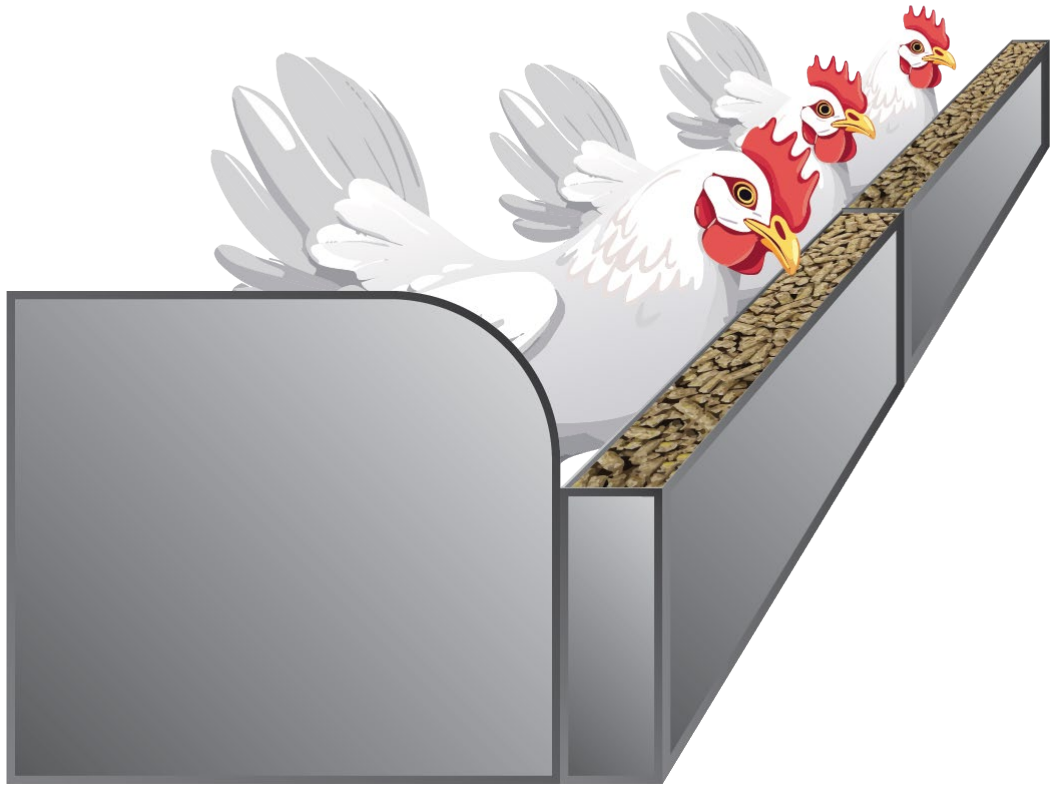
Synchronizing food availability with the natural rhythm dramatically improves production

Dror Sagi, The Volcani Institute, Israel

Hens, the common practice: Unlimited and continuous feeding scheme



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In humans and rodents: free access to feed is linked to metabolic disorders and worsening health

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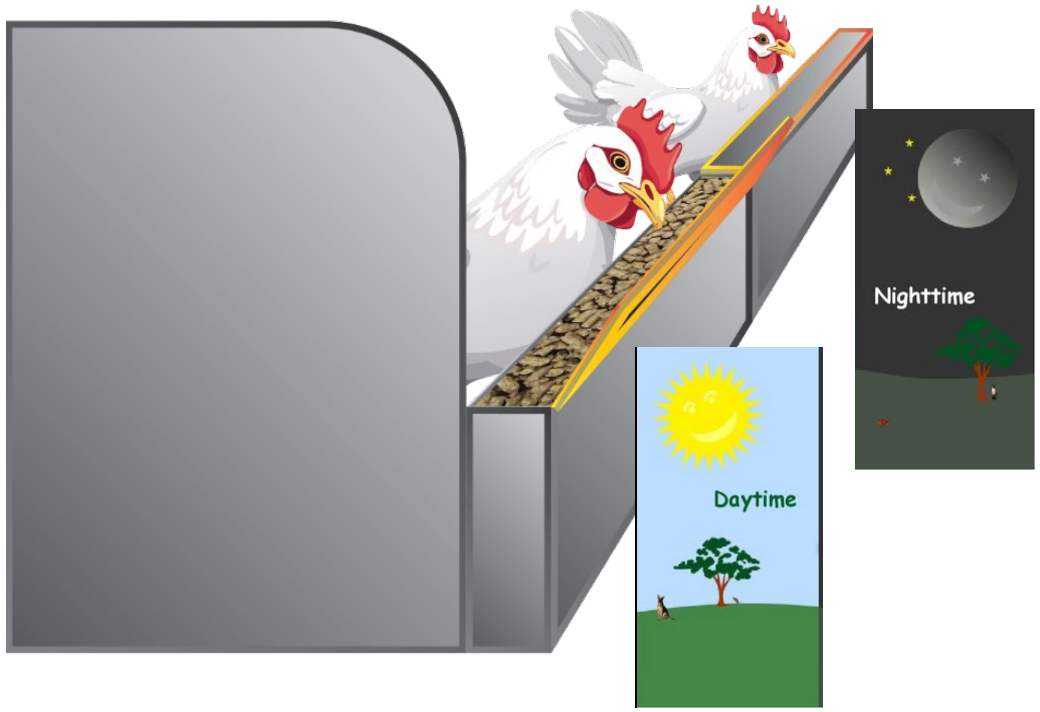

