

# The Effects of Heat Stress and Diet on Time Budget of Lactating Cows Housed in Tie-stalls

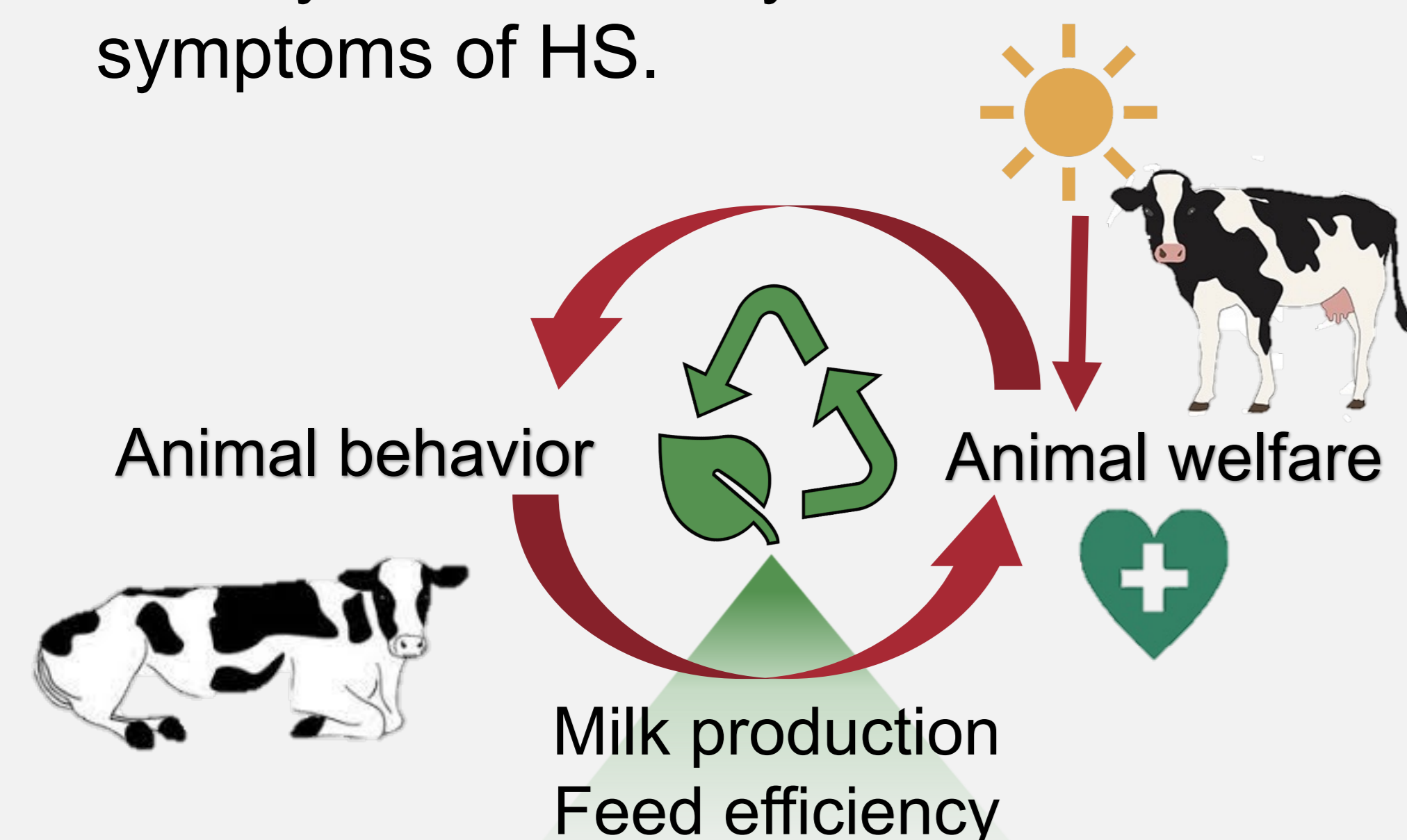
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## 1 Motivation & Method

### Context

- Heat stress (HS) impacts sustainable dairy production.
- Dietary nutrients may alleviate symptoms of HS.



