

# MICROWAVE HEAT TREATMENT EFFECT ON FEED RUMINAL DEGRADABILITY AND INTESTINAL CRUDE PROTEIN DIGESTIBILITY - A BRIEF REVIEW

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## Introduction

- Ruminants are in need of bioavailable crude protein (CP) for better production. However, it gets "robbed" by the rumen microbes in the form of rumen degradable protein (RDP) and converted into ammonia, amino acids, and peptides<sup>1</sup>.
- It is a challenge to develop a technique which will allow the CP availability to be stable in the rumen and improve digestibility and absorption in the intestine.
- Microwave (MW) heat treatment is successfully applied in concentrate feeds to achieve more available CP in the intestine and less degradation in the rumen.

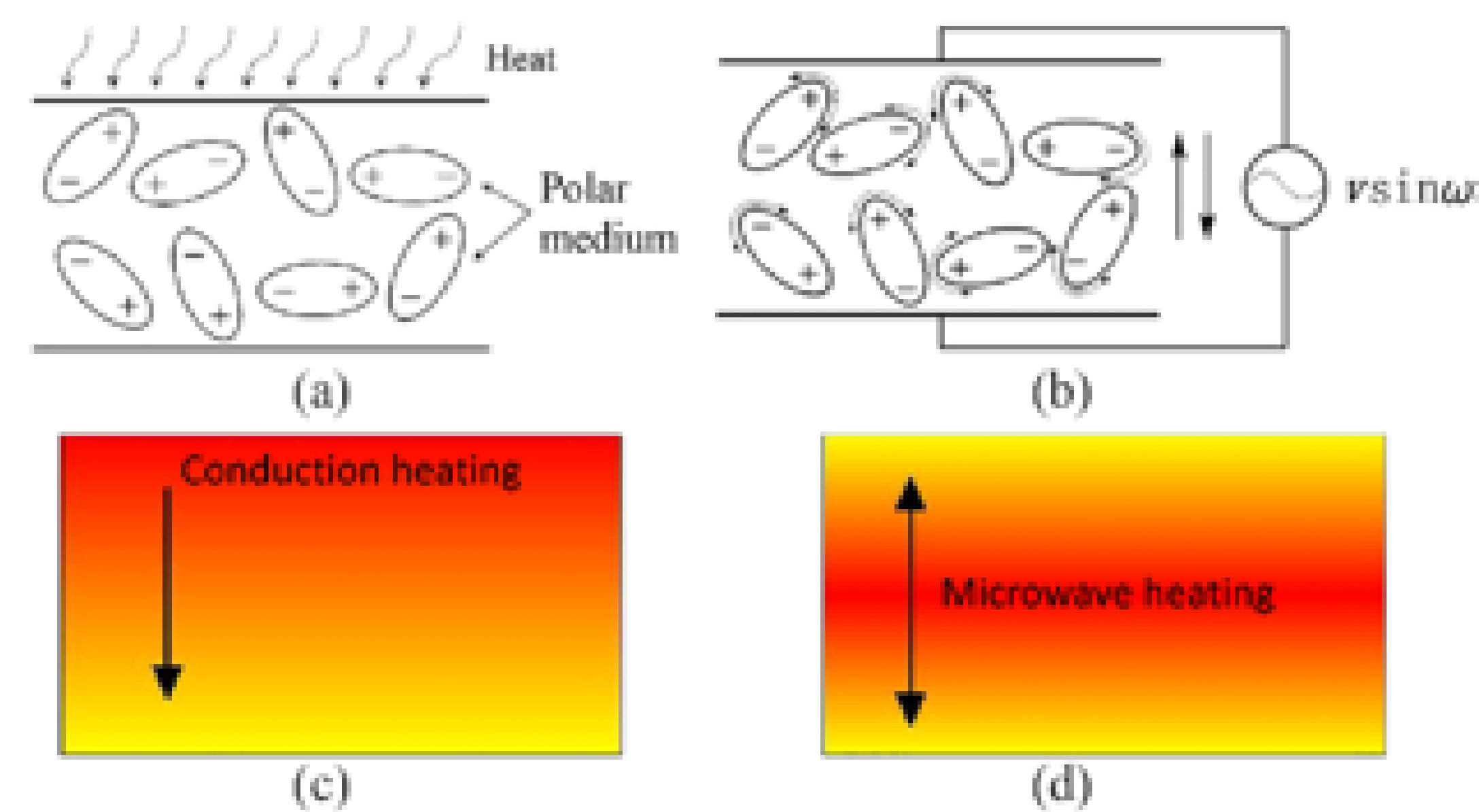


Figure 2. The principle of microwave heating: (a) no microwave, (b) microwave application, (c) heat conduction heating, and (d) microwave heating.<sup>6</sup>