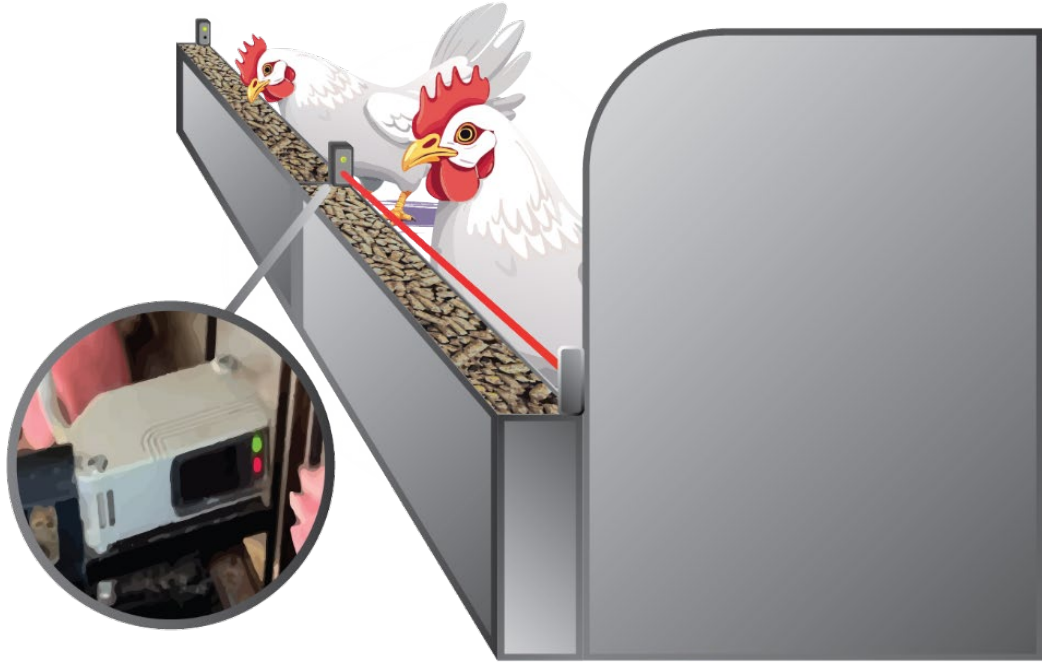

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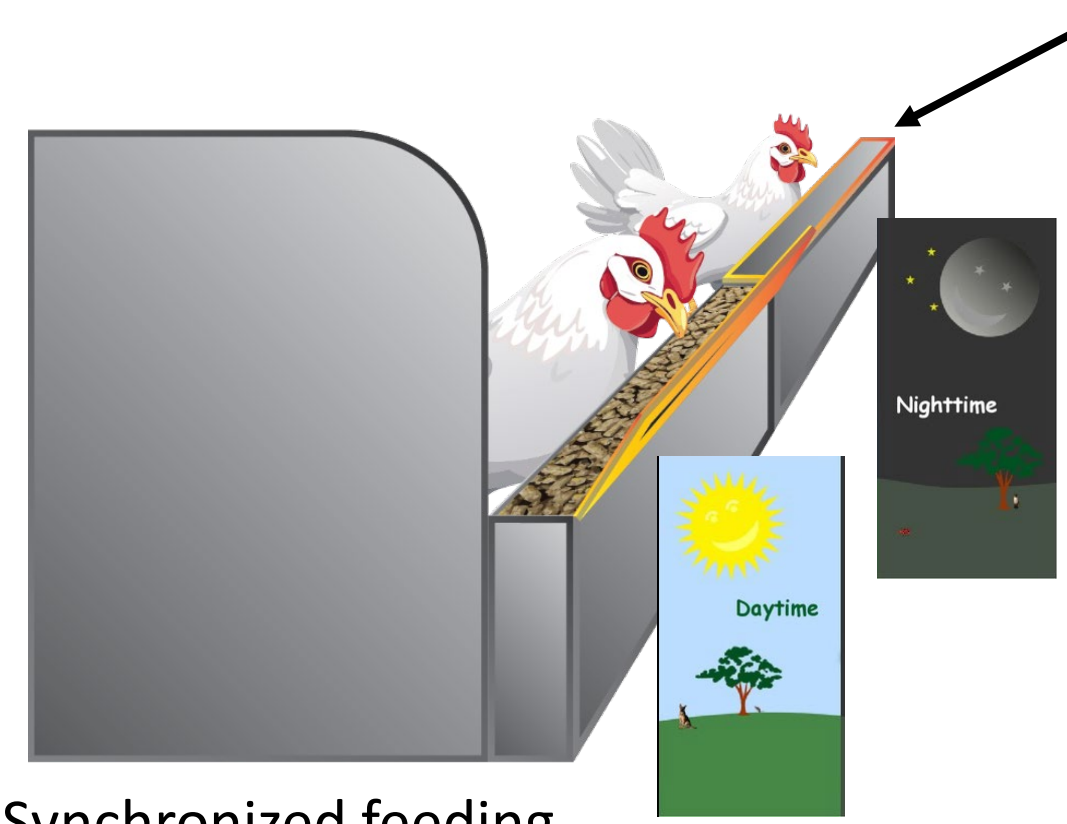
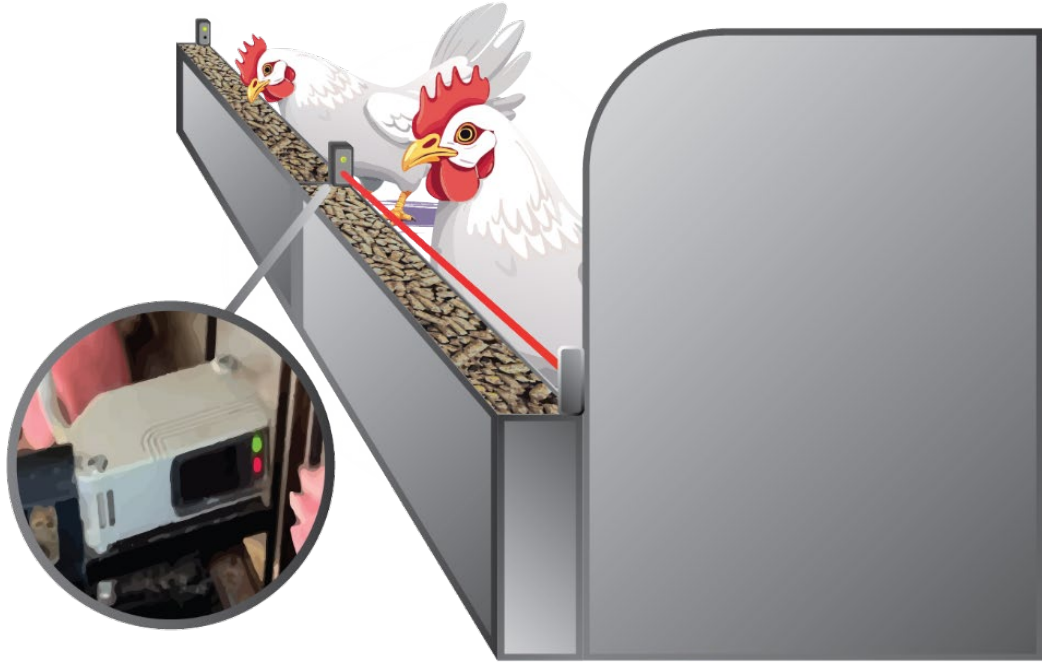
The setup: Programmable regulation of the covers, sensors to measure eating events