### Objective

- To characterize lying behavior of dairy cows under HS.
- To test whether dietary supplementation of vitamin D<sub>3</sub> and Ca (VDCa) can alleviate HS.

### Experimental design

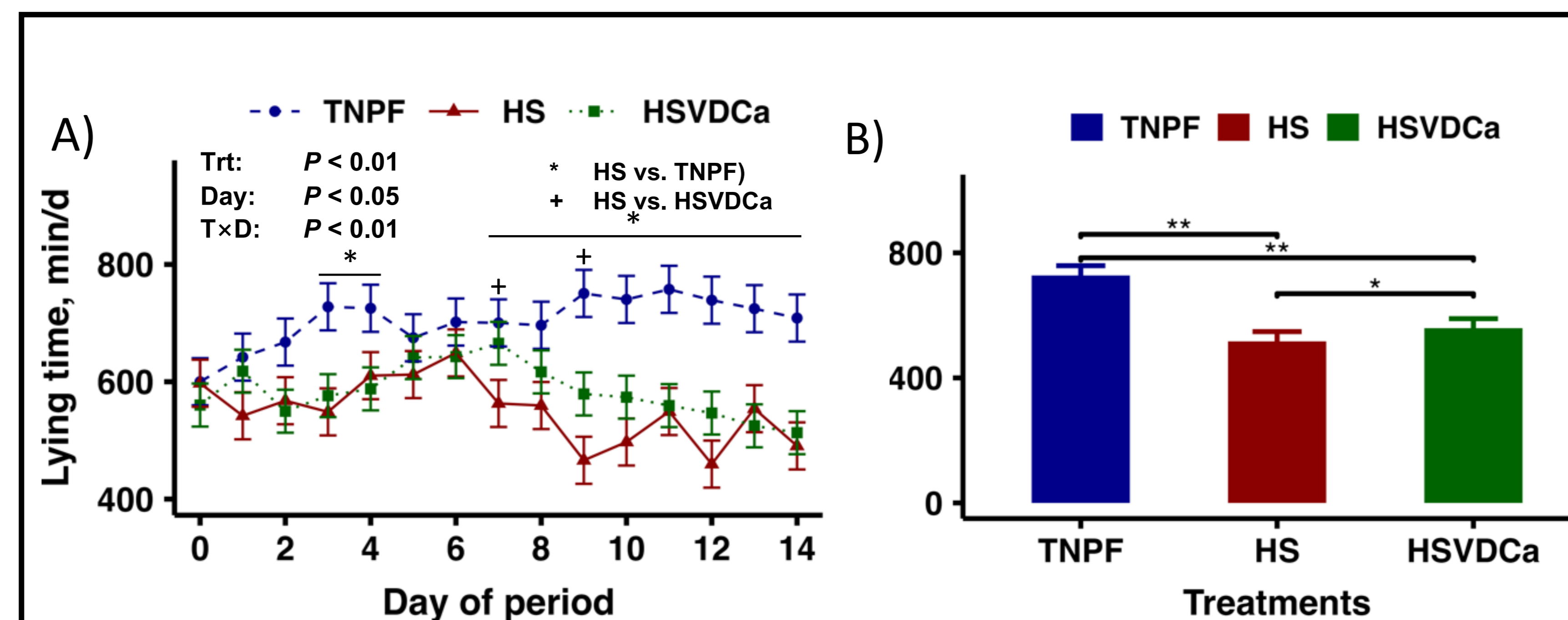
