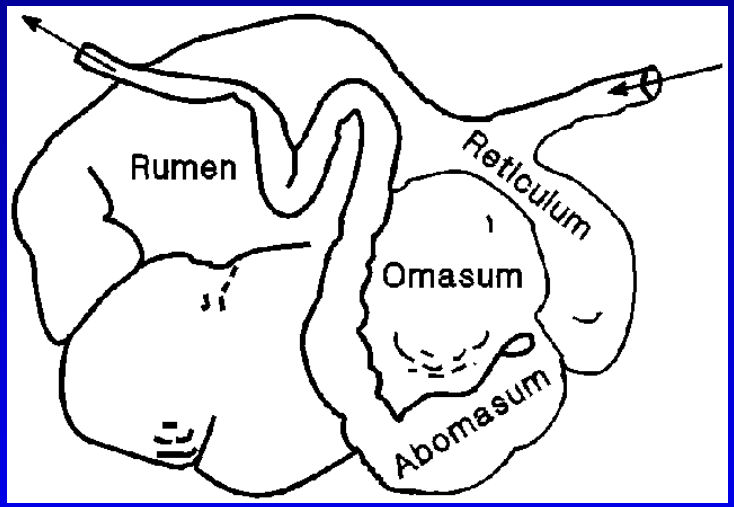

Soybean, Canola and Cottonseed Meal

In- Sacco technique for estimation of ruminal degradability of soybean, canola, and cottonseed meal

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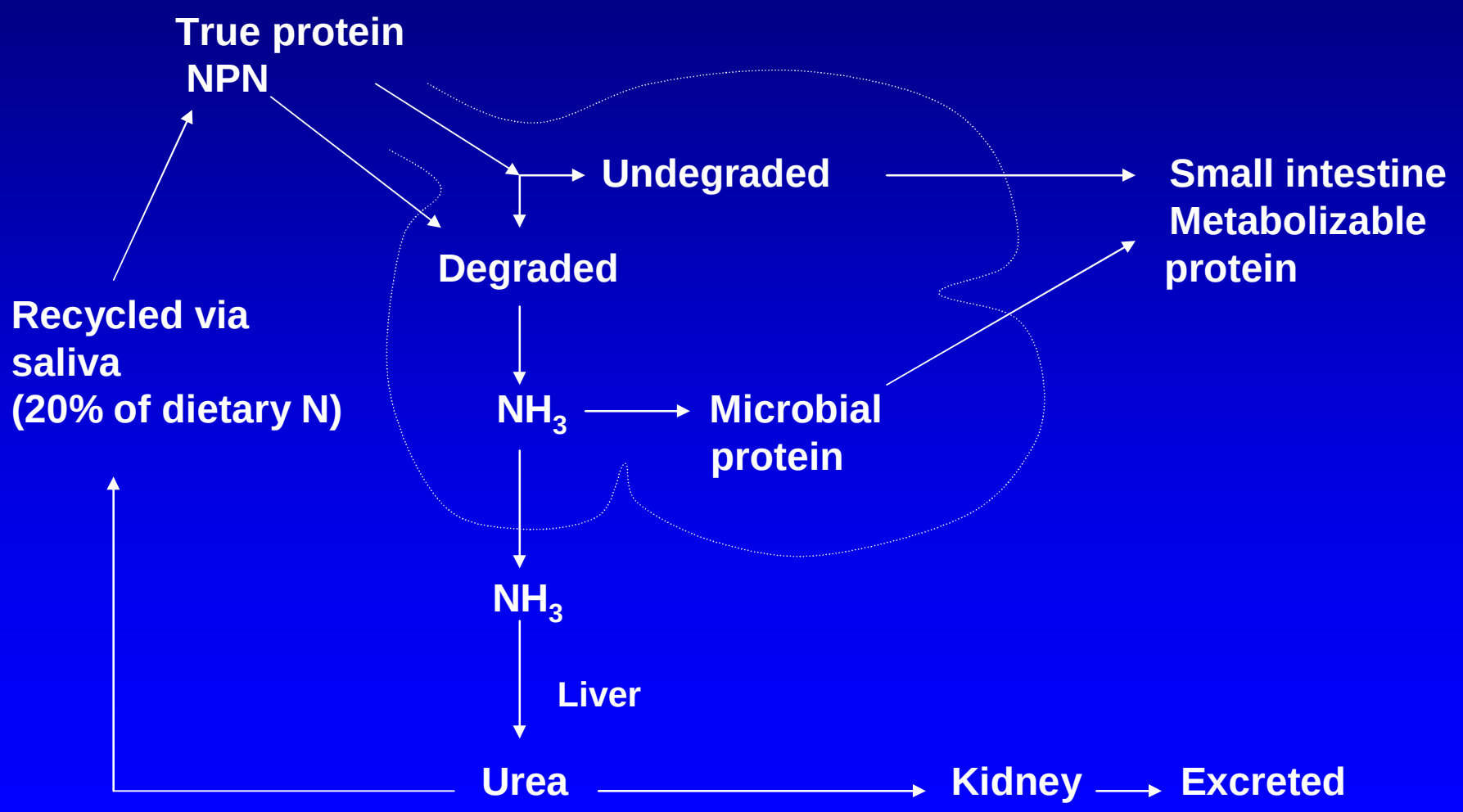
PROTEIN DIGESTION IN RUMINANTS