Synchronized feeding



Control, free (*ad libitum*) feeding

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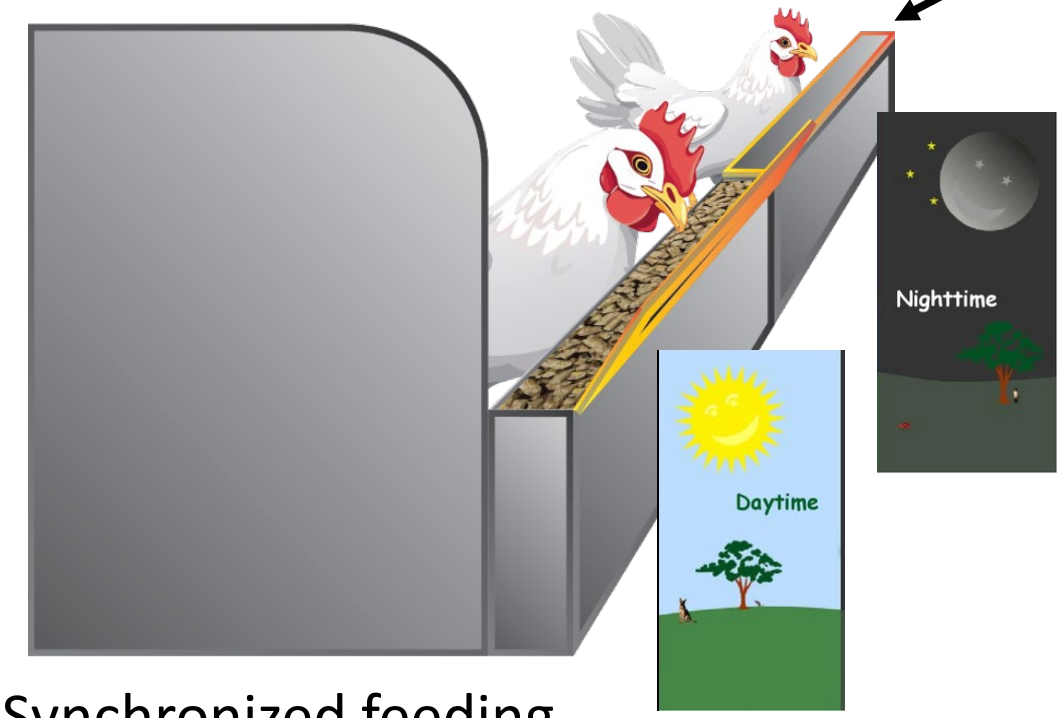
Eating patterns – if there is time today



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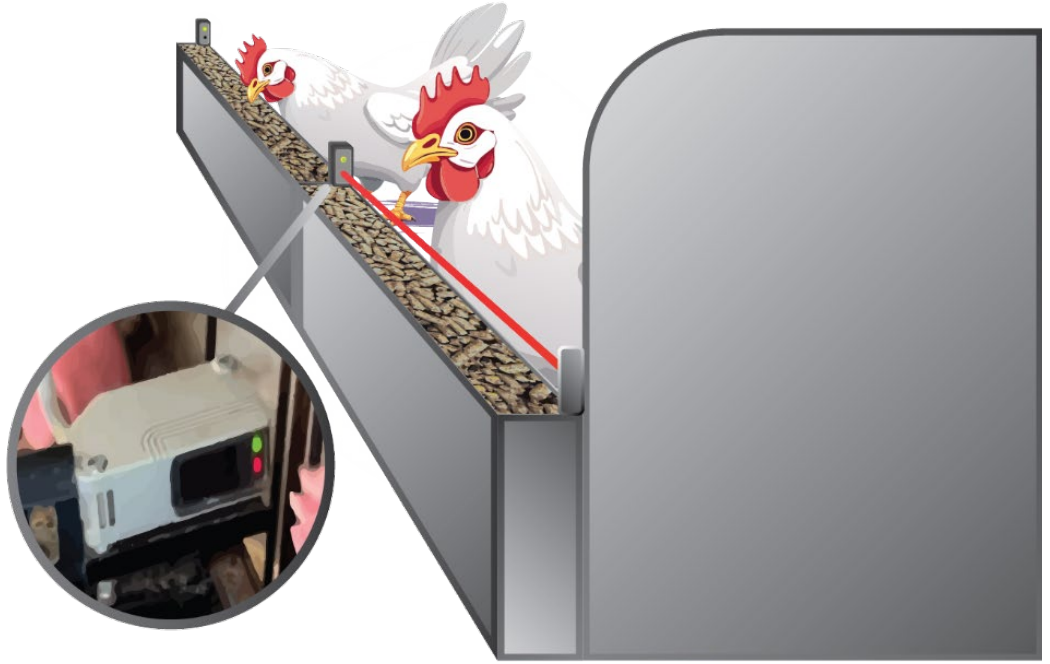

