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The Great Canadian Maple Syrup Consumption

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Abstract
This paper looks to provide insight on the Canadian stereotype of using and producing maple syrup, investigating if the Canadian production of the sweetener could support each Canadian having maple syrup at breakfast every day for a year. First, it is estimated how much maple syrup would be consumed for a specific age group and sex using suggested daily Calorie (kcal) values and Canadian demographic population estimates. A sample calculation is outlined for males aged 20-24, finding that solely for this age group it would require 6.24×10^4 L of maple syrup for one day's consumption. This method is then repeated for each age group and sex (see Appendix), then summed and multiplied by 365, getting a final value of 5.11×10^8 L of maple syrup in total for the whole year. Therefore, it was determined that since the annual production of maple syrup in 2017 was only 5.69×10^7 L, it would not be sustainable for every Canadian to have maple syrup at breakfast for an entire year.

Introduction
Canada has always been known for its stereotypes; poutine, politeness, overuse of "sorry" and "eh", and maple syrup. In particular, in 2016 Canada produced approximately 1.22×10^7 gallons of maple syrup [1]. This paper poses the following question: if the common stereotype of Canadians consuming extensive amounts of maple syrup is correct, what would the Canadian production of maple syrup need to be to allow every Canadian to consume maple syrup every day for a year?

Calculating the Required Amount of Maple Syrup
The process for obtaining an estimate of the required amount of maple syrup to enable each Canadian to consume maple syrup every day for a year is as follows:

1) Use the estimated Calorie (kcal) needs for males and females based on lifestyle and combine this information with Canadian physical activity assessments to obtain values for the daily Canadian kcal suggested intake for each age demographic and sex.
2) Divide each value by 3 in order to obtain the number of daily kcals for breakfast necessary for each age demographic and sex.
3) Divide these values by the total amount of kcal contained in one serving of a pancake (with maple syrup) breakfast in order to determine how many servings of the pancake breakfast each age demographic and sex would have to consume daily.
4) As these age demographics are split into different bin sizes when compared to Canadian population census data (e.g. some of the data in step 3 is given with bin sizes of 1 year, while census data is given with bin sizes of 5 years) we then re-arrange the values obtained in step 3 to match the bin sizes from the Canadian census data using weighted averages across appropriate bins.
5) Multiple these re-arranged values by Canadian population census data to get the total servings of pancake (with maple syrup) breakfast needed to feed one group of Canadians for a day based on age demographic and sex.
6) Calculate the total amount of maple syrup necessary for these pancake breakfasts for each age demographic and sex, and subsequently sum all entries to find the required amount of maple syrup to enable

each Canadian to consume maple syrup every day for a year.

To elaborate on these steps taken, a sample calculation is performed for the demographic group of Canadian males aged 20-24. Calculations for each age demographic and sex can be found in the excel spreadsheet included in the supplementary files.

First, the estimated kcal needs for an individual per day can be used as provided by dietary guidelines, which are 2,600 kcal for a sedentary individual and 2,800 kcal for a moderately active individual aged 20 [2]. These values can then be multiplied by the percentage of Canadians that were found to be sedentary or physically active within this age and sex demographic, which in this case is 71% and 29% respectively [3, 4]. This gives the weighted average of the recommended daily kcal for a typical person within this age and sex demographic, which is found to be 2658 kcals.

From this, portion sizes of meals can be based on this recommended daily kcal amount. It is assumed that this kcal amount is evenly split between the three standard meals; breakfast, lunch, and dinner. For individuals aged 20, the estimated kcal necessity for breakfast would be 886 kcals, one-third of the previous value found of 2658 kcals.

This estimation of a standard pancake breakfast (with maple syrup) is assumed to be made up of one serving of *Aunt Jemima Original Mix Pancakes*, which is 250 kcals once prepared as directed (approximately four 4-inch pancakes), and one serving of pure Canadian maple syrup, which is 220 kcals per serving (60 mL) [5, 6]. Thus, one serving of pancake breakfast is 470 kcals. Letting S represent the serving per person, C represent the required Caloric intake and C_s represent the kcals per serving, this would mean that the average 20-year-old male would consume approximately 1.885 servings of pancakes (with maple syrup) as seen using equation 1:

$$S = \frac{C}{C_s} = \frac{860}{470}. \quad (1)$$

We know that males aged 20 should consume 1.885 servings of breakfast per day, and males aged 21-25 should consume 1.751 servings by a similar process as completed previously. This does not match the given Canadian population estimation bin size for the age group 20-24. As such, the weighted average between these spanning bins can be taken so that based on dietary guidelines, males aged 20-24 should consume 1.778 servings of breakfast to satisfy Caloric requirements.