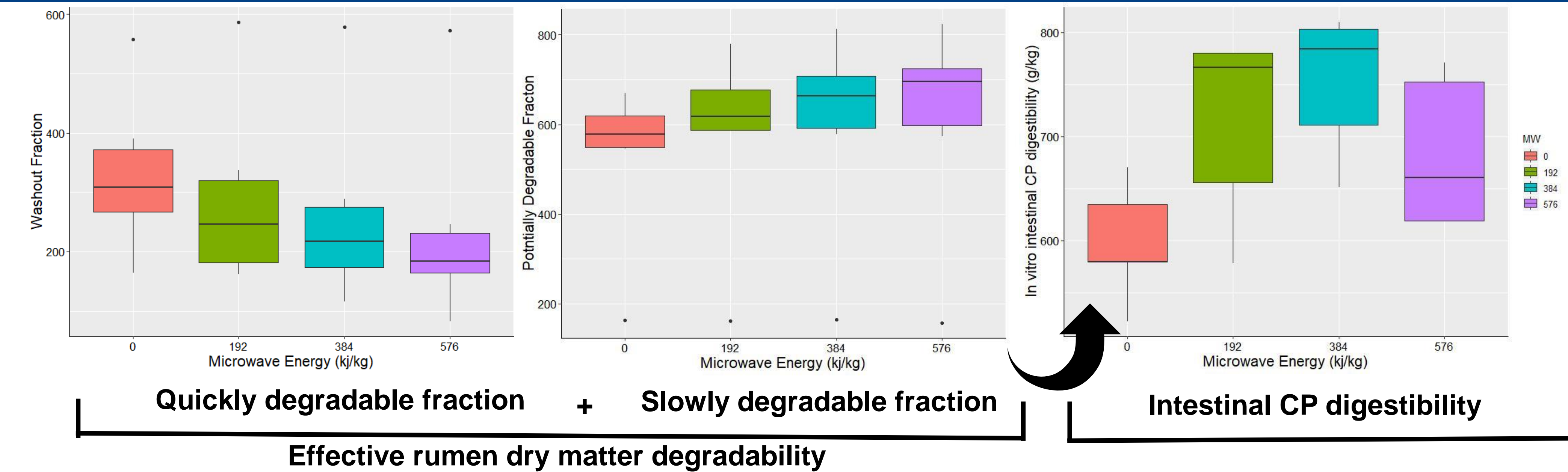


Figure 3. Graphical presentation of the effect of MW heat treatment on ruminal dry matter degradability and intestinal CP digestibility of concentrate feed

Table 1. A literature review of microwave heating impact on rumen feed degradability<sup>2</sup>

Target feed resources	MW power (W)	MW time (second)	MW Energy (kJkg <sup>-1</sup> )	ERD of DM	ERD of CP	Intestinal CP digestibility
Canola meal	800	0-360	0-576	23.0 % ↓	29.0 % ↓	20.0 % ↑
Soybean meal	800	0-360	0-576	40.0 % ↓	40.0 % ↓	21.0 % ↑
Canola seed	800	0-360	0-576	26.0 % ↓	21.0 % ↓	21.0 % ↑
Cotton seed meal	800	0-360	0-576	28.0 % ↓	30.0 % ↓	25.0 % ↑
Corn	800	0-420	0-672	11.0 % ↓	27.0 % ↓	-
Barley	800	0-420	0-672	4.40 % ↓	16.5 % ↓	-

↓ = reduced by, ↑ = increased by

## Possible reasons

- Cross-linking of chains and proteins aggregation through heating.<sup>5</sup>
- Chemical structure alteration during heat processing<sup>5</sup>
- Unfolding of protein structure due to denaturation increased exposure of hydrophobic groups, which reduce solubility and degradability sequentially.<sup>3</sup>
- Non thermal effect of MW<sup>2</sup>

## Conclusion

- Microwave heating may have the potential to reduce the rumen degradability and intestinal CP digestibility.
- However, there is a gap in understanding the most possible reason underpinning these changes.
- Further research may need to be developed to understand the mechanism for better use of MW heat technology toward feed processing for better utilization.