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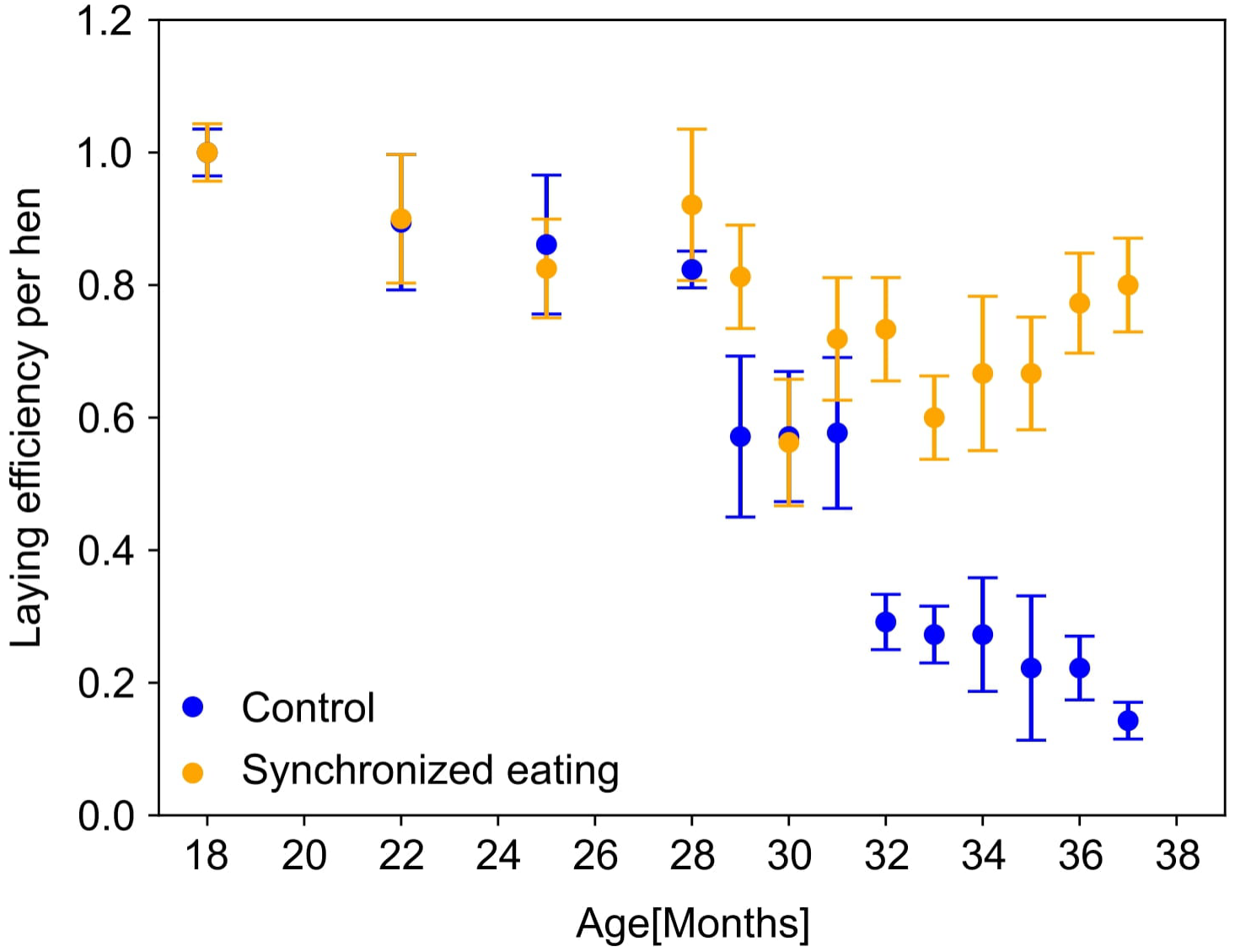
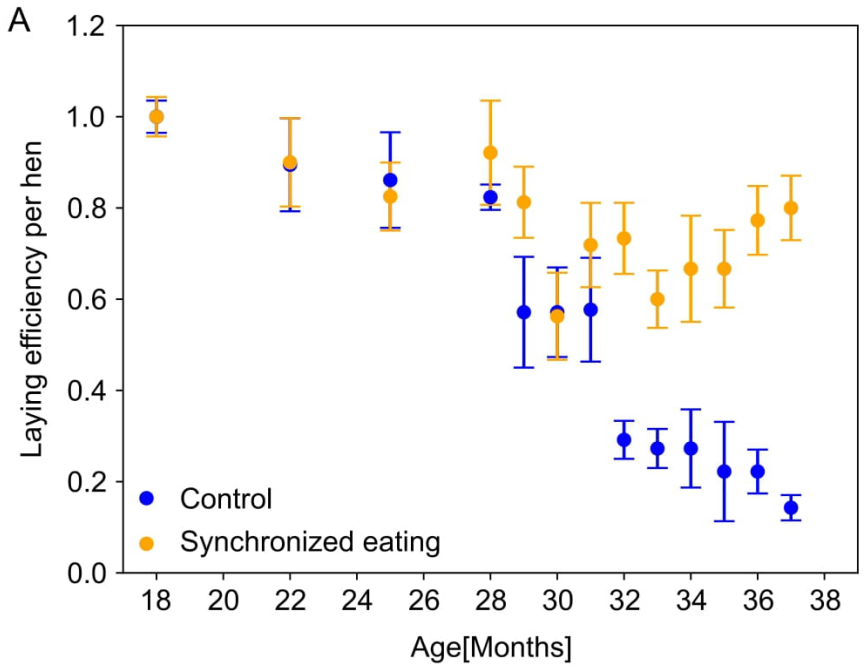
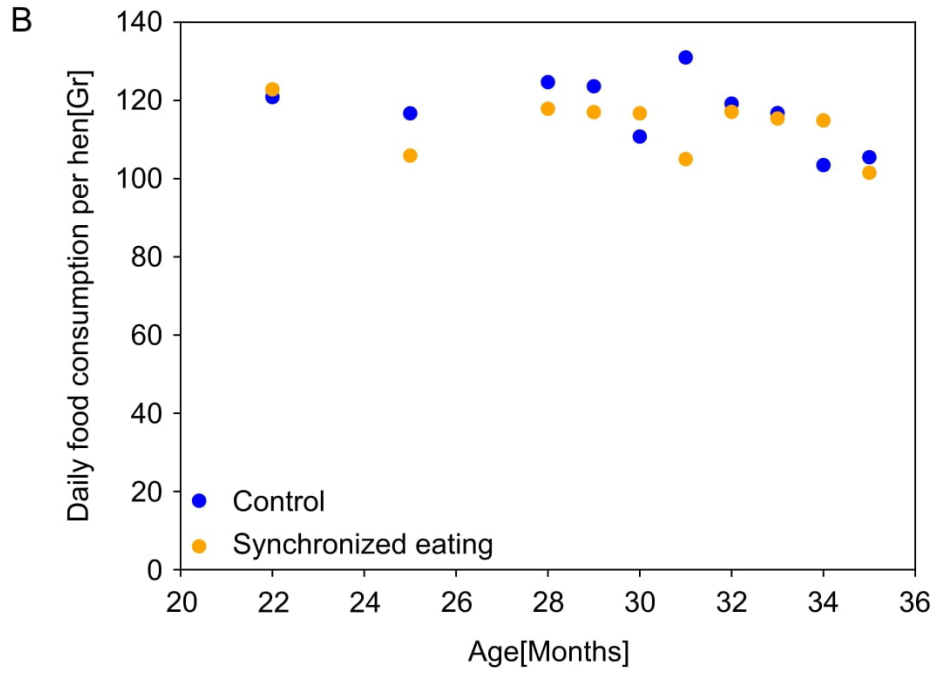
Synchronizing food availability with the natural rhythm dramatically improves egg production!

