight, maintain their weight, or who had no weight goals. Physically active students had a higher daily number of MMA servings (2.25 [SD: 1.46]) than students who did not participate in physical activity (1.89 [SD: 1.35]). Students involved in organized sport consumed higher mean servings of MMAs per day (2.18 [SD: 1.42] vs 1.81 [SD: 1.40]) and more commonly met the MMA guidelines than students who did not participate in sports. Moreover, students who met Canada's 2011 food guide for the other food groups, brought their lunch from home, ate breakfast every day, and purchased items from the vending machines all consumed higher mean daily servings of MMAs than students who did not. Students who were current smokers or binge drinkers consumed lower mean daily servings of MMAs than students who were not, whereas students who were current cannabis users consumed higher mean daily servings of MMAs than students who were not.

3.2 Multivariate associations

Student factors associated with meeting Canada's 2011 consumption guidelines for MMAs are shown in Table 2. After adjusting for all other student characteristics in the model, males had a higher odds of meeting the MMA guidelines (aOR: 1.75 [1.65-1.85]) than females. Compared to students in Ontario, students in Quebec had a higher odds (aOR: 1.16 [1.08-1.25]) of meeting the MMA guidelines, and students in British Columbia (aOR: 0.81 [0.75-0.88]) and Alberta (aOR: 0.86 [0.77-0.97]) had a lower odds.

With each increase in grade, the odds of meeting the MMA guidelines decreased. Students with more than \$100 of weekly spending money had the highest odds of meeting the MMA guidelines (aOR: 1.14 [1.04-1.25]) compared to students with no spending money. Moreover, students who identified as white had higher odds of meeting the MMA guidelines compared to students who identified as black, Asian, Latin American, or “other/mixed”. For students who identified as aboriginal, the odds were not significantly different from students who identified as white.

While BMI was not significantly associated with consuming the recommended number of servings of MMAs, students who indicated trying to lose weight had lower odds of meeting the MMA guidelines (aOR: 0.88 [0.83-0.93]), and students who reported trying to gain weight had a higher odds of meeting the MMA guidelines (aOR: 1.17 [1.10-1.25]), than students with no weight goals. Students who were physically active (aOR: 1.30 [1.24-1.35]) or who participated in team sports (aOR: 1.26 [1.20-1.31]) had a higher odds of meeting the MMA guidelines than students who were not physically active or did not engage in team sports, respectively. Students who regularly ate breakfast (aOR: 1.21 [1.15-1.28]) or who participated in a breakfast program (aOR: 1.11 [1.04-1.18]) had a higher odds of meeting the MMA guidelines than students who did not eat breakfast daily, or who did not participate in school-based breakfast programs, respectively. As well, students who brought their lunch from home at least once a week had higher odds of meeting the MMA guidelines than students who did not bring their lunch from home at all during the week.

The odds of meeting the MMA guidelines increased as the frequency of purchasing items from the school vending machines increased. Students who met the guidelines for other food groups in the 2011 food guide (fruits and vegetables (aOR: 1.58 [1.45-1.73]), meat and alternatives (aOR: 1.90 [1.81-2.00]), and grains (aOR: 3.53 [3.25-3.84])) all had significantly greater odds of meeting the MMA guidelines compared to students who did not meet the guidelines for the other food groups. Substance use was not associated with MMA consumption. The logistic regression model had a concordance statistic of 0.704, indicating that the model was moderately accurate in determining the significant associations observed. First order interactions between gender and (i) BMI, (ii) breakfast eating and (iii) meeting the meat and alternatives consumption guidelines were significantly associated with meeting the MMA guidelines. However, because effect sizes for these terms were not meaningful and their inclusion did not improve the model fit (as indicated by the consistency in the concordance statistic), first order interaction terms were not included in our final model.