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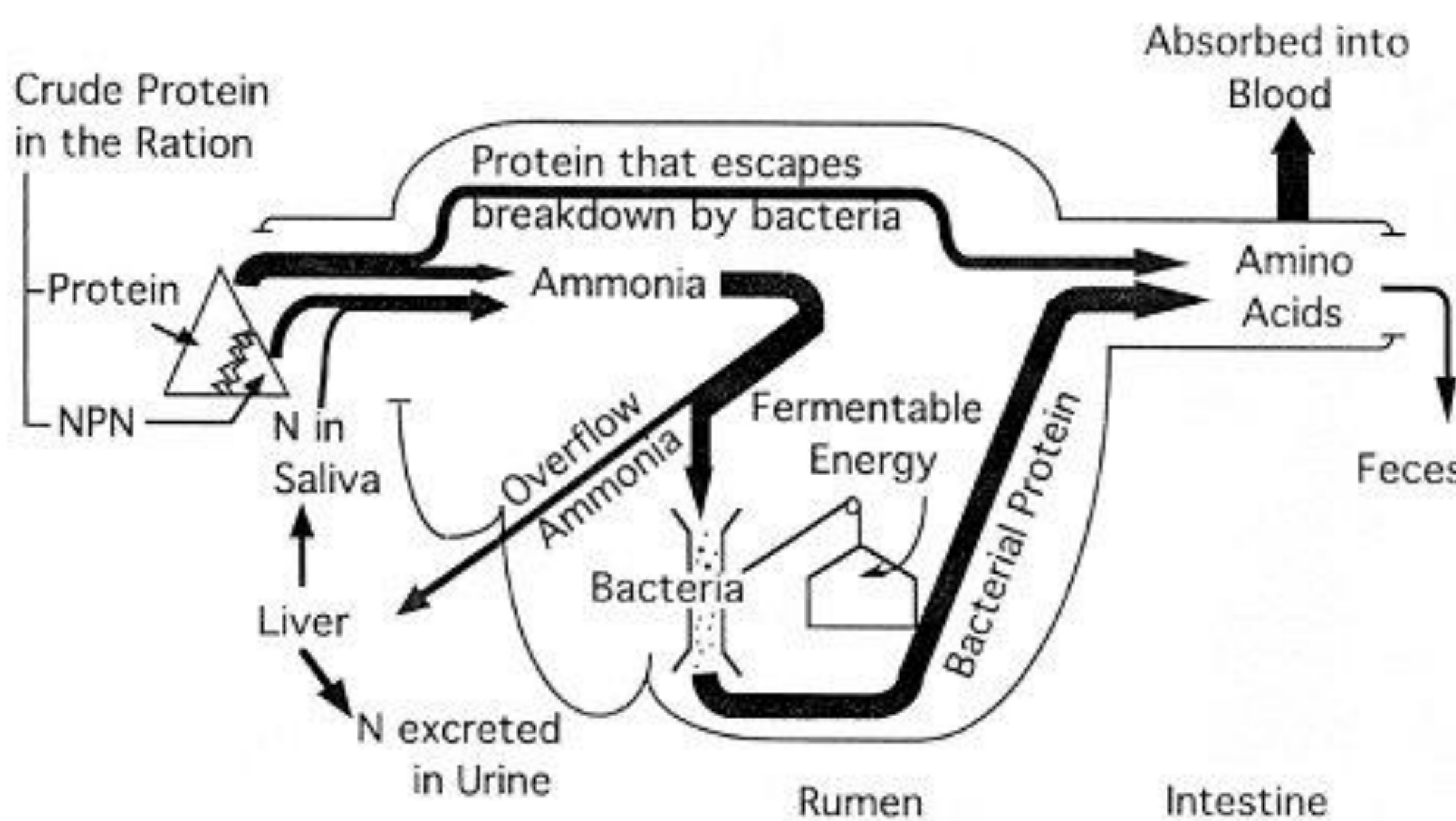


Figure 1. Schematic summary of nitrogen utilization by the ruminants.<sup>4</sup>