- **Rumen**



- **Ruminal degradation of true protein**
  - **Two steps**
    - **Proteolysis-slow**
    - **Deamination-rapid**
  - **By ruminal bacteria and protozoa**
    - **All proteases are cell-bound**
      - **Bacterial proteases are extracellular; require attachment**
      - **Protozoal proteases are intracellular; engulf feed and bacterial proteins**
  - **Endproducts**
    - **C-chains**
      - **Volatile fatty acids**
        - » **Straight chain (Acetic acid)**
        - » **Branched chain (Isovaleric, Isobutyric, 2-methyl butyric acids)**
      - **Ketones**
    - **Ammonia**
    - **CO_2**

Protein Pathways in the Ruminant

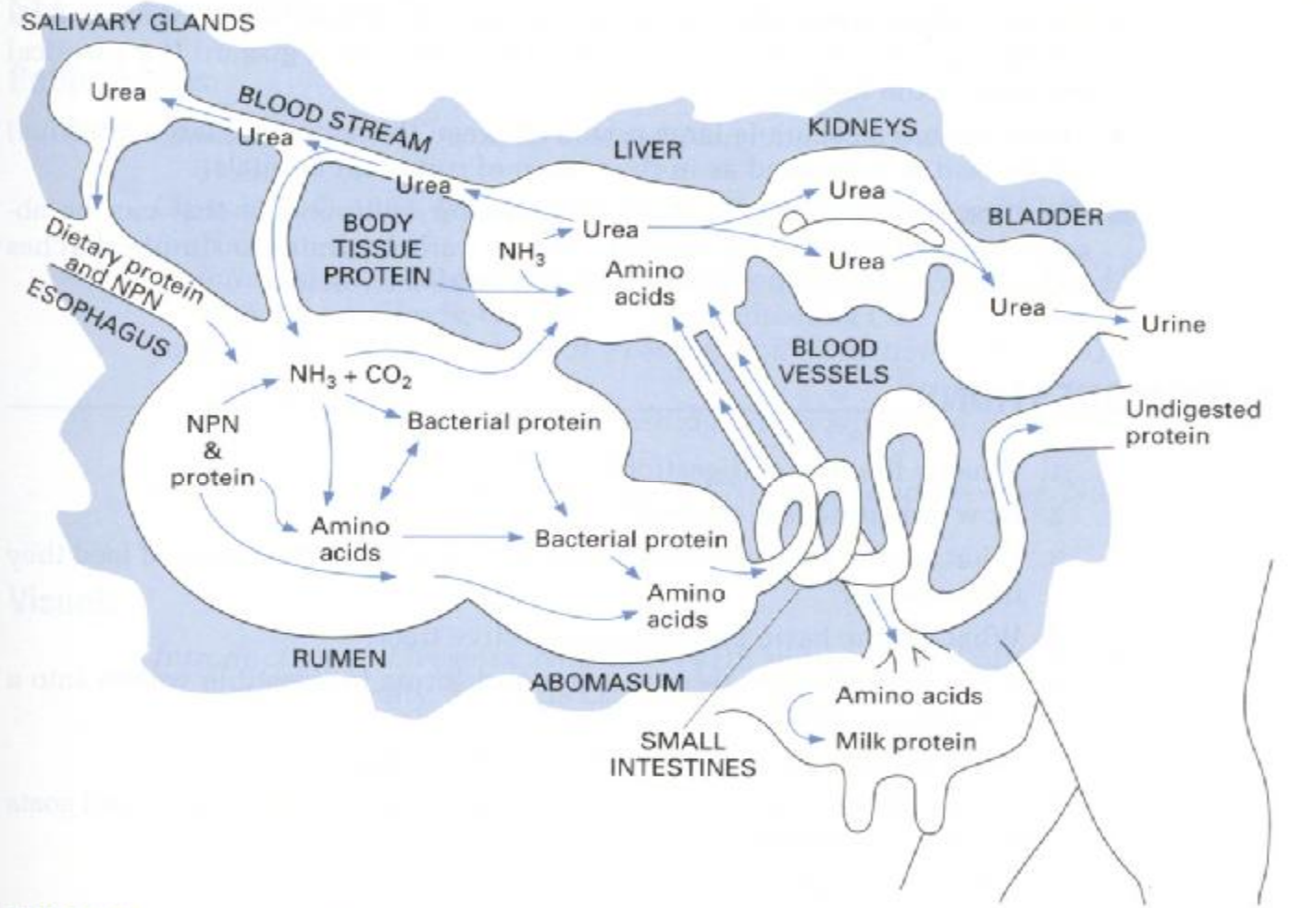
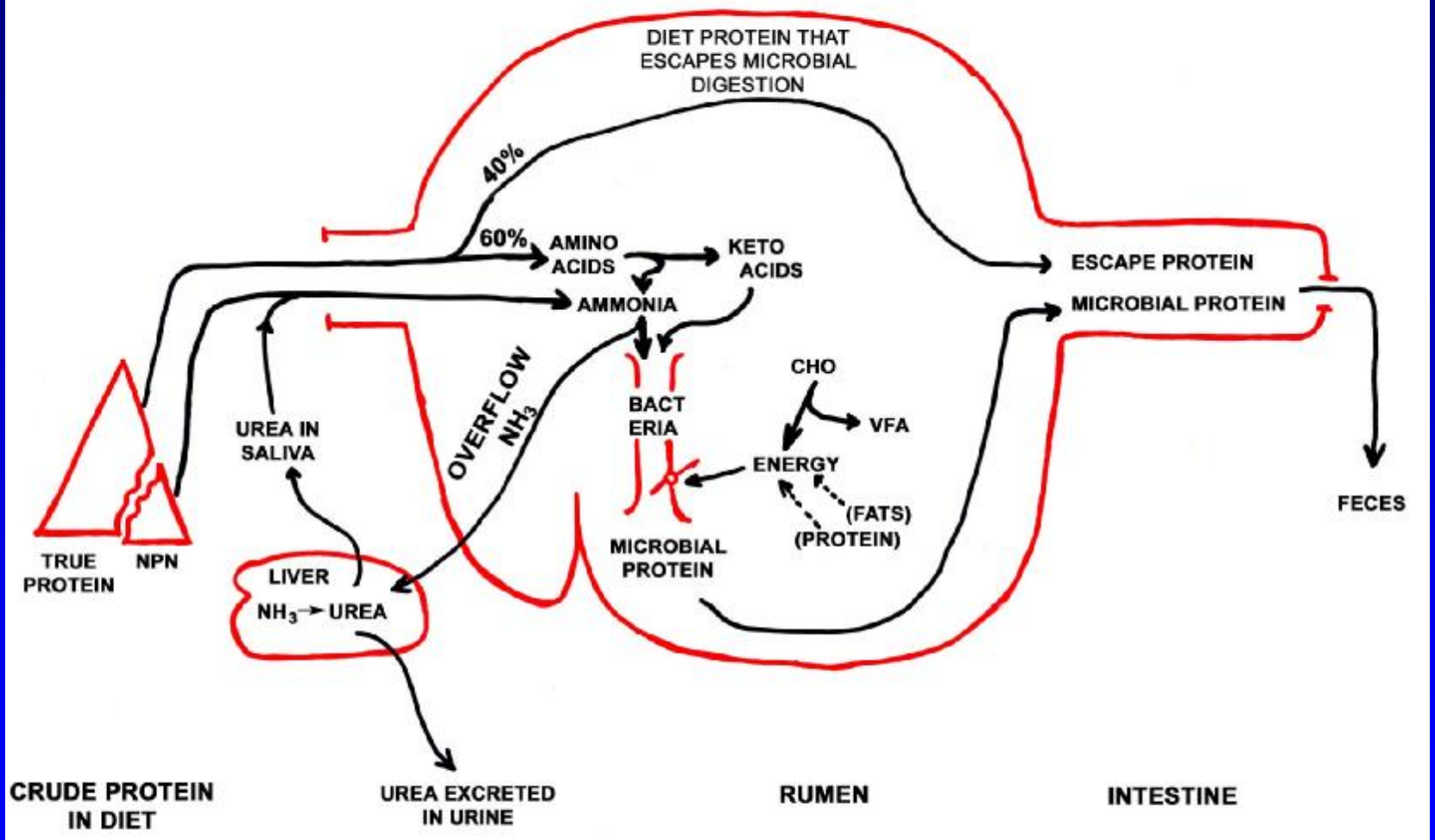