Student factors were associated with the number of daily MMA servings consumed (Table 3), in the same manner that the factors associated meeting the MMA guidelines were (Table 2), with two exceptions. While having \$21-\$100 in spending money, and being obese, were not significantly associated with meeting the guidelines (Table 2), students with \$21-\$100 in spending money, and who were obese, consumed significantly more servings of MMAs than students who had no spending money, and who were a healthy weight, respectively (Table 3). However, effect sizes were generally small, and the regression yielded an R-squared value of 0.165, indicating poor model fit. This suggests that student characteristics assessed here, do not adequately predict the number of servings of MMAs consumed. A number of first order interactions for both grade and gender were significantly associated with the number of MMA servings consumed. Because effect sizes were small (i.e., <0.5 servings of MMA) for all interactions, they were deemed as not meaningful, and thus we did not include them in the final model.

Discussion

Here, we analyzed self-reported survey data from a sample of over 49,000 Canadian secondary school students, and investigated student-level characteristics associated with MMA consumption. Under-consumption of MMAs were common among Canadian secondary school students, consistent with other Canadian studies.(8,9) Only one-third of students reported meeting the 2011 Canada's food guidelines for MMAs, with students consuming about two servings per day instead of the recommended three. As MMAs are a source of many nutrients that are required to support good bone health,(22,23) low consumption of MMAs may be an important indicator future illness burden if nutrients are not being obtained through other dietary means. Within this study, many covariates and behavioural correlates examined were significantly associated with MMA consumption, although the effect sizes were generally modest. As the food guide evolves,(13) it is necessary to evaluate the possible implications associated with changes and the impact it may have on youth health.

Students reporting an overall healthy behaviour profile were generally more likely to meet the guidelines for MMAs. For example, students who met the guidelines for other food groups outlined in the 2011 Canada's food guide were more likely to consume MMAs, suggesting that students who met the guidelines for MMAs consumed healthier diets. Indeed, existing research suggests that youth who participated in organized sports typically opt for non-flavoured milk instead of sugar-sweetened milk, compared to youth who are inactive.(24) As well, students who reported being physically active and involved in organized sports were more likely to consume MMAs. Interesting correlations between MMA consumption and weight status suggest that youth within our sample may perceive MMAs as products that lead to weight gain and in response, reduce consumption. Similar perceptions have been recognized in other research that has explored attitudes towards MMAs.(25,26) Moving forward, research should explore how changes in weight perceptions impact MMA consumption over time.

Food environments were also associated with MMA consumption. Students who regularly consumed breakfast and brought their lunch from home, reported consuming more MMAs. Likely attributable to parental guidance, one possible explanation may be that meals consumed from home may be more balanced than meals purchased at school or off school-campus. Additionally, students who made frequent purchases from the school vending machines were more likely to consume MMAs. Considering that students in Ontario were among some of the highest consumers of MMAs within this study, this finding could be a result of Ontario's School Food and Beverage Policy P/PM 150 (27) where MMAs are among the few items permitted for sale within vending machines. As the school environment has a pivotal role in shaping youth health behaviours,(11,28–31) schools may consider implementing evidence-based nutrition policies,(32) or, better yet, providing students with healthy meals throughout the school-day to improve dietary behaviours among their students.

This research demonstrates important findings to inform school-based program development and key correlates to control for in future analyses. Further investigation of barriers to MMA consumption is needed, and findings of this study would be strengthened with qualitative data to expand our understanding of influential factors among Canadians that extend beyond the individual-level. Identifying student, school, and broader environment characteristics that influence consumption of MMAs and changes in consumption over time will provide an in-depth understanding of declining consumption within a youth demographic, who represent the next generation of Canadian adults. Whether this decline in consumption of MMAs represents a decline in overall healthy diets is unknown. Nevertheless, this study may help inform future nutrition research, target youth populations where consumption rates are low,

and help tailor school- or community-based health promotion strategies to help Canadian youth consume adequate nutrients through their diet.