12 Holstein cows

3x3 Latin Square within split plot

### Treatments

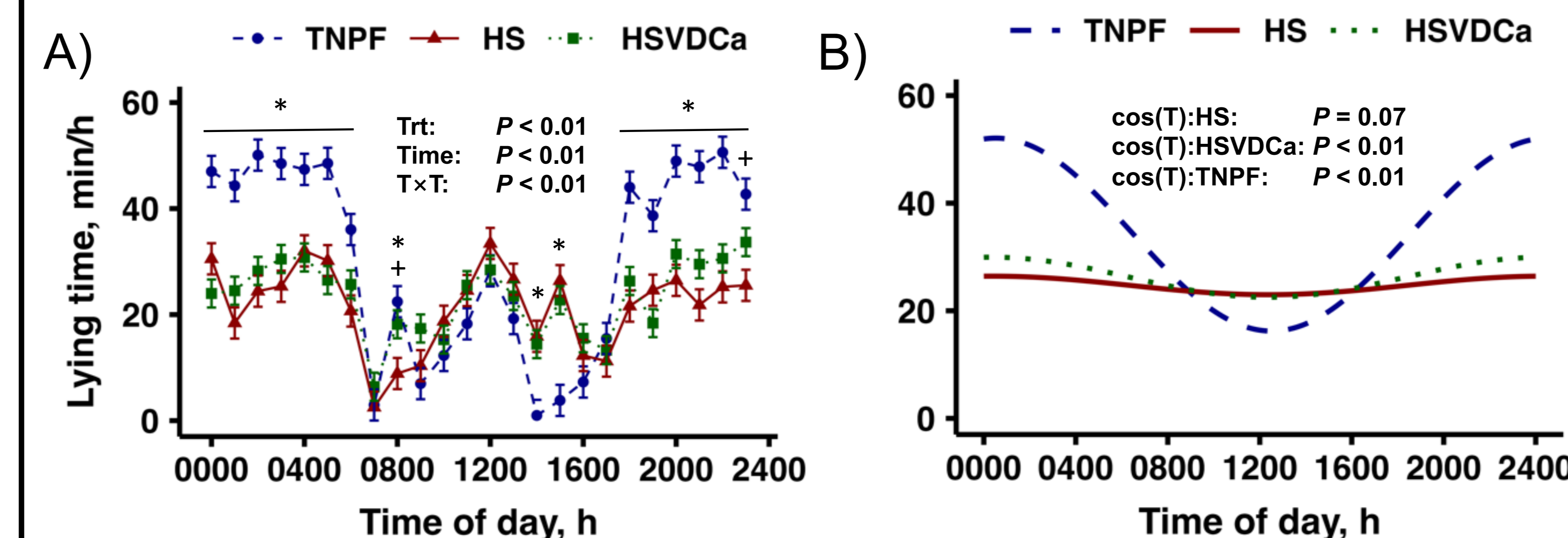
- **TNPF**: Thermoneutral pair-feeding
- **HS**: Heat stress
- **HSVDCa**: HS + VD<sub>3</sub> and Ca

