How many calories did Santa Claus consume on Christmas Eve?

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In the twilight hours of Christmas Eve, many families in North America provide cookies and milk for Santa Claus. Avoiding excessive calorie intake is increasingly emphasized as part of a healthy life style [1]. An interesting question is how many calories Santa will have consumed that night on his trip to this region? This topic has been commented on extensively in the last few years (Table 1); however, the methodology used to determine households visited and calories consumed per household varies widely, is often incompletely disclosed, and when it is disclosed, often seems arbitrary. Furthermore, no source we reviewed attempted to address the specific metabolic demands of Santa Claus or the thermic effect of the food he consumes. Here we attempt to construct a more accurate picture of the Calories (herein use of a capital “C” refers to large/food calories) both ingested and expended by Santa Claus on Christmas Eve 2017. We restrict our data to the United States of America, where survey information is available on pertinent attitudes and behaviors in the population.

In 2013, a Pew survey showed that of United States adults with children, 49% planned to make preparations for Santa’s arrival on Christmas Eve, as did a surprising 22% of adults who were not parents or guardians [2]. According to the 2016 American Community Survey (United States Census Bureau), there are 118,860,065 households in the USA, with an average size of 2.65 persons. Of these, there were 36,846,620 households with children <18 years of age (31%; [3]). If 49% of United States households with children make preparations for Santa’s arrival, this yields 18.1 million households. Furthermore, of the households without children, if 22% prepare for

Santa’s arrival, this yields an additional 18.0 million households, for a total of 36.1 million households that will leave out cookies and milk (or another suitable snack).

If each home leaves out three cookies, and assuming that the average cookie contains 50–100 Calories, plus an 8-ounce glass of milk (~135 Calories), Santa can anticipate at least a 275 Calorie or 1150 kilojoules (kJ) snack waiting for him at each house he visits. Therefore, before the night is out, he will have consumed approximately 9.9 billion Calories (41.4 billion kJ), just from the visit to the USA. This snack consists mainly of carbohydrates and fat. To account for the thermic effect of food, let us generously assume that 10% of these Calories are used in the process of digestion, which leaves 8.9 billion Calories (37.2 billion kJ). Assuming Santa is the equivalent of a 60-year-old, 110 kg, active male with a height of 1.8 m, his daily total energy expenditure (TEE) can be calculated as follows [4]:

$$\text{TEE} = 1086 - (10.08 \times \text{age}) + [1.25 \times (13.7 \times \text{weight} + 416 \times \text{height})] = 3301 \text{ Calories/day (13,811 kJ/day)}$$

Consumption of 8.9 billion Calories would exceed Santa’s usual daily requirement by 2.7 million-fold. Even if Santa spread out the consumption over the next 365 days until the following Christmas, the daily Calorie consumption would exceed the standard consumption by over 7300-fold per day. One might ponder whether these Calories are offset by his travails of the night. Sadly, this is unlikely. For example, let us assume that Santa has to ascend up a 4 m chimney when he leaves each house. The work required to raise him and his bag of gifts (perhaps 160 kg in total) up a 4 m chimney comes to a mere 1.5 Calories (6.3 kJ), although this translates to more than 54.2 million

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Table 1 Calorie consumption by Santa Claus and parameters published by internet media groups

Source	Calories consumed in billions (kiloJoules in billions)	Households in millions	Calories/household (kiloJoules)	Methodology (if disclosed)	URL (all accessed December 7, 2017)
OC Weekly	0.262 (1.10)	1.14	230 (962)	USA: 100 million households, 76% Christian, 15% with children, 10% actually put out cookies	http://www.ocweekly.com/restaurants/how-many-calories-does-santa-claus-consume-on-christmas-6617835
Spoon University	494 (2067)	950	520 (2176)	Worldwide: 1.9 billion children worldwide, 2 children/household	https://spoonuniversity.com/lifestyle/this-is-how-many-calories-santa-would-eat-on-christmas
USA Today	7.00 (29.3)	20	350 (1464)	USA	https://www.usatoday.com/videos/news/nation/2015/12/23/77835834/
Chron	0.921 (3.85)	32.9	28 (117)	USA: 61 million children age 0–14 years, 1.86 children/household One “bite” of cookie (=12 Calories) plus one “sip” of milk (=16 Calories)	http://www.chron.com/life/health/article/The-crazy-number-of-calories-Santa-Claus-will-eat-6717682.php
Quora	105 (439)	378	278 (1163)	Worldwide	https://www.quora.com/How-many-calories-would-Santa-gain-and-burn-from-eating-all-those-cookies-and-delivering-all-those-presents-on-Christmas
Eat Out Eat Well	18.4 (77.0)	92	200 (837)	Worldwide	http://www.eatouteatwell.com/do-all-those-cookies-create-a-problem-for-santa/
Greatist	374 (1565)	2200	170 (711)	Worldwide: 2.2 billion Christians, each of whom leaves milk and cookies	https://greatist.com/happiness/santa-science-facts-christmas-122412
Snopes	20.7 (86.6)	91.8	225 (941)	Worldwide: 378 million Christian children, 3.5 children/household	http://www.snopes.com/holidays/christmas/santa/physics.asp
Telegraph	259 (1084)	740	350 (1464)	Worldwide: 1.85 billion children age 0–14 years, 2.5 children/household; minced pies and milk	http://www.telegraph.co.uk/finance/economics/11307918/Santanomics-the-calculations-that-make-it-all-possible-for-Saint-Nick.html
Daily Mail	150 (628)	640	234 (979)	Worldwide: CEBR ^a	http://www.dailymail.co.uk/sciencetech/article-2521973/The-science-Santa-Mr-Claus-eat-150-BILLION-calories-visit-5-556-houses-SECOND-Christmas-Eve.html
Quick Country	150 (628)	640	234 (979)	Worldwide: CEBR ^a	http://quickcountry.com/santa-facts-how-many-calories-does-he-eat/
Mr. Mango Delivery	156 (653)	640	244 (1021)	Worldwide: CEBR ^a	http://mrmangodelivery.co.uk/blog/how-many-calories-does-santa-eat-on-christmas-eve/
Z1035	150 (628)	640	234 (979)	Worldwide: CEBR ^a	http://z1035.com/how-much-santa-will-eat-drink-on-christmas-eve/

^aCEBR methodology of the UK Center for Economic and Business Research (1.6 billion children in world, 2.5 kids/household)

Calories (227 million kJ) expended across all of the households visited in the USA.

Although it is likely that some of the assumptions we made were incorrect, precluding a precise determination of the number of Calories that were consumed by Santa Claus on this past Christmas Eve, it is, nevertheless, quite apparent that the number would be enormous by any usual standard! But Santa does not gain weight and returns year after year seemingly at about the same weight. That Santa might have an extraordinarily high rate of metabolism, or perhaps had bariatric surgery that unexpectedly resulted in a profound degree of malabsorption, does not com-

port with his stable weight and apparent good health. Instead, we can only conclude that it's a Christmas miracle!

Conflict of interest G.P. Wormser reports receiving research grants from Immunetics, Inc., Institute for Systems Biology, Rarecyte, Inc., and Quidel Corporation. He owns equity in Abbott/AbbVie; has been an expert witness in malpractice cases involving Lyme disease; and is an unpaid board member of the American Lyme Disease Foundation. A. Ladenheim declares that he has no competing interests.

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