This study is not without limitations. Common to many retrospective dietary studies, all measures were self-reported and are subject to recall bias. MMA consumption was measured based on students reporting how many servings were consumed on the day previous to data collection and as such, it cannot be determined if the reported servings of MMAs consumed that day reflects normal consumption patterns. While previous school-based research (33) has demonstrated significant differences in consumption patterns between unsweetened and sugar-sweetened milk options, we were unable to measure MMA items separately. Additionally, complete-case analysis may over- or under-estimate the associations examined in this study. Although this study only provides cross-sectional results, these findings are important for informing future qualitative assessments, as well as research examining how school- and broader environmental factors impact youth consumption of MMAs, and how these patterns change over time. A major limitation of this study is the low R-squared value and small effect size produced by the linear model for daily number of MMAs consumed. Despite many correlates being significantly associated with the number of MMAs consumed, we were unable to conclude that the variables included in this model predict the number of servings of MMAs. As such, future COMPASS research will include school and environment level characteristics as we hypothesize that these variables will contribute significantly to, and provide a more detailed explanation for the under-consumption of MMAs by secondary students in Canada.

Conclusion

Establishing healthy eating behaviours during adolescence is essential for lifelong health, and MMAs have traditionally been considered an important part of a healthy diet. We determined that two-thirds of Canadian secondary school students were not meeting the national dietary guidelines for MMA consumption, in place at the time of the study. Indeed, Canada's 2019 food guide no longer recommends a daily number of servings for defined food groups such as MMAs, and how this change in dietary guidance manifests in the diets of Canadian secondary school students remains undetermined. Nevertheless, understanding MMA consumption prior to the update of Canada's food guide provides valuable insight for future evaluations of the impact of the 2019 Canada's food guide.

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Appendix

Appendix A:

Table 1. Characteristics of the 49,486 Canadian Secondary School Students who participated in the 2017/2018 wave of the COMPASS study, overall and by whether or not they consumed the daily recommended number of servings of Milk and Milk Alternatives

		Proportion of all students	Proportion of students, among those who:			Mean number of servings consumed per day (SD)
			Consumed less than 3 servings/day (i.e., did not meet the requirements)	Consumed 3 or more servings/day (i.e., met the requirements)	Chi-Square p-value	
		% (n)	% (n)	% (n)		
Total		100 (49486)	66.9 (33100)	33.1 (16386)		2.03 (1.14)
Demographics						
Province	Ontario	54.5 (26994)	53.9 (17843)	55.8 (9151)	<.0001	2.05 (1.41)
	British Columbia	21.2 (10476)	23.3 (7715)	16.8 (2761)		1.82 (1.34)
	Alberta	5.7 (2818)	5.9 (1942)	5.3 (876)		1.95 (1.38)
	Quebec	18.6 (9198)	16.9 (5600)	22.0 (3598)		2.26 (1.43)
Grade	9	27.0 (13357)	25.7 (8502)	29.6 (4855)	<.0001	2.15 (1.44)
	10	28.2 (13972)	27.8 (9190)	29.2 (4782)		2.07 (1.41)
	11	27.1 (13394)	27.6 (9133)	26.0 (4261)		1.99 (1.39)
	12	17.7 (8763)	19.0 (6275)	15.2 (2488)		1.86 (1.34)
Gender	Female	51.8 (25611)	58.3 (19308)	38.5 (6303)	<.0001	1.73 (1.27)
	Male	48.2 (23875)	41.7 (13792)	61.5 (10083)		2.36 (1.47)
Ethnicity	White	71.6 (35447)	68.3 (22605)	78.4 (12842)	<.0001	2.14 (1.42)
	Black	4.0 (1986)	4.2 (1400)	3.6 (586)		1.84 (1.50)
	Asian	14.5 (7169)	17.0 (5625)	9.4 (1544)		1.66 (1.25)
	Latin American	2.8 (1377)	3.0 (1005)	2.3 (372)		1.86 (1.33)
	Other/Mixed	7.1 (3507)	7.4 (2465)	6.4 (1042)		1.91 (1.38)
Spending Money	Zero	15.7 (7770)	16.3 (5394)	14.5 (2376)	<.0001	1.94 (1.42)
	\$1-\$5	5.1 (2537)	5.2 (1710)	5.0 (827)		2.01 (1.39)
	\$6-\$10	6.6 (3250)	6.5 (2145)	6.7 (1105)		2.06 (1.34)
	\$11-\$20	12.4 (6123)	12.3 (4084)	12.4 (2039)		2.06 (1.37)
	\$21-\$40	11.3 (5573)	11.3 (3737)	11.2 (1836)		2.03 (1.39)
	\$41-100	14.0 (6923)	14.4 (4677)	13.7 (2246)		2.01 (1.38)
	More than \$100	20.6 (10186)	19.8 (6570)	22.1 (3616)		2.11 (1.44)
	I don't know	14.4 (7124)	14.5 (4783)	14.3 (2341)		2.03 (1.42)
Weight Status						
BMI	Underweight	1.7 (827)	1.6 (534)	1.8 (293)	<.0001	2.09 (1.45)
	Healthy weight	56.9 (28163)	56.0 (18524)	58.8 (9639)		2.07 (1.39)
	Overweight	12.5 (6207)	12.6 (4165)	12.5 (2042)		2.05 (1.42)

