Farm level dominates losses in Swedish beef supply chain

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1. Introduction

Food loss and waste (FLW) is a major environmental problem, where global FLW accounted for about half of the global annual GHG emissions from the whole food system (Zhu, J.; *et al.,* 2023). Although animal-based food is lost or wasted in low quantities compared to other commodities, the higher impact associated with producing them still makes it worth addressing (Lipinski, B., 2020). This holds particularly true for beef, which has an outstandingly high impact on global greenhouse gas emissions (Xu, et al., 2021). Losses of Swedish beef at farm level was found to be high, with an average loss rate of 9 % of the initially produced weight (Strid, et al., 2023). To put this into perspective and to guide action, an overview of the losses and waste along the entire beef supply chain would be a help. The aim of the present study was therefore to map out such an overview.

2. Methods

The method used was a material flow analysis, with data sources from scientific and grey literature. Some flows and loss rates have robust sources, whereas others had to be approximated from similar processes in combination with process specific assumptions. The study does therefore not claim high accuracy, especially not for the consumption stage, but can contribute with a perspective on beef losses along the supply chain. Main data sources include: Strid et al, 2023 and Swedish Food Administration, 2023; more sources in footnotes of Table 1.

3. Results and discussion

3.1 Results

The beef losses was clearly largest at farms, followed by butcheries and households. Restaurants, farms and public catering had the highest loss rates. See Table 1.

Table 1. Flows and losses of beef in the Swedish beef supply chain [ton bonefree meat]

3.2 Discussion

Considering that the majority of the environmental burden from beef is attributed to the first

stage (animal production at farms), farm losses is a true environmental problem, compared to e.g., potatoes where the burden builds up along the supply chain and farm losses become less severe. Based on this, and the size of the farm losses, it seems reasonable to firstly address this sector. However, wasting beef at late stages of the supply chain infer that also the early losses have occurred in vain, as they are built in in the product's "backpack". Therefore, also measures targeting later stages can be effective, and could be more cost efficient as a smaller amount needs to be handled. In the wait for these losses to drastically reduce, LCAs of beef need to acknowledge them and include them in calculations to not underestimate the impact of beef.

4. Conclusions

Beef losses at farm level outnumbers all the following supply chain stages together, and should be a priority for measures. However, also measures in later stages could be effective, as they will bring their upstream losses with them. LCAs of beef need to acknowledge and account for the farm stage losses.

5. Acknowledgements

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6. References

EU Commission, 2020. Farm to Fork Strategy, European Commission, Brussels.

EU Commission, 2023. Proposal for a directive of the European parliament and of the council amending Directive 2008/98/EC on waste, 2023/0234, Brussels.

Lipinski, B., 2020. Why Does Animal-Based Food Loss and Waste Matter? *Animal Frontiers*, 10 (4), 48–52.

Swedish Food Administration, 2023. What kind of food is wasted in households (in Swedish). Fritz, K. report L 2023 (13): Swedish Food Administration. Uppsala.

Strid I, Jacobsen M, Alvåsen K, Rydén J., 2023. Loss of beef during primary production at Swedish farms 2002–2021. *Front. Sustain. Food Syst*. 7:1171865.

UN, 2015. Transforming our world: the 2030 Agenda for sustainable development, UN.

Zhu, J., Luo, Z., Sun, T. *et al.* 2023. Cradle-to-grave emissions from food loss and waste represent half of total greenhouse gas emissions from food systems. *Nat Food* **4**, 247–256.

Xu, X., Sharma, P., Shu, S. *et al.* 2021. Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. *Nat Food* **2**, 724–732.

