# The effects of pellet starch concentration and allocation amount for Holstein cows at peak, mid, and late lactation in an automatic milking system

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| Study | Dietary strategy | DIM | Animals and parity | Substitution ratio (kg of DM) |
|---|---|---|---|---|
| Halachmi et al. 2006 | Static PMR with two types of concentrate | 142.2 ± 0.47 | 54 Multiparous | - |
| Bach et al. 2007 | Isocaloric with 2 amounts of concentrate | 191 ± 2.13 | 69 Primiparous 46 Multiparous | 1.14 |
| Hare et al. 2018 | Isocaloric with 2 amounts of concentrate | 227 ± 25 123 ± 71 | 3 Primiparous 5 Multiparous | 1.58 |
| Menajovsky et al. 2018 | LF-PMR HF-PMR | 141 ± 13.6 | 8 Multiparous | 0.89 0.78 |
| Henriksen et al., 2018 | Static PMR with 2 pellets and 2 amounts | 32 – 320 14 - 330 | 22 Primiparous 19 Multiparous | 0.58 0.92 |
| Henriksen et al., 2018 | Static PMR with 2 pellet and 2 amounts | 29 – 218 17 - 267 | 14 Primiparous 28 Multiparous | 0.69 0.50 |
| Henriksen et al. 2019 | Static PMR with individual or control concentrate strategy | Early:5-14 Mid: 15-240 Late: 240-305 | 68 Holstein 60 Jersey | 5.00 1.10 2.90 |
| Paddick et al. 2019 | Isocaloric with four amounts of concentrate | 90.6 ± 9.8 | 8 Primiparous | 0.97 |
| Schwanke et al., 2019 | Isocaloric with two amounts of concentrate | 47.1 ± 15 | 15 Primiparous | 0.62 |
| Johnson et al. 2022 | Static PMR with two types of concentrate | 142 ± 62 | 14 Primiparous 8 Multiparous | - |

# Hypotheses and objectives

- Hypotheses: PMR intake will be affected by starch concentration and allocation of the AMS pellet with peak and late lactation cows decreasing PMR intake to a greater extent as pellet allocation increases

- Objectives: evaluate the effects of AMS pellet allocation and starch concentration on AMS pellet and PMR intake and milking characteristics for Holstein cows in peak, mid, and late lactation

# Material and Methods

- Rayner Dairy Research and Teaching Facility

  - Free-stall with feed-first guided-flow barn design

- Twenty-four Holstein cows

- Stage of lactation

  - Peak: 85 DIM; SD ± 25.7 d

  - Mid: 185 DIM; SD ± 35.1 d

  - Late: 290 DIM; SD ± 69.5 d

# Feeding management and treatments

- Fed twice daily (60% at 1000 h and 40% at 2100 h) for ad libitum intake

  - Insentec bunks allowed for feeding behaviour measurement

  - AMS pellet allocations were set at 2.3 kg and 8 kg per day to achieve 2 and 6 kg/d

  - Refusal of pellet that cows left behind in the AMS were measured

| Variable | AMS pellet allocation | |
|---|---|---|
| | 2 kg/d DM | 6 kg/d DM |
| **Starch** | | |
| Low, 24% DM | LSLA | LSHA |
| High, 34% DM | HSLA | HSHA |

| Treatments | Milk yield predicted, kg/d | |
|---|---|---|
| | MP, g/d | ME, Mcal/d |
| LSLA | 41.83 | 42.70 |
| LSHA | 49.02 | 49.74 |
| HSLA | 42.44 | 43.24 |
| HSHA | 50.83 | 51.40 |

# Milkings and milking permission

- Milking permission: every 4 h

- Milking behaviour recorded

- Milk samples were collected at the end of each period

# Increasing robot pellet allocation increased DMI



**Starch concentration** — Legend: ■ Low, ☰ High. X-axis: Pellet, PMR, Total. Y-axis: DMI, kg/d (0–40).

**AMS pellet allocation** — Legend: ☐ Low, ▦ High. X-axis: Pellet, PMR, Total. Y-axis: DMI, kg/d (0–40). Annotations: Pellet 1.8 kg/d, 4.33 kg/d (*); PMR 1.2 kg/d (*); Total 1.3 kg/d (*).