FIGURE 16.9 Protein pathways in the ruminant. Courtesy of J. Bryant and B. R. Moss, Montana State University.

PROTEIN (NITROGEN) UTILIZATION BY THE RUMINANT



General Information

- No proteases in saliva
- No rumen secretions
- Microorganisms responsible for protein digestion in rumen (and reticulum)
  - Bacteria
  - Protozoa

Sources of Rumen Nitrogen

- **Feed**
  - Protein nitrogen
    - Protein supplements (SBM, CSM, grains, forages, silages...
  - Nonprotein nitrogen (NPN)
    - Usually means urea
    - However, from 5% of N in grains to 50% of N in silage and immature forages can be NPN
- **Endogenous (recycled) N**
  - Saliva
  - Rumen wall

NPN Utilization

- Urea (and most sources of NPN) rapidly degraded to NH_3
- MO's don't care where NH_3 comes from

Limitations of Microbial Protein Synthesis

- Two most likely limitations
  - Energy available
  - NH_3 available
  - These need to be synchronized
- For diets containing urea, may also need
  - Sulfur (for S-containing AA)
  - Branched-chain C-skeletons
    - MO cannot make branched-chain C-chains
  - These normally not a problem

Overflow Ammonia

- Shortage of energy relative to available NH_3
- Liver: NH_3 è Urea
- Urea recycled or excreted, depending on animal needs
  - Saliva
  - Rumen wall

Protein Leaving Rumen

- Microbial protein
- Escape protein (also called “bypass” protein)

- Enter abomasum & small intestine
  - Digested by proteolytic enzymes similar to nonruminants