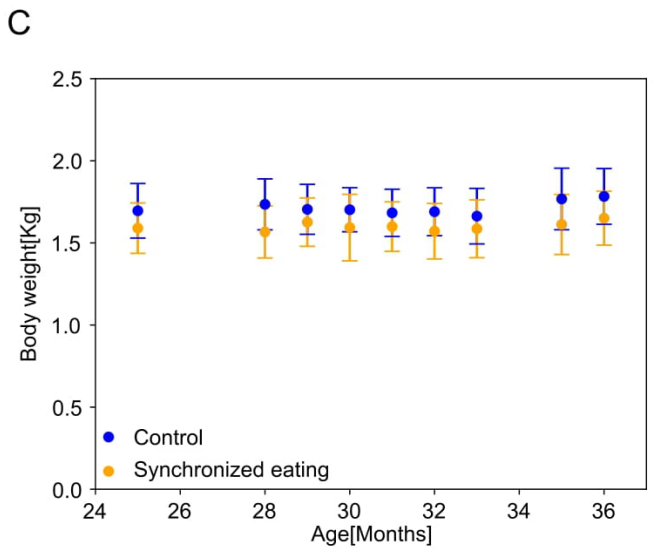


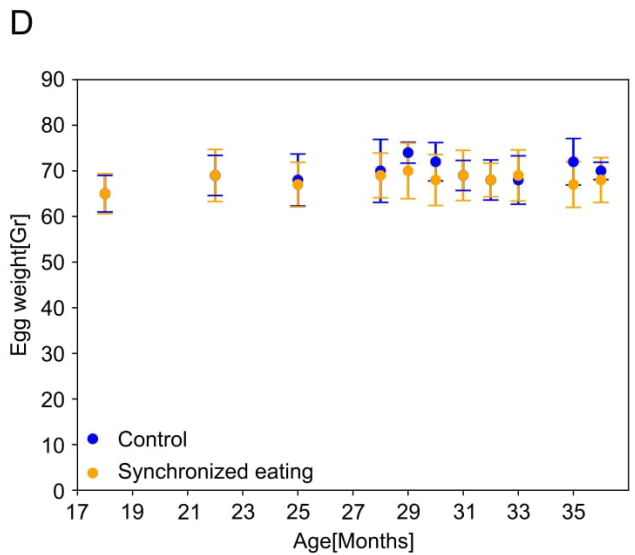
Levkovich et al 2024

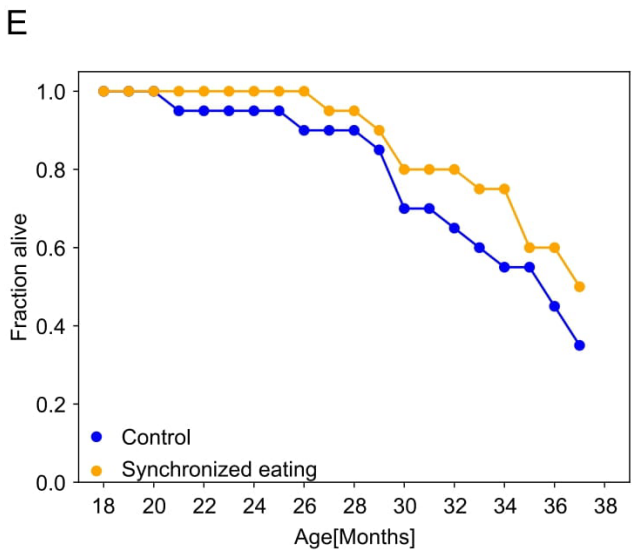
Egg production is improved without any tradeoff





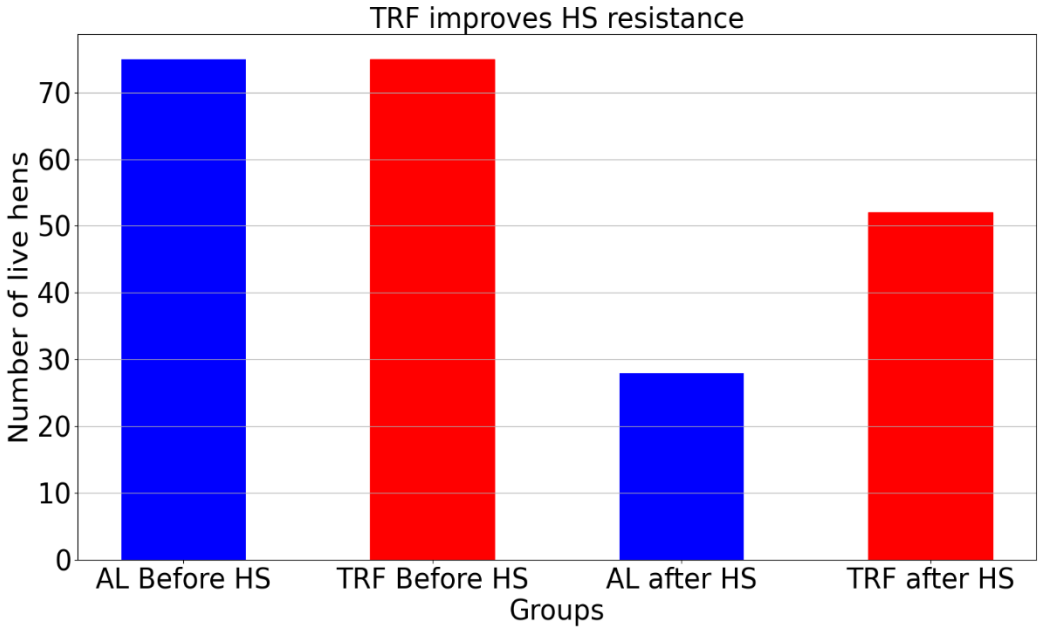






Time-**R**estricted **F**eeding hens are healthier and more durable

TRF improves resistance to heat stress (40^0C 24h)



TRF animals are much more durable than their chronological age counterparts (p = 2.5 x 10^{-8})