**Lactation stage** — Legend: ☐ Pellet, ▦ PMR, ■ Total. X-axis: Peak, Mid, Late. Y-axis: DMI, kg/d (0–40).
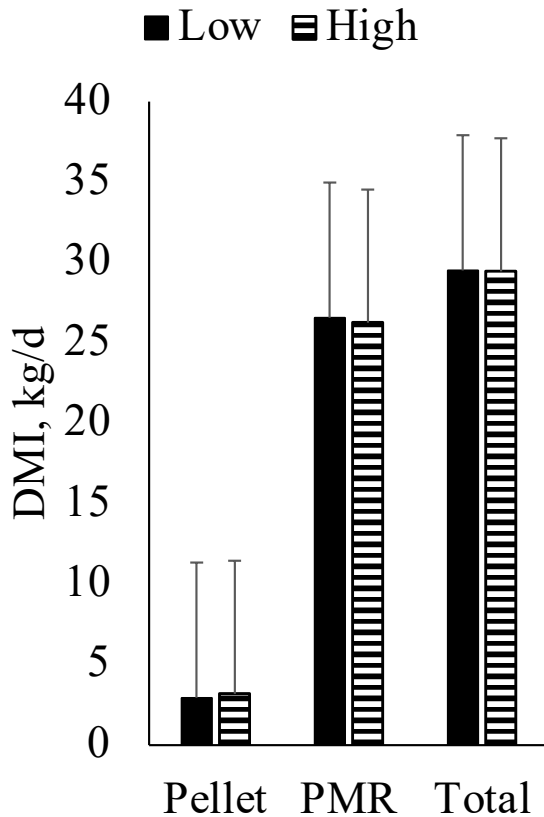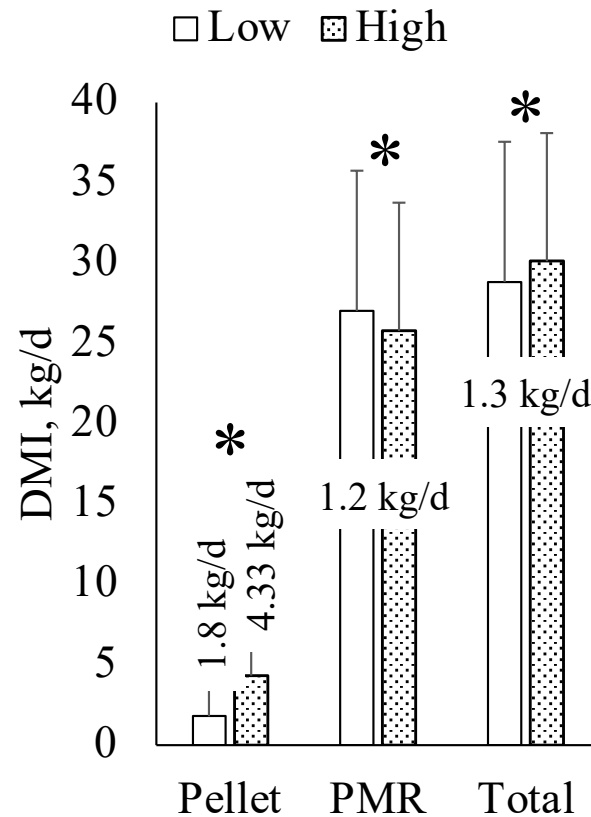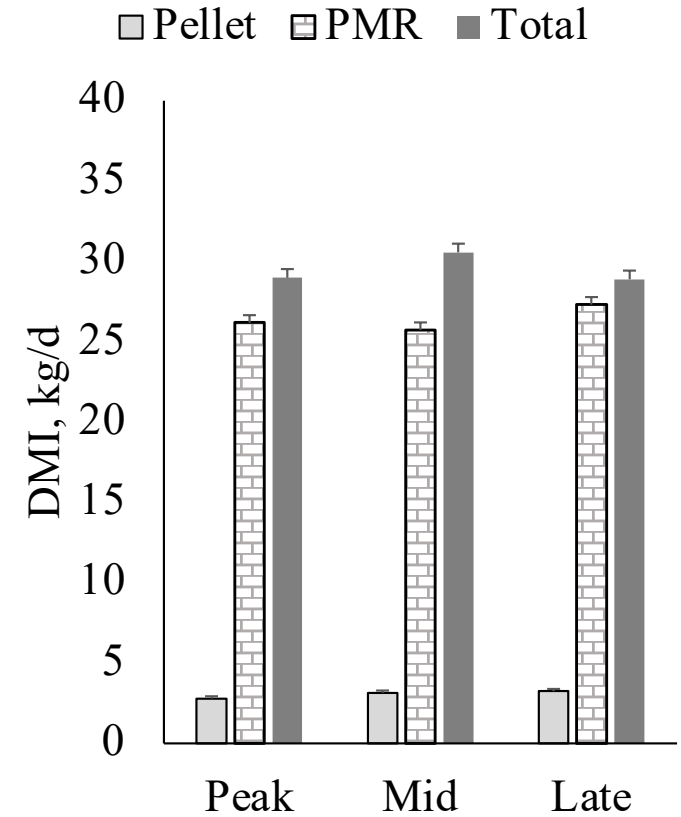
*Indicates means are different ($P < 0.05$)