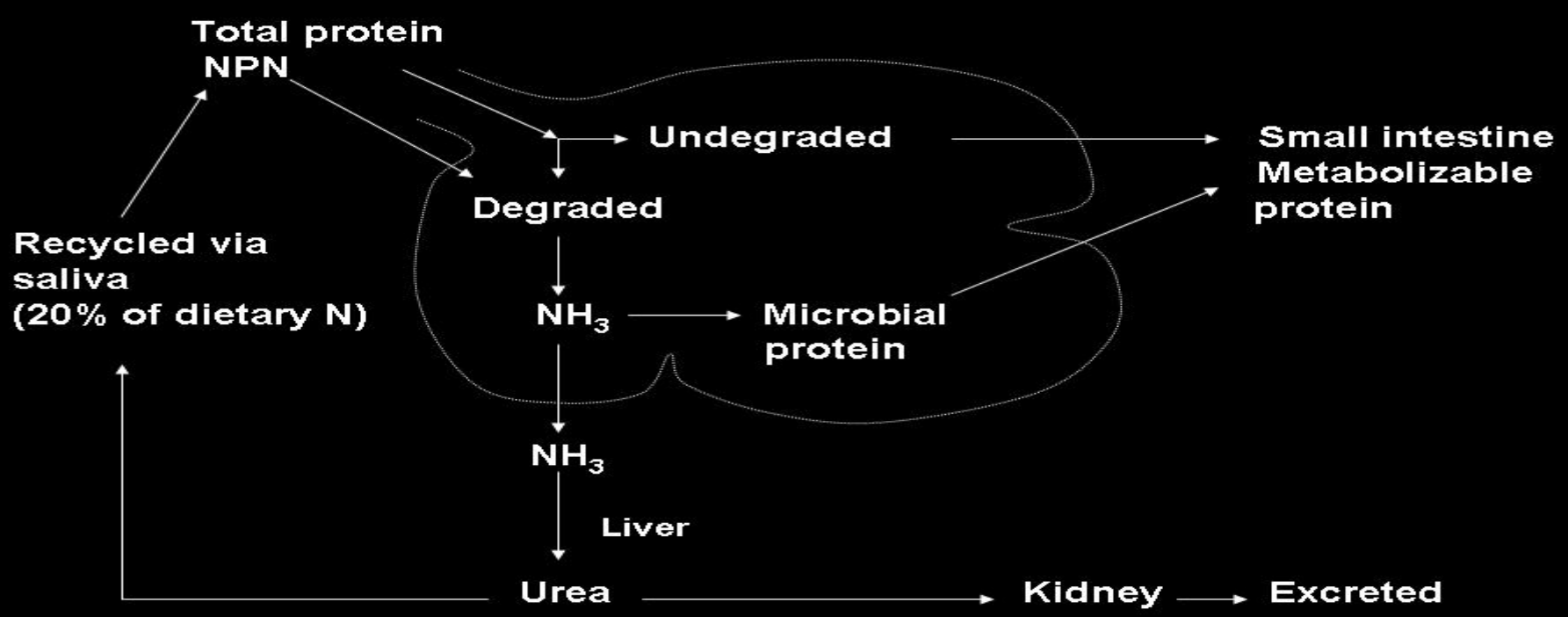
- Escape *vs* Bypass protein
  - Technically not “bypass”
  - Reticular groove

CONSIDERATIONS TO LIMIT N EXCRETION BY RUMINANTS

- Supply adequate degradable N to meet ammonia needs of rumen microbes
- Supply adequate metabolizable protein to meet the amino acid needs of the animal for maintenance and production

PROTEIN DIGESTION IN RUMINANTS

- Rumen



In- Sacco technique for estimation of ruminal degradability of soybean, canola, and cottonseed meal

In- Sacco (The nylon bag technique)

The nylon bag technique described by Ørskov et al (1980) for the determination of the degradation of feedstuffs in the rumen at various incubation periods can be used to screen feeds at the initial stages of assessing their nutritive values.

- **Ørskov E R , Hovell F D DeB and Mould F 1980** The use of the nylon bag technique for the evaluation of feedstuffs. Tropical Animal Production 5: 195 - 213.

Awareness of soybean, canola, and cottonseed meal ruminal degradability can plays a very important role in our understanding of relation between meal and animal nutrition,

Using in-sacco technique in three castrated male Zel sheep

This research was conducted in order to investigate rumen degradability of some factors includes;

Dray matter (DM)
Organic matter (OM)
Crude protein (CP)
Acid detergent fiber (ADF)

In three different plant protein supplements includes;

soybean, canola, and cottonseed meal

Researchers determined the level of effective degradability (ED) with three different sources in fistulated sheep

Results

Table1. Degradation Parameters and Effective Degradability of Soybean Meal Produced in Mazandaran Province, Iran ., Behpak Oil Plant