Let S_{total} represent the total serving size for the specified population and P represent the number of individuals in the age group. There are 1.25×10^6 individuals aged 20-24 [7], so we attain a total of 2.22×10^6 servings of breakfast needed to satisfy said age group for a day using equation 2:

$$S_{total} = S \times P = 1.778 \times 1.25 \times 10^6. \quad (2)$$

This number is then multiplied by f_{kcal}, which is the fraction of the number of kcals in one serving of maple syrup divided by the number of kcals in one serving of a pancake breakfast. This is then multiplied by the per-serving amount of maple syrup (S_m), 60 mL (0.06 L). This gives the total amount of maple syrup needed to feed all 20 to 24-year-olds for one pancake breakfast (V_m) as 6.24×10^4 L of maple syrup (using equation 3).

$$V_m = S_{total} \times S_m \times f_{kcal} = 2.22 \times 10^6 \times 0.06 \times \frac{220}{470}$$
$$V_m = 6.24 \times 10^4\ L. \quad (3)$$

This calculation is completed for all age groups for males and females, which is then summed and multiplied by 365 in order to estimate the total amount of maple syrup used by the entire population of Canada in a year. This number is found to be 5.11×10^8 L of maple syrup.

The 2017 maple syrup production of Canada was reported as 5.69×10^7 L [1]. This means that there would not be enough maple syrup produced in a single year to support the entire population of Canada consuming maple syrup at breakfast each day for a year.

Conclusion

This paper aimed to answer the question, "could the Canadian production of maple syrup support each Canadian having maple syrup every day for a year?". It was concluded that it is not sustainable for every Canadian to have maple syrup at breakfast for a year, as it would require 5.11×10^8 L of maple syrup while the production of maple syrup was only 5.69×10^7 L in 2017.

References

[1] Agriculture and Agri-Food Canada. (2018). *Statistical Overview of the Canadian Maple Industry 2017*. Government of Canada. [online] Available at: http://www.agr.gc.ca/eng/industry-markets-and-trade/canadian-agri-food-sector-intelligence/horticulture/horticulture-sector-reports/statistical-overview-of-the-canadian-maple-industry-2017/?id=1524607854094 [Accessed 27th February 2019].

[2] ODPHP (2015) *Dietary Guidelines for Americans 2015-2020 | Estimated Calorie Needs per Day, by Age, Sex, and Physical Activity Level*. Office of Disease Prevention and Health Promotion (ODPHP). [online] Available at: https://health.gov/dietaryguidelines/2015/guidelines/appendix-2/ [Accessed 27th February 2019].

[3] Colley, R.C., Garriguet, D., Janssen, I., Craig, C.L., Clarke, J. & Tremblay, M.S. (2011). *Physical activity of Canadian adults: Accelerometer results from the 2007 to 2009 Canadian Health Measures Survey*. Component of Statistics Canada Catalogue no. 82-003-X, Health Reports. [online] Available at: https://www150.statcan.gc.ca/n1/en/pub/82-003-x/2011001/article/11396-eng.pdf?st=Rf8Bb0_3 [Accessed 27th February 2019].

[4] Colley, R.C., Garriguet, D., Janssen, I., Craig, C.L., Clarke, J. & Tremblay, M.S. (2011). *Physical activity of Canadian children and youth: Accelerometer results from the 2007 to 2009 Canadian Health Measures Survey*. Component of Statistics Canada Catalogue no. 82-003-X, Health Reports. [online] Available at: https://www150.statcan.gc.ca/n1/en/pub/82-003-x/2011001/article/11397-eng.pdf?st=CzPBthnx [Accessed 27th February 2019].