# Pellet refusal - Cows fed more pellet leave more pellet in the robot when they leave



Starch concentration

AMS pellet allocation
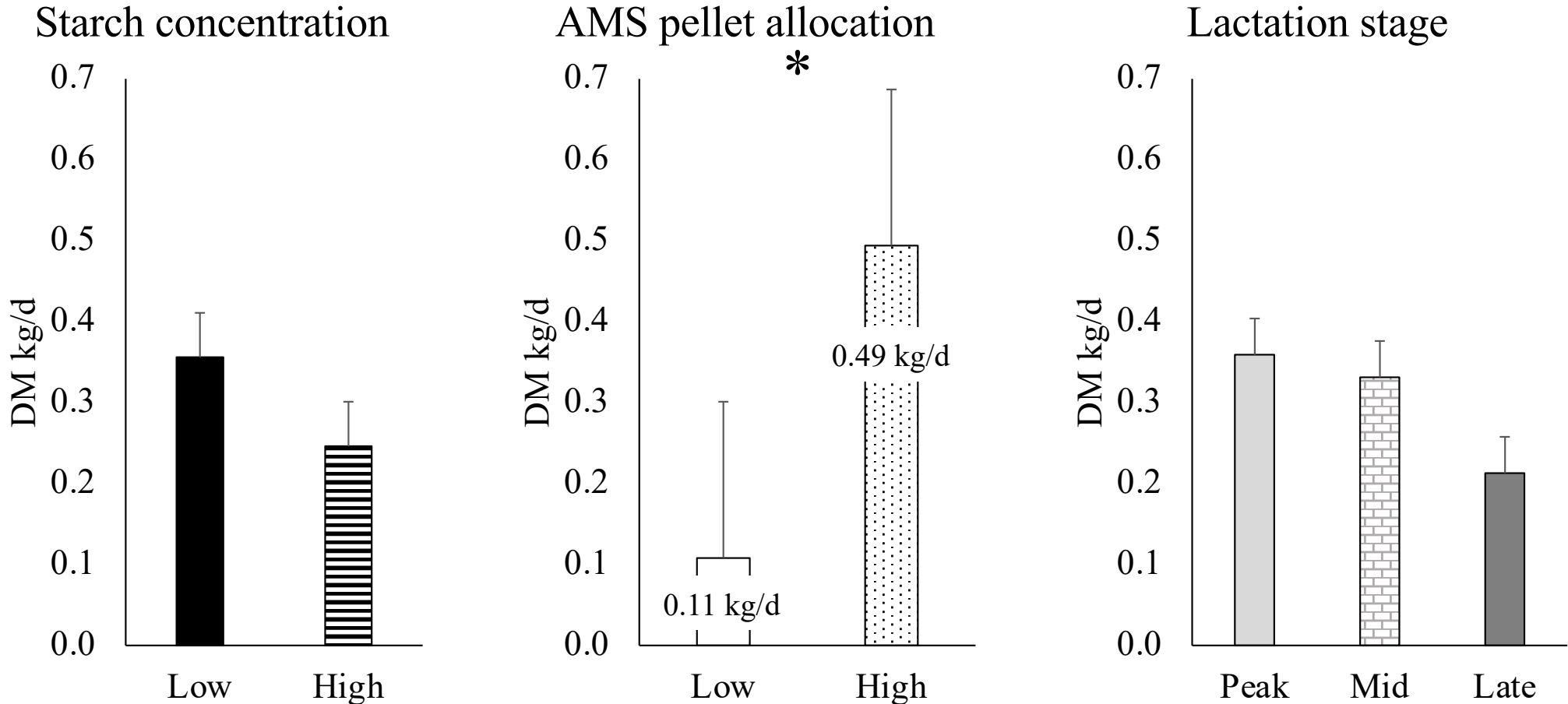
Lactation stage

*Indicates means are different (*P* < 0.001)

