Fatty acids profile of mammary gland and milk of *Palmera* and *Majorera* goat breeds subjected to weight loss

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Goats

- Historic, economic and nutritional importance in tropical and sub-tropical environments

- Valuable nutritional supply in developing countries
  - important sources of animal protein

- Recent increase of interest for their milk and dairy products
  - substitute of cow milk
  - gourmet products
Seasonal Weight Loss

Tropical, Sub-Tropical and Mediterranean Climate:

**Rainy season**
- abundant pastures

**Dry season**
- poor and scarce pastures

Seasonal Weight Loss

Tropical, Sub-Tropical and Mediterranean Climate:

Dry season
poor and scarce pastures

Animals may lose up to 30% of their live weight:

Seasonal Weight Loss (SWL)
Seasonal Weight Loss

Tropical, Sub-Tropical and Mediterranean Climate:

Animals may lose up to 30% of their live weight:

Seasonal Weight Loss (SWL)

Major limitation in ruminant production in drought-prone regions

Dry season
poor and scarce pastures

Seasonal Weight Loss

- Some **breeds** show higher adaptation to dry environments and **resistance to SWL effects**.

  Interest for breed selection

  Improvement

Production yields and quality
- milk
- meat
- wool/hair

Disease management

Animal welfare

Social and economic importance
Canaries Archipelago

- Atlantic Ocean, West of North Africa
- Subtropical Climate Zone
Canaries Archipelago

**Palmera breed**
- adapted to rainy climate
- low tolerance to pasture scarcity

**Majorera breed**
- adapted to arid climate
- high tolerance to pasture scarcity

Lérias et al. 2013. Trop Anim Health Prod. 45: 1731-1736
Aim

• Milk fat:
  • major influence in organoleptic qualities
  • more susceptible to environmental and physiological conditions

• Profile the fatty acids composition in mammary gland and milk, of Majorera and Palmera breeds

• Study the influence of feed-restriction in these profiles
Methodology

Sample collection

Palmera breed lactation ♀  
N = 10

CTRL Group (N = 6)

Restricted Feeding Group: 15-20% initial live weight (N = 4)

Majorera breed lactation ♀  
N = 9

CTRL Group (N = 4)

Restricted Feeding Group: 15-20% initial live weight (N = 5)

23 days

Regular:
- weight measurement
- milking
- milk yield recording

• Mammary gland biopsy
• Milk
I. Mammary gland

- extraction – Folch Method
- conversion to fatty acid methyl esters (FAME)

I. Milk

- liophilization
- conversion to fatty acid methyl esters (FAME)

II. Gas Chromatography

- Flame-ionization detector
- Fused silica capillary column

III. FAME Identification

- Comparison with commercial standard mixtures
- Electron impact mass spectrometry

IV. Statistical Analysis

- ProcMIXED, SAS
Results and Discussion

Mammary gland: control vs restricted-fed groups

**Palmera breed**
- oleic acid (18:1 cis-9)
- palmitic acid (16:0)
- caprylic acid (8:0)
- capric acid (10:0)
- lauric acid (12:0)

**Majorera breed**
- caprylic acid (8:0)
- capric acid (10:0)
- lauric acid (12:0)

(Significant differences $p < 0.05$)
Results and Discussion

Mammary gland: control vs restricted-fed groups

*Palmera* breed

- Oleic acid (18:1 cis-9)

*Majorera* breed

- Palmitic acid (16:0)
- Caprylic acid (8:0)
- Capric acid (10:0)
- Lauric acid (12:0)

(Significant differences $p < 0.05$)
Results and Discussion

Mammary gland: control vs restricted-fed groups

*Palmera* breed

- Oleic acid (18:1 cis-9)
- Palmitic acid (16:0)
- Caprylic acid (8:0)
- Capric acid (10:0)
- Lauric acid (12:0)

*Majorera* breed

- Oleic acid (18:1 cis-9)
- Caprylic acid (8:0)
- Capric acid (10:0)
- Lauric acid (12:0)

- *Palmera* more susceptible to feed restriction
- Decrease of short-chain FA due to lipid mobilization from adipose tissues

(Significant differences $p < 0.05$)
Results and Discussion

Mammary gland: interaction breed x feed-restriction

*Palmera* breed

*Majorera* breed

- Oleic acid (18:1 cis-9)
- Palmitic acid (16:0)

(Significant differences $p < 0.05$)
Results and Discussion

Mammary gland: interaction breed x feed-restriction

*Palmera* breed

| oleic acid (18:1 cis-9) | NS |

*Majorera* breed

| palmitic acid (16:0) | NS |

(Significant differences $p < 0.05$)
Results and Discussion

Mammary gland: interaction breed x feed-restriction

**Palmera breed**
- Oleic acid (18:1 cis-9)
- Palmitic acid (16:0)
- ~ 60%

**Majorera breed**
- NS
- NS

(Significant differences $p < 0.05$)
Results and Discussion

Mammary gland: interaction breed x feed-restriction

- Breed influences the response to feed-restriction
- *Palmera* more susceptible to feed restriction
- Variation due to fat mobilization

*Palmera* breed
- Oleic acid (18:1 cis-9)
- Palmitic acid (16:0)

~ 60%

*Majorera* breed
- NS

(Significant differences $p < 0.05$)
Results and Discussion

Milk: control vs restricted-fed groups

*Palmera* breed
- oleic acid (18:1 cis-9)
- palmitic acid (16:0)
- myristic acid (14:0)
- capric acid (10:0)

*Majorera* breed
- oleic acid (18:1 cis-9)
- palmitic acid (16:0)
- myristic acid (14:0)
- capric acid (10:0)

- Variation due to fat mobilization and negative energy balance

(Significant differences $p < 0.05$)
Results and Discussion

Milk: multivariate analysis - PCA

- Clustering by treatment
- No clustering by breed

Loadings (VP’s):
- C18:1 cis-9
- C10:0
- C15:0
Both statistical analysis presented similar results

Variation due to fat mobilization and negative energy balance
Results and Discussion

Milk: interaction breed x feed-restriction

**Palmera breed**
- margaric acid (17:0)
- cis-9-heptadecenoic acid (17:1 cis-9)

**Majorera breed**
- margaric acid (17:0)
- cis-9-heptadecenoic acid (17:1 cis-9)

(Significant differences $p < 0.05$)
Results and Discussion

Milk: interaction breed x feed-restriction

**Palmera breed**
- margaric acid (17:0)
- cis-9-heptadecenoic acid (17:1 cis-9)

**Majorera breed**
- margaric acid (17:0)
- cis-9-heptadecenoic acid (17:1 cis-9)

< 2 %

(Significant differences $p < 0.05$)
Milk: interaction breed x feed-restriction

- **Palmera breed**
  - margaric acid (17:0)
  - cis-9-heptadecenoic acid (17:1 cis-9)

- **Majorera breed**
  - margaric acid (17:0)
  - cis-9-heptadecenoic acid (17:1 cis-9)

- Minor importance in the total FA milk composition

(Significant differences $p < 0.05$)
Main outcomes

✓ Interaction of breed and feed-restriction in mammary gland
  
  • *Majorera* breed seems to have higher tolerance to feed-restriction
    
    • More suitable for breed selection - milk production

✓ *Palmera* breed uses fat storage to cope with feed-restriction

✓ *Milk* had significant responses to feed restriction in both breeds
  
  • Product optimization (fat profile, flavour, …)
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questions...

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