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## Is ‘The Very Hungry Caterpillar’ Unusually Hungry for a Caterpillar?

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### Abstract

Caterpillars are known for being a larval insect with a big appetite. The *Antheraea polyphemus* in particular is able to eat 86,000 times its own body mass in 56 days. When modelled as a caterpillar with a mass of 0.04 g, *The Very Hungry Caterpillar* eats 1918.8 g (2006.5 kcal) of food over seven days which is approximately 48,000 times its own body mass. On a day to day basis, this value is found to be much more than known caterpillars. The model does not take into account the growth of the caterpillar over time which may limit the extent of the accuracy of the values calculated.

### Introduction

Caterpillars are larvae of a butterfly or moth that are known to consume a high volume of food for their size. This allows them to store enough energy to pupate into a butterfly during metamorphosis [1].

*The Very Hungry Caterpillar* (TVHC) is a story about a fictional caterpillar that consumes a lot of food. It is one of the most famous children’s books, selling a total of 30 million copies [2]. In the story, TVHC consumes (over seven days): 1 apple, 2 pears, 3 plums, 4 strawberries, 5 oranges, 1 slice of chocolate cake, 1 ice cream and cone, 1 pickle, 1 slice of Swiss cheese, 1 slice of salami, 1 lollipop, 1 slice of cherry pie, 1 sausage, 1 cupcake, 1 slice of watermelon, and 1 leaf [3].

This paper looks at the food consumption of TVHC and that of real caterpillars to see if the mass intake of TVHC is normal or extreme in comparison.

### Real caterpillars

The range of mass consumption, per day, varies between caterpillars with determining values limited as the specific consumption amounts for specific subspecies is not very well documented. According to the Guinness book of world records, the *Antheraea Polyphemus* caterpillar is able to eat up to 86,000 times its own mass in its 56 days larval stage before pupation [4].

For a more average caterpillar, it is stated that they would eat 100 times their own body mass per day [5]. The most common garden caterpillar in the UK is the *Pieris rapae* (Cabbage White) caterpillar which has an average mass of 0.04 g [6]. Therefore, 100 times its mass is 4 g of food per day – equivalent to 60 g in its 15 day larval period [7]. On the upper end of the scale, using the suggested maximum value for the *Antheraea polyphemus* as 86,000 times its assumed 0.04 g mass, it would eat 3440 g of food over its lifespan or 61.4 g per day. *Pieris rapae* will be used as the standard comparator and *Antheraea Polyphemus* as the upper boundary of caterpillar normality.

### Results

Table 1 shows the calculated calorie and mass for each food item consumed. The data taken for each food item are based on averages for a typical item as no specific dimensions are stated in the book. It is assumed that the caterpillar is of average mass (0.04 g) and eats the entirety of all the food products.

It is found that TVHC eats a total of 1918.8 g of food which is 48,000 times its body mass over the seven days. Furthermore, the caterpillar eats a total of 2006.5 kcal which if the same mass was to be eaten of just leaves (23 kcal per 100 g, if comparable to a spinach leaf [23]) then the caterpillar would have only consumed about 441.3 kcal.

Day	Food	Quantity	Calorie density, kcal per g	Food mass, g (per item)	Food mass, g (total)	Cumulative mass, g	Calories consumed, kcals (per item)	Calories consumed, kcal (total)	Cumulative calories, kcal	Percentage body mass of intake, %
1	Apple [8]	1	0.43	75	75	75	32	32	32	187500
2	Pears [9]	2	0.37	100	200	275	37	74	106	500000
3	Plums [10]	3	0.34	100	300	575	34	102	208	750000
4	Strawberries [11]	4	0.25	12	48	623	3	12	220	120000
5	Oranges [12]	5	0.36	100	500	1123	36	180	400	1250000
6	Chocolate cake (slice) [13]	1	3.71	95	95	1218	352	352	752	237500
6	Ice cream (in cone) [14]	1	3.28	50*	50*	1268	164	164	916	125000
6	Pickle [15]	1	0.12	35	35	1303	4.2	4.2	920.2	87500
6	Swiss cheese (slice) [16]	1	3.50	20	20	1323	70	70	990.2	50000
6	Salami [17]	1	3.78	9.8	9.8	1332.8	37	37	1027.2	24500
6	Lollipop [18]	1	4.00	6	6	1338.8	24	24	1051.2	15000
6	Cherry pie (slice) [19]	1	2.70	180	180	1518.8	486	486	1537.2	450000
6	Sausage [20]	1	2.75	59	59	1577.8	162	162	1699.2	147500
6	Cupcake [21]	1	4.87	45	45	1622.8	219	219	1918.2	112500
6	Watermelon (slice) [22]	1	0.30	286	286	1908.8	86	86	2004.2	715000
7	Leaf [23]	1	0.23	10	10	1918.8	2.3	2.3	2006.5	25000
<b>TOTAL</b>					<b>1918.8 g</b>			<b>2006.5 kcal</b>		<b>4797000%</b>

Table 1 – The calculated total mass of food consumed by *The Very Hungry Caterpillar*, the total calories consumed and the comparable percentage of food mass to the mass of the caterpillar (0.04 g) (\* shows estimated values).

## Discussion

The total mass of food consumed by TVHC is 1918.8 g. In comparison to the model of a *Pieris rapae* caterpillar (60 g) this greatly exceeds the consumption value but is less than the model upper range set by the *Antheraea Polyphemus* caterpillar (3440 g). Therefore, TVHC is a very hungry caterpillar but not exceedingly hungry for a caterpillar when compared by total quantities.

The life span varies from caterpillar to caterpillar. It is assumed that TVHC has a life span of seven days as represented by the number of days he eats in the book. The *Antheraea Polyphemus* has a life cycle of 56 days and is therefore expected to eat more food overall. A gram per day equivalent of the *Antheraea Polyphemus* versus TVHC is 61.4 g and 274 g respectively. Therefore whilst the overall mass intake of TVHC is less than *Antheraea Polyphemus*, the daily equivalent is significantly higher.

The value, stated by the Guinness book of world records, that a caterpillar could eat 86,000 times its

own mass does not seem like a logical value. The justification in this value may be the mass compared to its smallest size of the larvae just after it has hatched out of its egg. The mass of the caterpillar is not going to be consistent throughout its lifespan up to metamorphosis and thus an increase of 100 times its mass per day is going to be sequentially more than the day before. Therefore, the extent to which the values calculated and those compared to are accurate is not very high. What this model does show is, however, is that whilst TVHC does consume an inordinate amount of food in mass it is not outrageously out of range for total food mass with that of a real caterpillar but is for daily mass and overall calorie intake.

## Conclusion

*The Very Hungry Caterpillar* is an exceedingly hungry caterpillar in comparison to a real caterpillars. The total mass consumption of food over the seven days is 1918.8 g (~48,000 times its 0.04 g mass). This is an inordinate amount of food and lies outside of the daily intake of the *Antheraea Polyphemus* caterpillar.

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