# Feeding high starch and more pellet did not affect milk yield
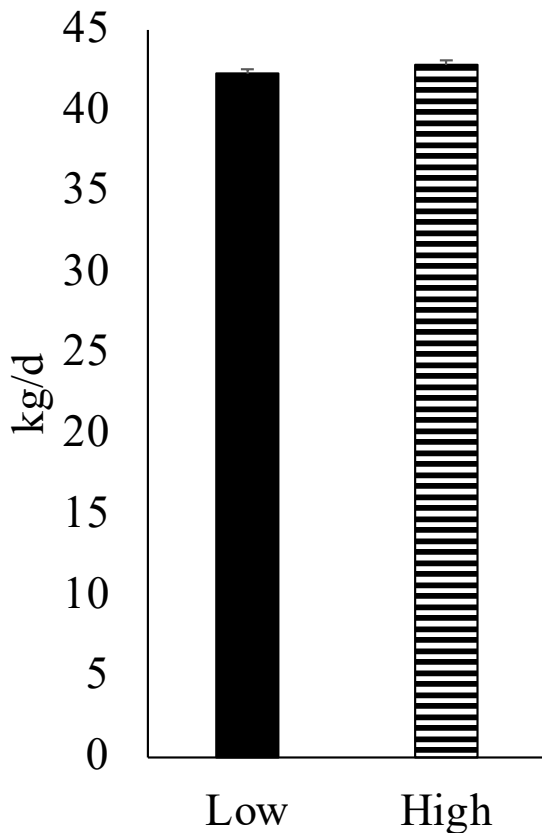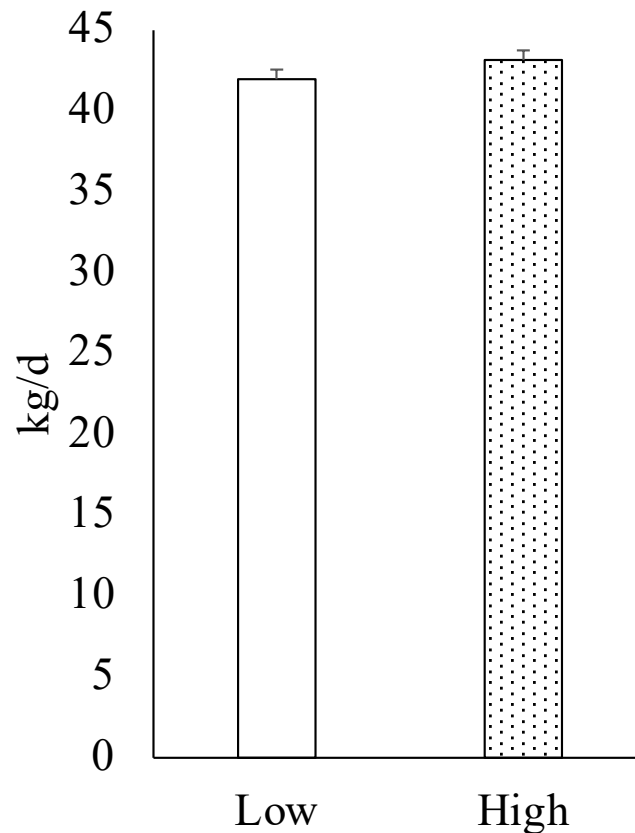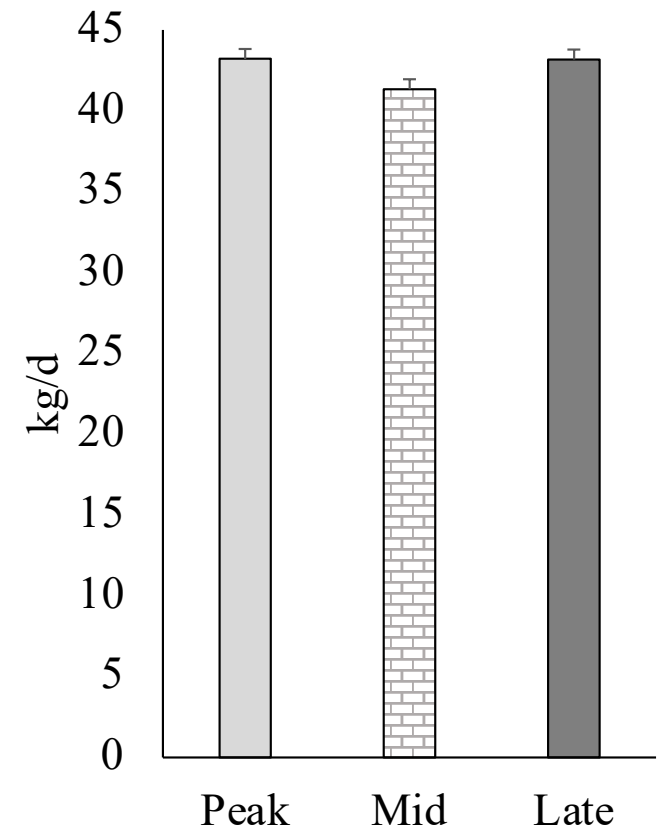
Average milk yield 42.6 kg/d