Table 1. Flows and losses of beef in the Swedish beef supply chain [ton bonefree meat]

	Live animals	Farms[1,2]	Slaughter[3,4,5]	Butchery[6]	Retail and wholesale[7]	Consumption		
						House-holds[8,9]	Public cate-ring[10,11,12]	Restau-rants[11,13]
Share of beef purchases						85%	4%	11%
Swedish domestic beef								
Beef purchases						89 000	3 900	
Produced Swedish beef	109 000	96 000	96 000	94 000	93 000	88 000	3 600	
Home slaughter		3 300						
Losses		9 200	200	1 900	1 000	1 600	300	
Loss rate of incoming flow [%]		9%	0.2%	2%	1%	2%	8%	
Imported beef								
Beef purchases						64 000		8 600
Produced Imported beef	84 000	75 000	75 000	74 000	73 000	63 000		8 000
Home slaughter		1 400						
Losses		7 100	100	1 500	700	1 000		700
Loss rate of incoming flow [%]		9%	0.2%	2%	0.9%	2%		9%
Total domestic and imported beef								
Beef purchases						153 000	3 900	8 600
Produced beef	192 000	171 000	171 000	168 000	166 000	151 000	3 600	8 000
Home slaughter		4 700						
Lost beef		16 400	300	3 400	1 600	2 800	300	700
Loss rate of incoming flow [%]		9%	0.2%	2%	1%	2%	8%	9%
Lost beef [kg per capita and year][14]		1.6	0.03	0.3	0.2	0.3	0.03	0.07

[1]Strid I, Jacobsen M, Alvåsen K, Rydén J. 2023. Loss of beef during primary production at Swedish farms 2002–2021. *Front. Sustain. Food Syst.* 7:1171865.

[2]Blomberg S. 2022. *Dressing and meat percentage in cattle and lamb*. First cycle, Swedish University of Agricultural Sciences, Skara.

[3]Swedish Board of Agriculture. Slaughter of large animals at slaughteries. https://statistik.sjv.se/PXWeb/pxweb/sv/Jordbruksverkets%20statistikdatabas. Accessed 09-02-2024.

[4]Swedish Board of Agriculture. Total food consumption by good and year. https://statistik.sjv.se/PXWeb/pxweb/sv/Jordbruksverkets%20statistikdatabas/. Accessed 07-02-2024.

[5]Swedish Board of Agriculture. 2022. *Loss of pork, beef and milk at farms.* Report 2022:19. Swedish Board of Agriculture, Jönköping.

[6]Swedish Board of Agriculture. 2022. *Pilot study on food waste and side streams in the food industry.* Report 2023:13. Swedish Board of Agriculture, Jönköping.

[7]Eriksson, M., 2015. *Supermarket food waste - prevention and management with focus on reduced waste for reduced carbon footprint.* Doctoral thesis No. 2015:119. Swedish University of Agricultural Sciences.

[8]Statistics Sweden, 2020. Statistics on food sales in retail 2019, Report HA 24 SM 2001, Statistics Sweden.

[9]Swedish Food Administration. 2023. *What kind of food is wasted in households* (in Swedish). Fritz, K. report L 2023 (13): Swedish Food Administration. Uppsala.

[10]National Agency for Public Procurement. Procurement of food and meal services. https://www.upphandlingsmyndigheten.se/branscher/upphandling-av-livsmedel-och-maltidstjanster. Accessed 05-02-2024.

[11]Swedish Environmental Protection Agency. Food waste amounts in Sweden. https://www.naturvardsverket.se/amnesomraden/avfall/avfallslag/matavfall-och-matsvinn. Accessed 05-02-2024.

[12]Halvarsson, R. 2023. *Investigating food waste composition in school catering with focus on carbon footprint*. First cycle, Swedish University of Agricultural Sciences, Uppsala.

[13]Statistics Sweden, 2024. Withdrawal from Restaurant Index, 2019, turnover in the Swedish restaurant sector. Statistics Sweden (personal communication). Accessed 19-02-2024.

[14]Statistics Sweden. Swedish population in November, average 2017-2021. https://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START__BE__BE0101__BE0101A/FolkmangdNov/. Accessed 05-02-2024.