## 2 Results



**Fig 1. Effects of dietary treatments and HS on daily lying time**

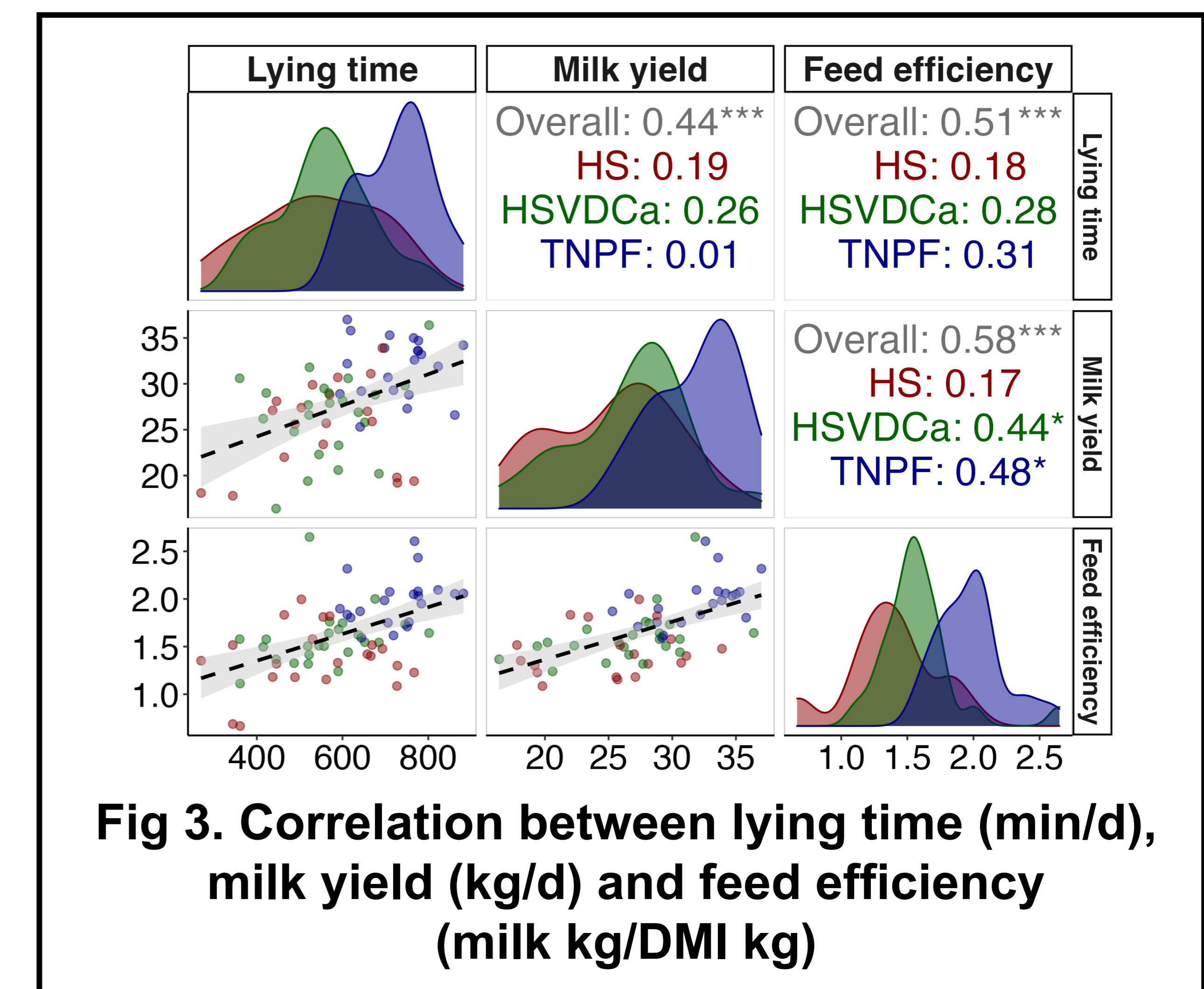
- A) Daily lying time.
- B) Average daily lying time from d 8 to d 14.



**Fig 2. The daily rhythm of lying behavior**

- A) Least square estimates.
- B) Cosine functions of time fitted with linear mixed model.

*\*Data during feeding and milking were excluded for daily pattern fitting, therefore, only spontaneous lying behaviour was used.*



**Fig 3. Correlation between lying time (min/d), milk yield (kg/d) and feed efficiency (milk kg/DMI kg)**

## 3 Conclusion

**Circadian rhythm of lying behavior of dairy cows experiencing HS was disrupted.**

- Cows under HS spent less time lying than TNPF cows (211 min), whereas VDCa increased daily lying time by 42 min.
- Cows under HS spent less time lying during late afternoon and early morning periods.

## 4 Contribution to Sustainable Food Systems

This study provides valuable guidance for alleviating heat stress and improving animal welfare with supplementation of dietary nutrients.