Oilseed Meal	Degradation Parameters (%)			C (%/hr)	Effective Degradation (0.05/hr)
Soybean Meal	**a**	**b**	**a±b**	**0.05**	
Dry Matter (%)	29.3	69.1	98.4	0.031	55.8
Organic Matter (%)	28.8	71.2	100	0.030	55.7
ADF (%)	28.7	59.8	88.5	0.039	55.0
Crude Protein (%)	29.3	69.2	98.5	0.031	55.8

Table2. Degradation Parameters and Effective Degradability of Canola Meal
Produced in Mazandaran Province, Iran ., Behpak Oil Plant

Oilseed Meal	Degradation Parameters (%)			C (%/hr)	Effective Degradation (0.05/hr)
Canola Meal	**a**	**b**	**a±b**	**0.05**	
Dry Matter (%)	24.9	58.1	83.0	0.055	55.2
Organic Matter (%)	29.8	57.3	87.1	0.043	56.4
ADF (%)	30.8	49.2	80.0	0.062	58.2
Crude Protein (%)	32.7	66.0	98.7	0.040	62.0

Table 3. Degradation Parameters and Effective Degradability of Cottonseed Meal Produced in Mazandaran Province, Iran ., Behpak Oil Plant

Oilseed Meal	Degradation Parameters (%)			C (%/hr)	Effective Degradation (0.05/hr)
Cottonseed Meal	**a**	**b**	**a±b**	**0.05**	
Dry Matter (%)	35.6	18.6	54.2	0.077	64.9
Organic Matter (%)	36.5	21.3	57.8	0.052	47.4
ADF (%)	18.9	34.6	53.5	0.059	37.6
Crude Protein (%)	34.8	22.0	56.8	0.078	48.3

Table 4. Degradation Parameters and Effective Degradability of Soybean Meal Produced in Mazandaran Province, Iran ., Culture and Industry Oil Plant

Oilseed Meal	Degradation Parameters (%)			C (%/hr)	Effective Degradation (0.05/hr)
Soybean Meal	**a**	**b**	**a±b**	**0.05**	
Dry Matter (%)	26.8	56.7	83.5	0.045	53.5
Organic Matter (%)	27.5	56.0	83.5	0.043	53.4
ADF (%)	29.9	46.4	76.3	0.036	49.3
Crude Protein (%)	26.8	54.9	81.7	0.047	53.4

Table 5. Degradation Parameters and Effective Degradability of Canola Meal Produced in Mazandaran Province, Iran ., Culture and Industry Oil Plant

Oilseed Meal	Degradation Parameters (%)			C (%/hr)	Effective Degradation (0.05/hr)
Canola Meal	**a**	**b**	**a±b**	**0.05**	
Dry Matter (%)	29.2	51.6	80.8	0.051	55.2
Organic Matter (%)	30.3	53.0	83.0	0.045	55.1
ADF (%)	26.6	46.4	73.0	0.077	55.1
Crude Protein (%)	33.8	56.3	90.1	0.040	58.7

Table 6. Degradation Parameters and Effective Degradability of Sunflower Meal Produced in Mazandaran Province, Iran ., Culture and Industry Oil Plant

Oilseed Meal	Degradation Parameters (%)			C (%/hr)	Effective Degradation (0.05/hr)
Sunflower Meal	**a**	**b**	**a±b**	**0.05**	
Dry Matter (%)	16.0	66.1	82.1	0.064	53.0
Organic Matter (%)	17.9	63.0	80.9	0.066	53.7
ADF (%)	23.3	53.6	76.9	0.015	36.0
Crude Protein (%)	6.6	83.9	90.5	0.069	55.7

Conclusion:

- CP were 55.8, 62, and 48.3 percentage
- ADF were 55, 56.4, and 37.6 percentage
- OM were 55.7, 56.4, and 47.4 percentage
- DM were 55.8, 73.8, and 48.5 percentage

The results reveal that In-sacco technique can be as a novel strategy for the determination of ruminal degradability of soybean, canola, and cottonseed meal through the use of fistulated sheep

Thank you for your attention