[5] Quaker Oats Company (2019). *Original Mix: Nutrition Information*. Aunt Jemima, Quaker Oats Company. [online] Available at: http://www.auntjemima.com/products/pancake_waffle_mixes/original_pancakes [Accessed 27th February 2019].

[6] Producteurs et productrices acericoles du Quebec. (2019). *Maple sugar – Industry sheet and Nutrition facts table*. [online] Available at: http://ppaq.ca/en/producer/retail-sales/labelling/ [Accessed 27th February 2019].

[7] Statistics Canada. (2018). Population estimates on July 1st, by age and sex. Table: 17-10-0005-01 (formerly CANSIM 051-0001) [online] Available at: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000501 [Accessed 27th February 2019].

Appendix: *Supplementary Data Tables*

Age	Estimated Calorie Needs - Sedentary (F)	Estimated Calorie Needs - Mod. Active (F)	Canadian Calorie Needs (F)	Calories Needed for Breakfast (F)	Servings of breakfast that the age group should eat (F)
2	1,000	1,000	1000	333.3	0.709
3	1,000	1,200	1043	347.5	0.739
4	1,200	1,400	1243	414.2	0.881
5	1,200	1,400	1243	414.2	0.881
6	1,200	1,400	1243	414.2	0.881
7	1,200	1,600	1285	428.4	0.911
8	1,400	1,600	1443	480.9	1.023
9	1,400	1,600	1443	480.9	1.023
10	1,400	1,800	1485	495.1	1.053
11	1,600	1,800	1643	547.5	1.165
12	1,600	2,000	1685	561.7	1.195
13	1,600	2,000	1685	561.7	1.195
14	1,800	2,000	1843	614.2	1.307
15	1,800	2,000	1843	614.2	1.307
16	1,800	2,000	1843	614.2	1.307
17	1,800	2,000	1843	614.2	1.307
18	1,800	2,000	1843	614.2	1.307
19-20	2,000	2,200	2043	680.9	1.449
21-25	2,000	2,200	2027	675.8	1.438
26-30	1,800	2,000	1827	609.1	1.296
31-35	1,800	2,000	1827	609.1	1.296
36-40	1,800	2,000	1827	609.1	1.296
41-45	1,800	2,000	1827	609.1	1.296
46-50	1,800	2,000	1827	609.1	1.296
51-55	1,600	1,800	1627	542.5	1.154
56-60	1,600	1,800	1627	542.5	1.154
61-65	1,600	1,800	1627	542.5	1.154
66-70	1,600	1,800	1627	542.5	1.154
71-75	1,600	1,800	1627	542.5	1.154
76+	1,600	1,800	1627	542.5	1.154

Table 1 – Calculation of the number of breakfast ‘servings’ per age group for females.

Age (Re-arranged)	Servings of breakfast that the age group should eat (F)	Canada population estimates 2017 (F)	Total Servings of breakfast per age group (F)	Total Servings of Maple Syrup per age group (F)
0 to 4	0.742	948,837	704,494.65	329,763.45
5 to 9	0.944	990,893	935,459.21	437,874.53
10 to 14	1.183	955,958	1,130,986.45	529,397.91
15 to 19	1.422	1,014,561	1,443,159.06	675,521.26
20 to 24	1.440	1,150,978	1,657,440.97	775,823.43
25 to 29	1.324	1,222,932	1,619,647.67	758,132.95
30 to 34	1.296	1,247,926	1,617,347.50	757,056.28
35 to 39	1.296	1,237,443	1,603,761.23	750,696.75
40 to 44	1.296	1,189,006	1,540,985.51	721,312.36
45 to 49	1.296	1,215,381	1,575,168.25	737,312.80
50 to 54	1.183	1,333,575	1,577,023.37	738,181.15
55 to 59	1.154	1,355,973	1,565,042.88	732,573.26
60 to 64	1.154	1,215,067	1,402,411.37	656,447.88
65 to 69	1.154	1,025,973	1,184,162.03	554,288.61
70 to 74	1.154	797,192	920,106.57	430,688.18
75 to 79	1.154	567,940	655,507.49	306,833.29
80 to 84	1.154	422,156	487,245.87	228,072.53
85 to 89	1.154	300,711	347,075.94	162,461.08
90 to 94	1.154	157,412	181,682.47	85,042.86
95 to 99	1.154	49,366	56,977.47	26,670.30
100+	1.154	7,608	8,781.03	4,110.27

Table 2 – Calculation of the total servings of Maple syrup per age group for females.