	Obese	5.9 (2917)	5.6 (1868)	6.4 (1049)		2.14 (1.48)
	Unknown	23.0 (11372)	24.2 (8009)	20.5 (3363)		1.89 (1.40)
Weight Goals	Lose weight	36.8 (18193)	40.5 (13418)	29.1 (4775)	<.0001	1.79 (1.33)
	Gain weight	15.9 (7856)	13.3 (4409)	21.0 (3447)		2.40 (1.48)
	Stay the same					
	weight	20.1 (9965)	19.3 (6403)	21.7 (3562)		2.15 (1.40)
	No weight goal	27.2 (13472)	26.8 (8870)	28.1 (4602)		2.07 (1.40)
Physical Activity						
Physically active	No	60.0 (29686)	63.7 (21089)	52.5 (8597)	<.0001	1.89 (1.35)
	Yes	40.0 (19800)	36.3 (12011)	47.5 (7789)		2.25 (1.46)
Sports participation	No	40.4 (19988)	44.1 (14612)	32.8 (5376)	<.0001	1.81 (1.35)
	Yes	59.6 (29498)	55.9 (18488)	67.2 (11010)		2.18 (1.42)
Healthy Eating Habits						
Breakfast eater	No	55.0 (27198)	58.1 (19216)	48.7 (7982)	<.0001	1.88 (1.40)
	Yes	45.0 (22288)	41.9 (13884)	51.3 (8404)		2.22 (1.39)
Participate in breakfast program	No	88.8 (43927)	89.0 (29453)	88.3 (14474)	0.0311	2.03 (1.41)
	Yes	11.2 (5559)	11.0 (3647)	11.7 (1912)		2.08 (1.40)
Bring lunch from home	0 days	22.0 (10884)	23.3 (7701)	19.4 (3183)	<.0001	1.84 (1.43)
	1-3 days	23.4 (11598)	23.7 (7856)	22.8 (3742)		2.00 (1.40)
	4-5 days	54.6 (27004)	53.0 (17543)	57.7 (9461)		2.12 (1.39)
Buy snacks from vending machine	0 days	78.8 (39015)	79.8 (26409)	76.9 (12606)	<.0001	2.01 (1.40)
	1-3 days	19.6 (9696)	18.9 (6254)	21.0 (3442)		2.12 (1.40)
	4-5 days	1.6 (775)	1.3 (437)	2.1 (338)		2.30 (1.59)
Meet Fruit and Vegetable Guidelines	No	95.2 (47117)	96.7 (32004)	92.2 (15110)	<.0001	2.00 (1.38)
	Yes	4.8 (2372)	3.3 (1096)	7.8 (1276)		2.78 (1.63)
Meet Meat Guidelines	No	29.7 (14683)	35.4 (11701)	18.2 (2982)	<.0001	1.56 (1.26)
	Yes	70.3 (34803)	64.6 (21399)	81.8 (13404)		2.24 (1.41)
Meet Grain Guidelines	No	93.7 (46390)	97.0 (32121)	87.1 (14269)	<.0001	1.95 (1.36)
	Yes	6.3 (3096)	3.0 (979)	12.9 (2117)		3.24 (1.55)
Substance Use						
Current Smoker	No	90.4 (44739)	90.3 (29888)	90.6 (14851)	0.0232	2.04 (1.39)
	Yes	9.6 (3212)	9.7 (3212)	9.4 (1535)		1.98 (1.50)
Current Binge Drinker	No	81.4 (40266)	82.1 (27172)	79.9 (13094)	<.0001	2.02 (1.39)
	Yes	18.6 (9220)	17.9 (5928)	20.1 (3292)		2.10 (1.47)
Current Cannabis User	No	85.7 (42396)	85.7 (28372)	85.6 (14024)	0.696	2.04 (1.39)
	Yes	14.3 (7090)	14.3 (4728)	14.4 (2362)		2.01 (1.47)