# High starch and high allocation reduce milk fat %

Starch concentration

AMS pellet allocation
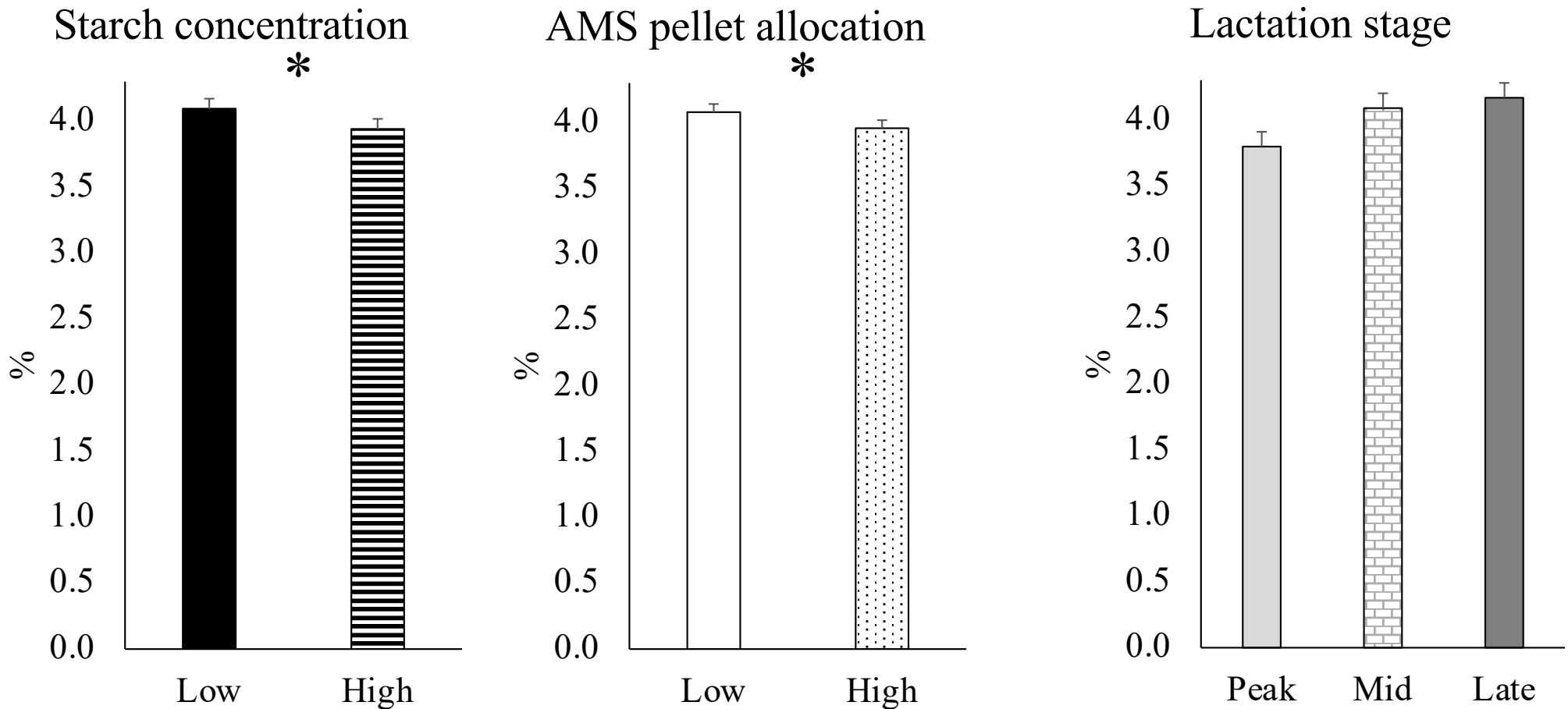
Lactation stage

*Indicates means are different (*P* < 0.005)

