Starch digestibility in the alimentary tract of dairy cows

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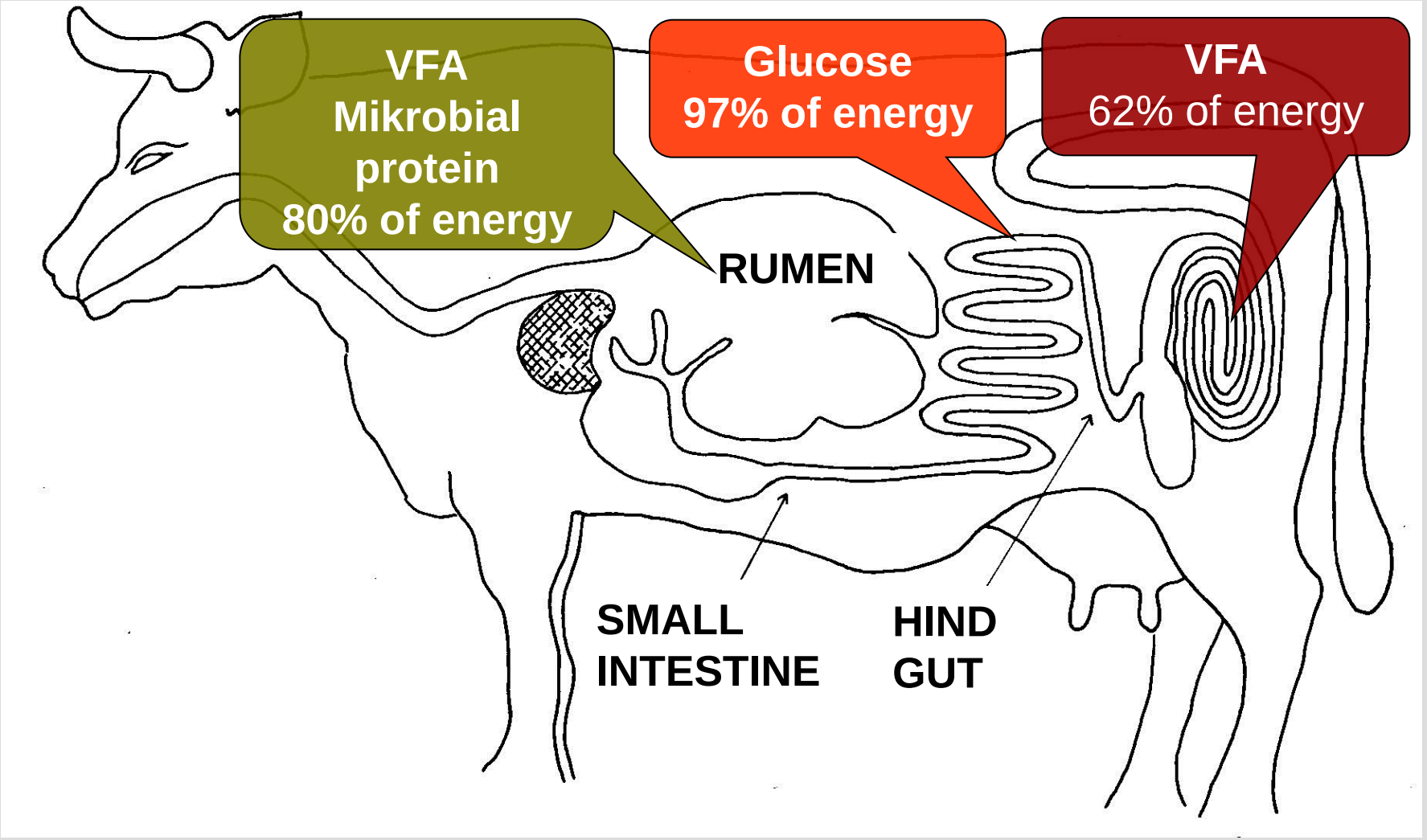
Aim:

- **Describe/model starch digestibility in different compartments of the intestinal tract of dairy cows**

- **Based on literature information on in vivo digestibility experiments on dairy cows**
  - **Starch source and processing**
  - **Intake of dry matter and starch**
  - **Chemical composition of the ration**

- **To be used in feed evaluation models in practice**

Ruminant starch digestion



Hypothesis:

- **Rumen starch digestibility can be described by starch source and intake of starch**

- **Lower tract starch digestibility (small intestine and hind gut) is a function of rumen starch digestibility**
  - **Rumen and small intestinal digestibilities are positively correlated**
  - **Rumen and hind gut digestibility are negatively correlated (compensatory digestion)**

Literature data – dairy cows

62 publications
Observations as treatment means
Selection criteria:

- **Lactating dairy cows**
- **At least total tract starch digestibility, preferentially rumen, small intestinal and hind gut**

Starch digestibility	Observations
Total tract	279
Rumen	173
Small intestine	54
Hind gut	57

Database included

- Nutrient intakes
- Starch flow (digestibilities)
- Name of main starch sources (2 main concentrate and 2 main forage sources, if appropriate)
- Proportion of total starch intake coming from these 4 starch sources
- In total 21 starch sources

Data analysis

Regression and multiple regression analysis

Y = starch digestibility, total or in different digestive compartments

- **Y = starch intake/escape + proportion of starch source$_{1\text{-}21}$**

- **Y = starch intake/escape**
- **Y = proportion of starch source$_{1\text{-}21}$**

Main results – regression analyses

Rumen and total digestibility →

- **info on source (name) necessary**

Small intestinal digestibility →

- **positively correlated to rumen degradability – source (name) still important**

Hind gut digestibility →

- **source (name) not important - positively correlated to rumen degradability [opposite to hypothesis!!]**

Digestibilities for individual starch sources

Digestibilities - estimated using GLM –
obs. dig = source digestibility x source prop. of ration total starch

Starch source	Total tract	Rumen	Small intestine	Hind gut
Wheat Starch	1016	1067	739	704
Corn starch	999	863	669	753
Wheat	999	915	679	622
Oat	989	870	703	696
Faba beans	961	799	360	664
Barley	952	860	719	545
Corn silage (CS)	931	629	840	624
CS high[1]	962	910	820	655
Wheat NaOH	929	648	710	54
Wrinkled pea	922	740	225	616
Corn	913	544	509	458
Sorghum	905	619	na	na
Smooth pea	899	780	472	463
Barley NaOH	839	670	203	389

Green = highest, blue=high, purple=low, red =lowest

1 → corn silage > 60% of ration starch

How can this be used to model starch digestion in practical feed evaluation models?

Rumen: k_d calculated from in vivo rumen digestibility, and tabulated

Small intestine: function of rumen digestibility (if we forget about starch source, problematic with legumes)
or
use estimates for digestibility of individual sources

Hind gut: function of rumen digestibility

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It does not necessarily reflect its view and in no way anticipates the Commission's future policy in this area.

SEVENTH FRAMEWORK PROGRAMME

Innovative and practical management approaches to reduce nitrogen excretion by ruminants