In collaboration with Miri Einat's group

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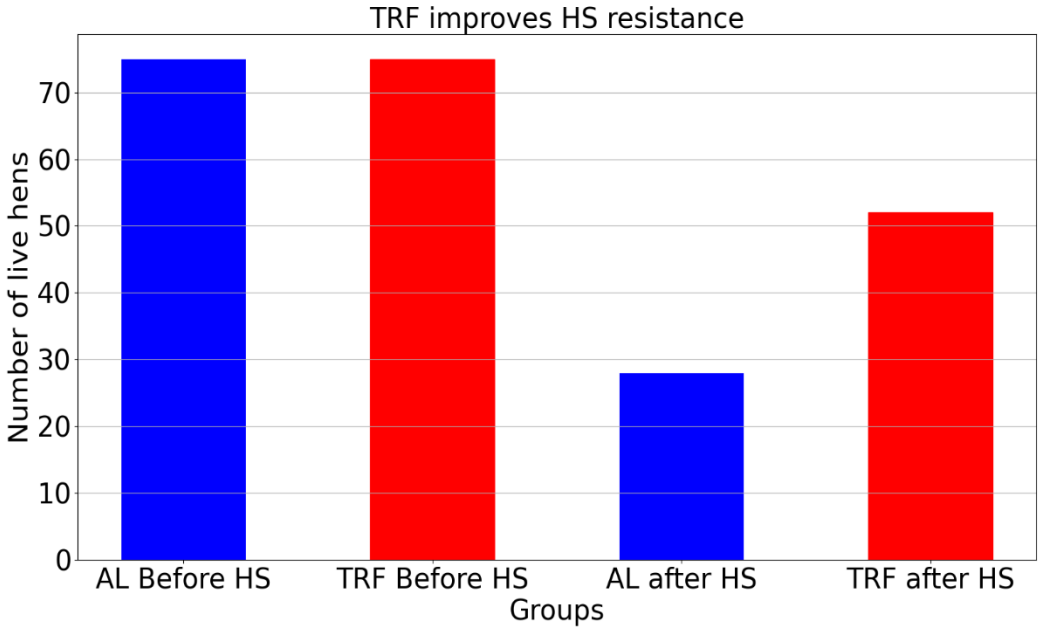
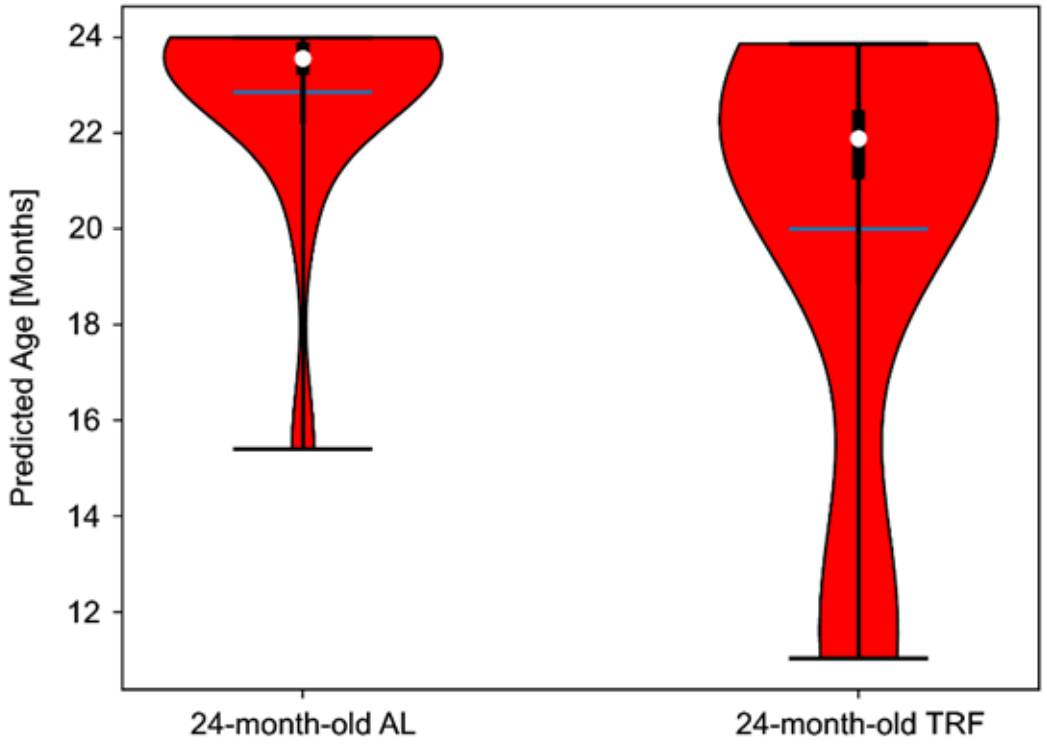