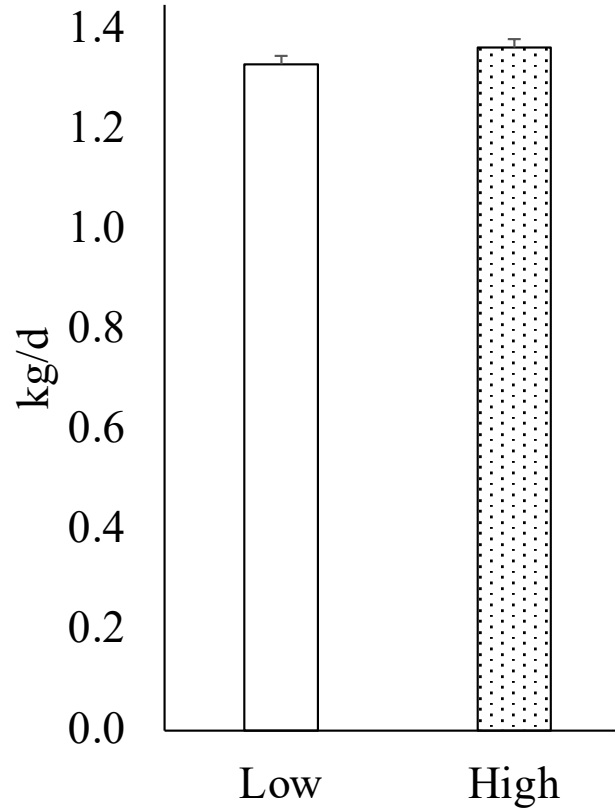Feeding high starch and more pellet did not affect fat yield
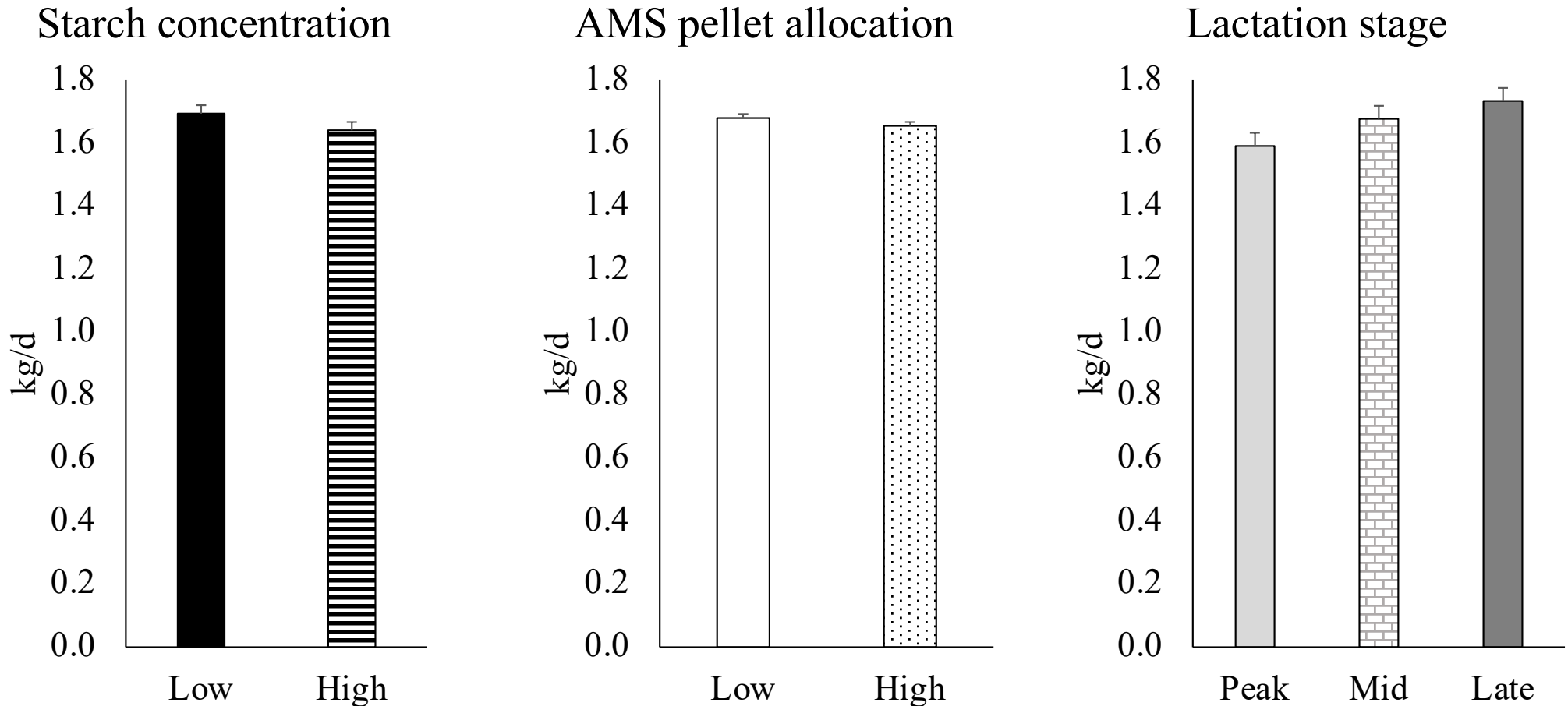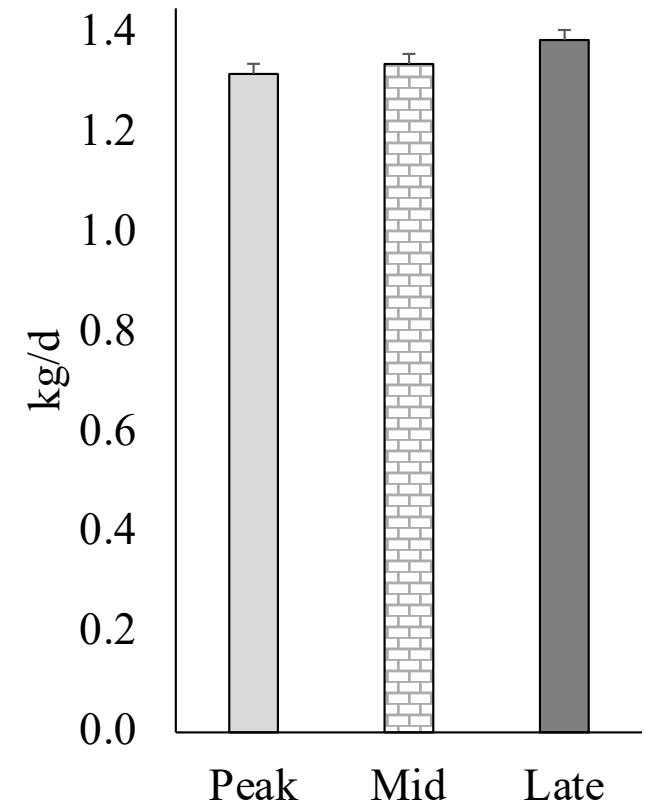
# No effect of treatment on protein yield
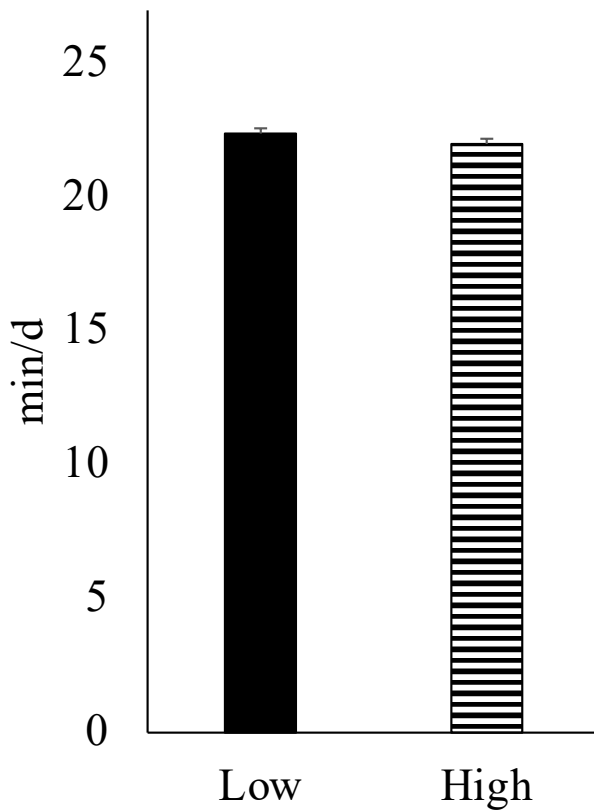
Starch concentration
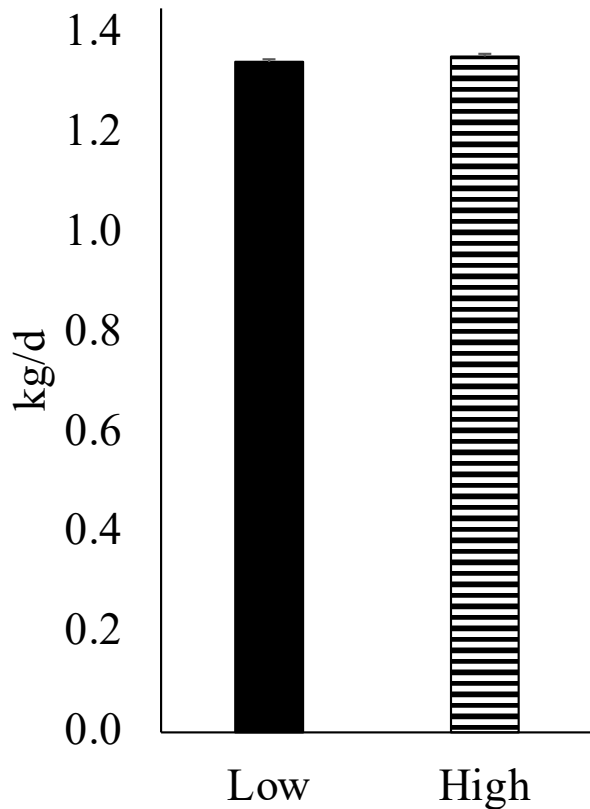
AMS pellet allocation