Age	Estimated Calorie Needs - Sedentary (M)	Estimated Calorie Needs - Mod. Active (M)	Canadian Calorie Needs (M)	Calories Needed for Breakfast (M)	Servings of breakfast that the age group should eat (M)
2	1,000	1,000	1000	333.3	0.709
3	1,000	1,400	1116	372.0	0.791
4	1,200	1,400	1258	419.3	0.892
5	1,200	1,400	1258	419.3	0.892
6	1,400	1,600	1458	486.0	1.034
7	1,400	1,600	1458	486.0	1.034
8	1,400	1,600	1458	486.0	1.034
9	1,600	1,800	1658	552.7	1.176
10	1,600	1,800	1658	552.7	1.176
11	1,800	2,000	1858	619.3	1.318
12	1,800	2,200	1916	638.7	1.359
13	2,000	2,200	2058	686.0	1.460
14	2,000	2,400	2116	705.3	1.501
15	2,200	2,600	2316	772.0	1.643
16	2,400	2,800	2516	838.7	1.784
17	2,400	2,800	2516	838.7	1.784
18	2,400	2,800	2516	838.7	1.784
19-20	2,600	2,800	2658	886.0	1.885
21-25	2,400	2,800	2468	822.8	1.751
26-30	2,400	2,600	2434	811.4	1.726
31-35	2,400	2,600	2434	811.4	1.726
36-40	2,400	2,600	2434	811.4	1.726
41-45	2,200	2,600	2268	756.1	1.609
46-50	2,200	2,400	2234	744.7	1.585
51-55	2,200	2,400	2234	744.7	1.585
56-60	2,200	2,400	2234	744.7	1.585
61-65	2,000	2,400	2068	689.5	1.467
66-70	2,000	2,200	2034	678.1	1.443
71-75	2,000	2,200	2034	678.1	1.443
76+	2,000	2,200	2034	678.1	1.443

Table 3 – Calculation of the number of breakfast ‘servings’ per age group for males.

Age (Re-arranged	Servings of breakfast that the age group should eat (M)	Canada population estimates 2017 (M)	Total Servings of breakfast per age group (M)	Total Servings of Maple Syrup per age group (M)
0 to 4	0.751	995,569	747,400.48	349,847.03
5 to 9	1.034	1,029,781	1,064,837.37	498,434.52
10 to 14	1.363	992,142	1,351,846.25	632,779.10
15 to 19	1.776	1,076,227	1,911,539.44	894,763.14
20 to 24	1.778	1,250,439	2,222,695.23	1,040,410.53
25 to 29	1.731	1,289,864	2,233,056.47	1,045,260.47
30 to 34	1.726	1,265,936	2,185,490.36	1,022,995.49
35 to 39	1.726	1,217,355	2,101,620.95	983,737.47
40 to 44	1.632	1,163,555	1,899,284.86	889,026.95
45 to 49	1.589	1,202,076	1,910,567.66	894,308.27
50 to 54	1.585	1,330,497	2,108,224.40	986,828.44
55 to 59	1.585	1,339,923	2,123,160.26	993,819.70
60 to 64	1.490	1,172,407	1,747,435.22	817,948.40
65 to 69	1.448	969,797	1,403,825.86	657,109.98
70 to 74	1.443	735,981	1,061,796.13	497,010.96
75 to 79	1.443	489,673	706,448.81	330,678.16
80 to 84	1.443	329,119	474,818.35	222,255.40
85 to 89	1.443	193,130	278,627.69	130,421.47
90 to 94	1.443	72,772	104,987.80	49,143.23
95 to 99	1.443	15,548	22,431.02	10,499.63
100+	1.443	1,589	2,292.44	1,073.06

Table 4 – Calculation of the total servings of Maple syrup per age group for males.

Total amount of maple syrup needed to feed females in Canada for 1 day (L)	Total amount of maple syrup needed to feed males in Canada for 1 day (L)	Total amount of Maple Syrup Needed to feed all of Canada for 1 year (L)
623,896	776,901	511,290,815

Table 5 – Summary data.