AL: *ad libitum*, control with free access to feed

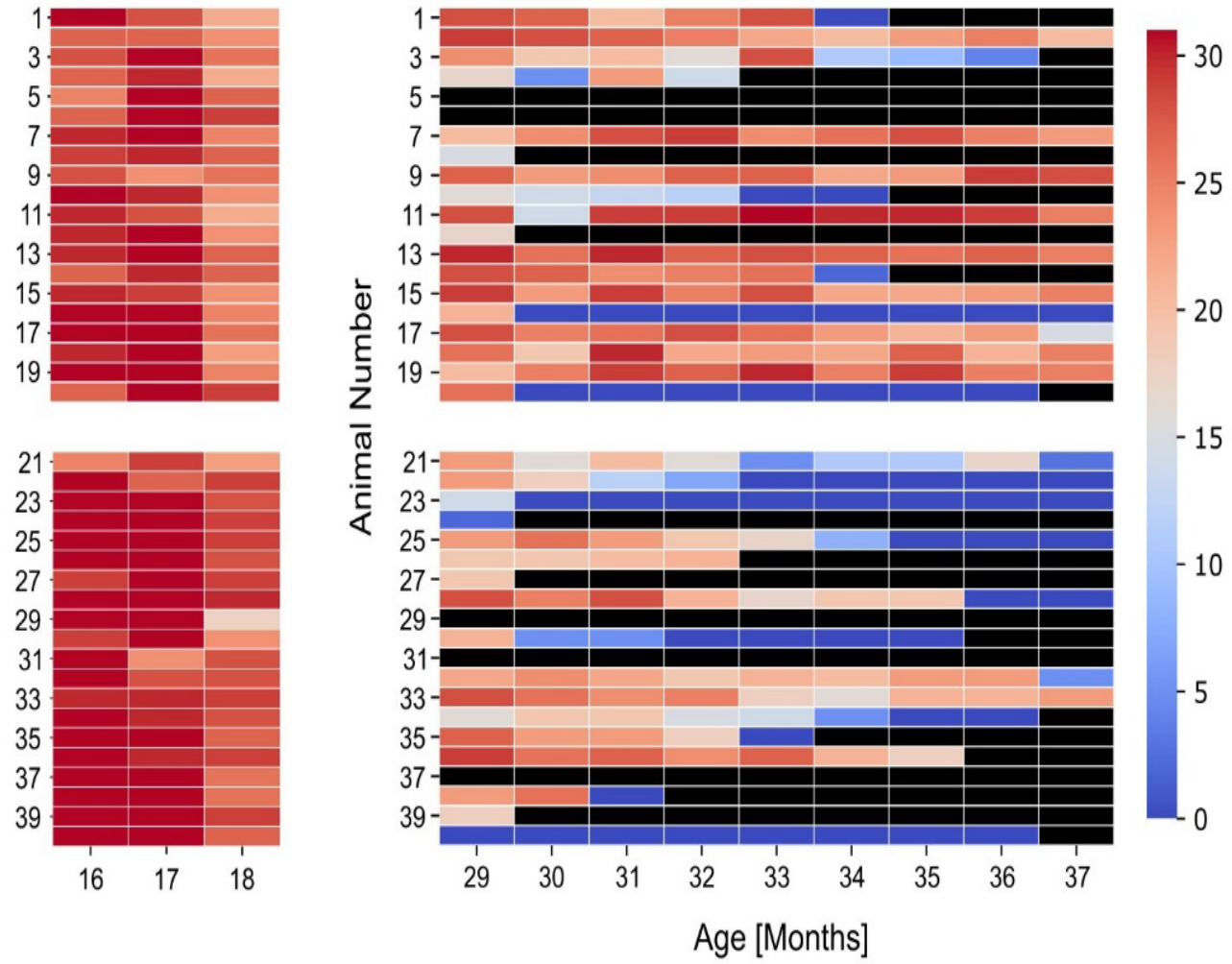
Bendikov-Bar et al 2021

TRF animals appear younger than their chronological age



(p = 0.005)