Lactation stage

# High allocation tended to reduce milking time
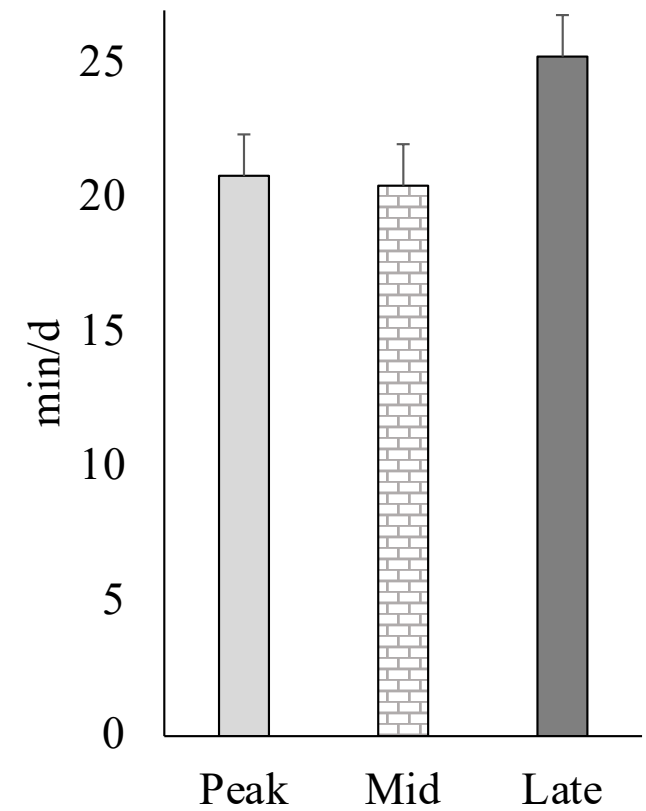
# High allocation tended to increase milking frequency