Appendix B:

Table 2. Factors associated with meeting the consumption guidelines for milk and milk alternatives (i.e., consuming 3 or more servings per day), compared to not meeting the guidelines, among the 49,486 Canadian Secondary School Students who participated in the 2017/2018 wave of the COMPASS study (with significant factors at p=0.01 shown in bold)

		aOR (99% CI)	p-value
Demographics			
Province	Ontario †	--	
	Alberta	0.87 (0.79-0.95)	0.0021
	British Columbia	0.81 (0.77-0.86)	<0.0001
	Quebec	1.16 (1.10-1.23)	<0.0001
	9 †	--	
Grade	10	0.91 (0.86-0.96)	0.0008
	11	0.82 (0.78-0.87)	<0.0001
	12	0.76 (0.71-0.82)	<0.0001
	Gender	Female †	--
	Male	1.75 (1.68-1.83)	<0.0001
Ethnicity	White †	--	
	Black	0.67 (0.61-0.75)	<0.0001
	Asian	0.53 (0.50-0.57)	<0.0001
	Latin American	0.67 (0.59-0.76)	<0.0001
	Other/Mixed	0.79 (0.73-0.86)	<0.0001
Spending Money	Zero †	--	
	\$1-\$20	1.09 (1.02-1.17)	0.0094
	\$21-100	1.08 (1.01-1.15)	0.0323
	More than \$100	1.14 (1.06-1.22)	0.0003
	I don't know	1.08 (1.00-1.16)	0.0408
Weight Status			
BMI	Healthy weight †	--	
	Underweight	1.07 (0.92-1.25)	0.3630
	Overweight	0.95 (0.89-1.02)	0.1334
	Obese	1.11 (1.02-1.22)	0.0158
	Unknown	0.97 (0.92-1.02)	0.2134
Weight Goals	Nothing †	--	
	Lose weight	0.88 (0.83-0.93)	<0.0001
	Gain weight	1.17 (1.10-1.25)	<0.0001
	Stay the same weight	1.05 (0.99-1.11)	0.1309
Physical Activity			
Physically active	No †	--	
	Yes	1.30 (1.24-1.35)	<0.0001
Sports participation	No †	--	
	Yes	1.26 (1.20-1.31)	<0.0001
Healthy Eating Habits			
Breakfast eater	No †	--	
	Yes	1.21 (1.15-1.28)	<0.0001
Participate in breakfast program	No †	--	