Starch concentration

AMS pellet allocation

Lactation stage
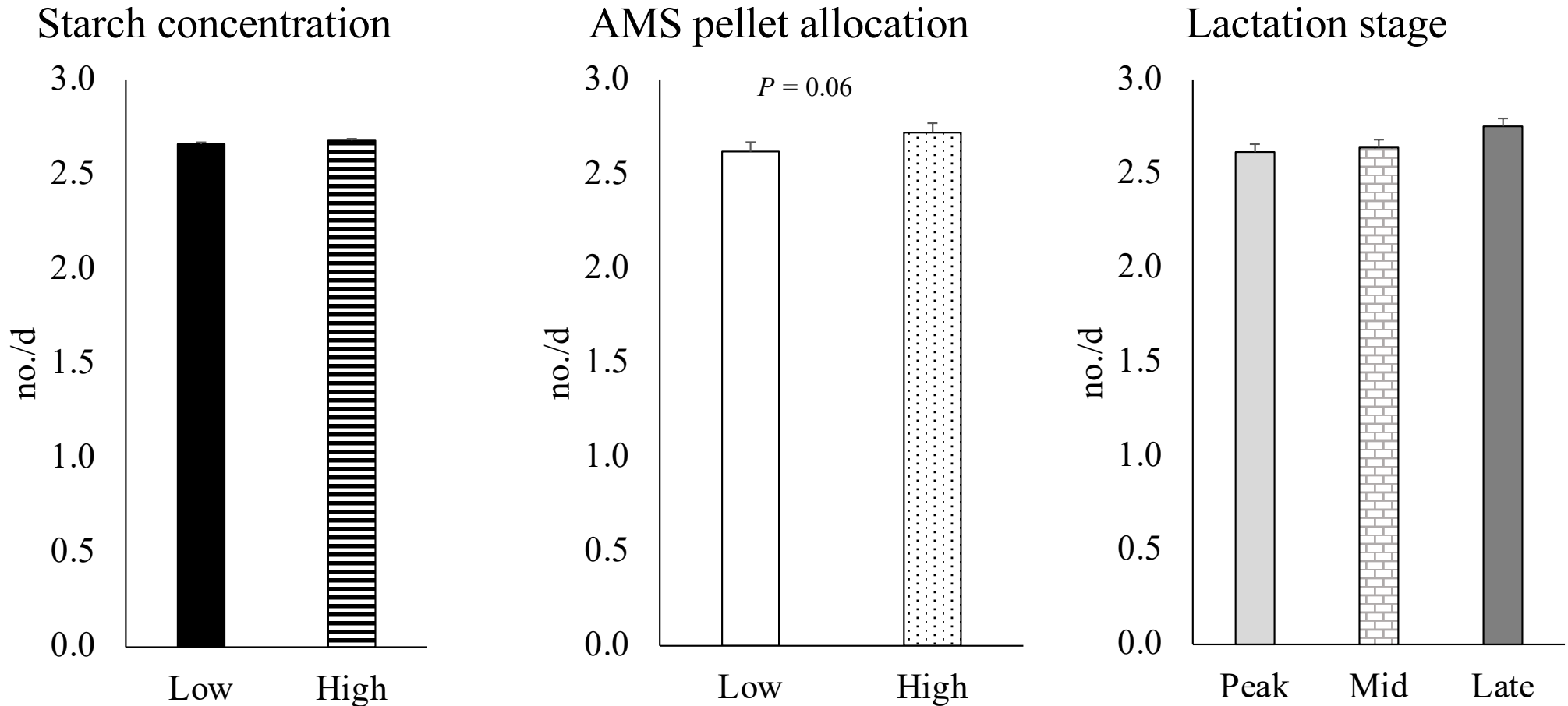
# What are the substitution values?

| DIM | Substitution rate | |
|---|---|---|
| | LS | HS |
| Peak | 1.76 | 0.41 |
| Mid | 0.13 | 0.97 |
| Late | -0.29 | 0.18 |

# LSLA treatment had greatest IOFC

| Variable | Treatment | | | |
|---|---|---|---|---|
| | HSHA | HSLA | LSHA | LSLA |
| Diet cost, $/cow/d | 13.24 | 12.99 | 13.44 | 12.79 |
| PMR | 11.12 | 11.64 | 11.34 | 11.46 |
| Pellet delivered | 1.95 | 1.26 | 1.90 | 1.22 |
| Pellet refused | 0.17 | 0.09 | 0.20 | 0.11 |
| Gross milk value, $/cow/d | 35.69 | 35.91 | 36.23 | 36.45 |
| Income over feed cost, $/cow/d | 22.45 | 22.92 | 22.79 | 23.66 |

Based on September 2023 milk prices. High starch pellet ($443/t + $24/t freight) and low starch pellet ($447/t + 24 $/t freight).

# Take home messages

- Feeding higher amounts of pellet in the AMS

    - Reduced PMR intake while increasing total DMI

    - Results in higher amounts of pellet left behind in the AMS

    - May increase attendance at the AMS

    - Did not affect milk or milk component yields

        - Reduced milk fat%

- Starch concentration of the pellet has little effect on productivity

Thank you!
FUNDING