	Yes	1.11 (1.04-1.18)	0.0013
Bring lunch from home	0 days †	--	
	1-3 days	1.10 (1.03-1.16)	0.0034
	4-5 days	1.10 (1.04-1.16)	0.0013
Buy snacks from vending machine	0 days †	--	
	1-3 days	1.15 (1.09-1.21)	<0.0001
	4-5 days	1.56 (1.34-1.83)	<0.0001
Meet Fruit and Vegetable Guidelines	No †	--	
	Yes	1.58 (1.45-1.73)	<0.0001
Meet Meat and Alternative Guidelines	No †	--	
	Yes	1.90 (1.81-2.00)	<0.0001
Meet Grain Guidelines	No †	--	
	Yes	3.53 (3.25-3.84)	<0.0001
<i>Substance Use</i>			
Current Smoker	No †	--	
	Yes	0.97 (0.90-1.05)	0.4415
Current Binge Drinker	No †	--	
	Yes	1.03 (0.97-1.10)	0.2846
Current Marijuana User	No †	--	
	Yes	0.98 (0.91-1.04)	0.4696
Concordance Statistic			0.704

Appendix C:

Table 3. Factors associated with the number of servings of milk and milk alternatives consumed by the 49,486 Canadian Secondary School Students who participated in the 2017/2018 wave of the COMPASS study (with significant factors at $p=0.01$ shown in bold)

		Number of Servings (SE)	p-value
Intercept		1.21 (0.03)	<0.0001
Demographics			
Province	Ontario †	--	
	Alberta	-0.09 (0.03)	0.0004
	British Columbia	-0.11 (0.02)	<0.0001
	Quebec	0.13 (0.02)	<0.0001
Grade	9 †	--	
	10	-0.06 (0.02)	<0.0001
	11	-0.13 (0.02)	<0.0001
	12	-0.18 (0.02)	<0.0001
Gender	Female †	--	
	Male	0.41 (0.01)	<0.0001
Ethnicity	White †	--	
	Black	-0.32 (0.03)	<0.0001
	Asian	-0.38 (0.02)	<0.0001
	Latin American	-0.23 (0.04)	<0.0001
	Other/Mixed	-0.16 (0.02)	<0.0001
Spending Money	Zero †	--	
	\$1-\$20	0.08 (0.02)	<0.0001
	\$21-100	0.06 (0.02)	0.0010
	More than \$100	0.11 (0.02)	<0.0001
	I don't know	0.06 (0.02)	0.0044
Weight Status			
BMI	Healthy weight †	--	
	Underweight	0.02 (0.05)	0.6942
	Overweight	0.00 (0.02)	0.8458
	Obese	0.09 (0.03)	0.0003
	Unknown	-0.03 (0.01)	0.0243
Weight Goals	Nothing †	--	
	Lose weight	-0.09 (0.02)	<0.0001
	Gain weight	0.11 (0.02)	<0.0001
	Stay the same weight	0.04 (0.02)	0.0122
Physical Activity			
Physically active	No †	--	
	Yes	0.19 (0.01)	<0.0001
Sports participation	No †	--	
	Yes	0.15 (0.01)	<0.0001
Healthy Eating Habits			
Breakfast eater	No †	--	
	Yes	0.16 (0.01)	<0.0001
Participate in breakfast program	No †	--	

	Yes	0.08 (0.02)	<0.0001
Bring lunch from home	0 days †	--	
	1-3 days	0.11 (0.02)	<0.0001
	4-5 days	0.12 (0.02)	<0.0001
Buy snacks from vending machine	0 days †	--	
	1-3 days	0.09 (0.01)	<0.0001
	4-5 days	0.22 (0.05)	<0.0001
Meet Fruit and Vegetable Guidelines	No †	--	
	Yes	0.36 (0.03)	<0.0001
Meet Meat Guidelines	No †	--	
	Yes	0.44 (0.01)	<0.0001
Meet Grain Guidelines	No †	--	
	Yes	0.95 (0.02)	<0.0001
Substance Use			
Current Smoker	No †	--	
	Yes	-0.01 (0.02)	0.5190
Current Binge Drinker	No †	--	
	Yes	0.01 (0.02)	0.5956
Current Marijuana User	No †	--	
	Yes	-0.03 (0.02)	0.1980
R-squared			0.1646

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