The switch: Hens are either efficient or inefficient layers, no gray zone



Every row represents an individual hen, Columns represent the age in months
Color code is the laying efficiency. Black refers to dead hens
Each column refers to the egg production of all animals of the same age

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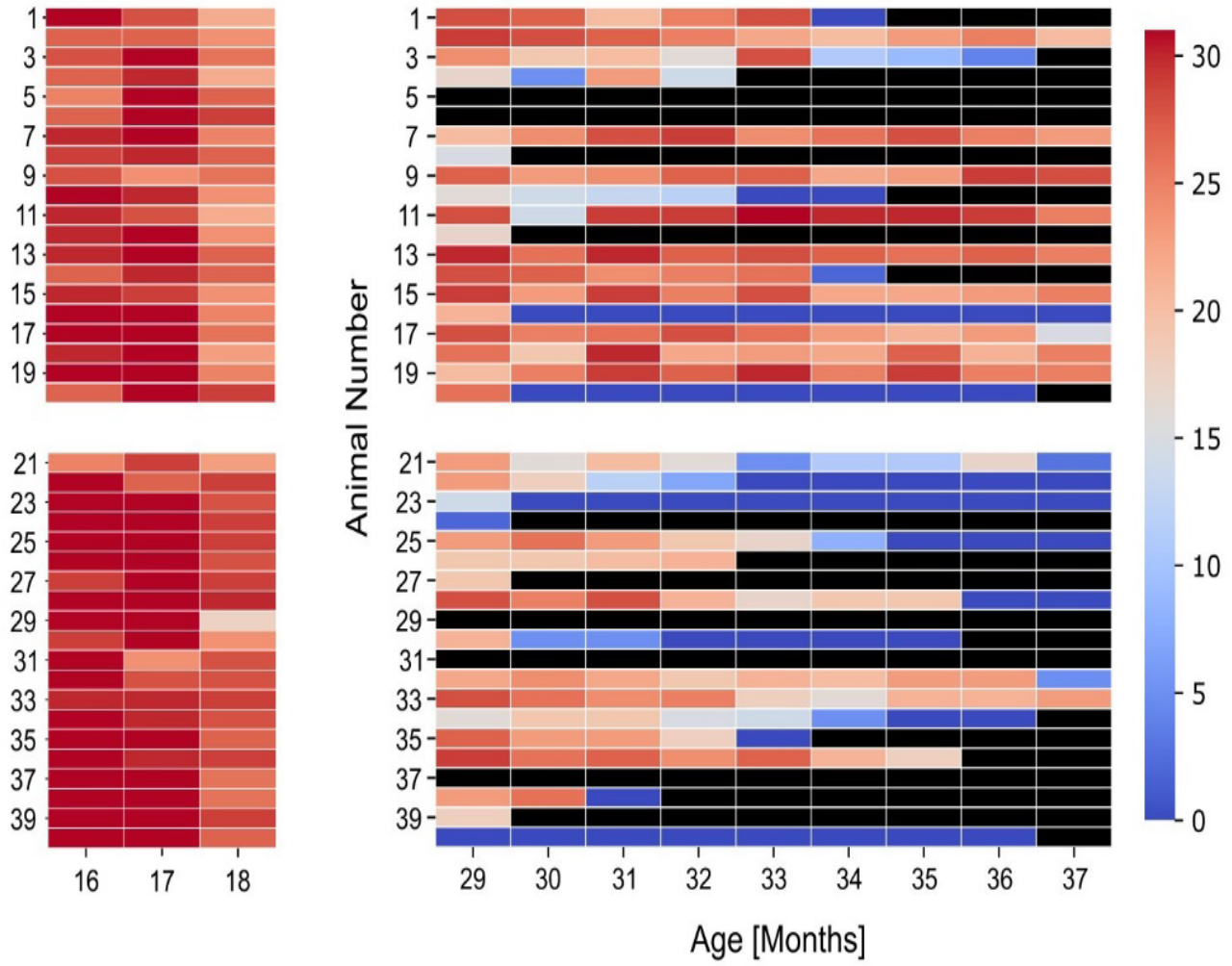

There are almost no light-blue colors

Summary

Synchronizing food availability with the natural rhythm dramatically improves production – **consistent with several projects**

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Synchronizing food availability with the natural rhythm dramatically improves production

Synchronizing food availability with the natural rhythm improves welfare and health without any tradeoffs

Synchronizing food availability with the natural rhythm extends the productive and youthful part of life

Summary

Synchronizing food availability with the natural rhythm dramatically improves production

Synchronizing food availability with the natural rhythm improves welfare and health without any tradeoffs

Currently, we are looking at a larger sample in an attempt to repeat and find a molecular mechanism

Circadian Rhythms

Acknowledgments

Acknowledgments

Guy Levkovich; Inna Bendikov-Bar

Dana Almagor, German Shiklov

Miri Einat, and Shelly Druyan for helpful advice and guidance

The Druyan group, especially Dima Shinder

Sergey Malitsky and Maxim Itkin – metabolomics team @ Weizmann core facilities

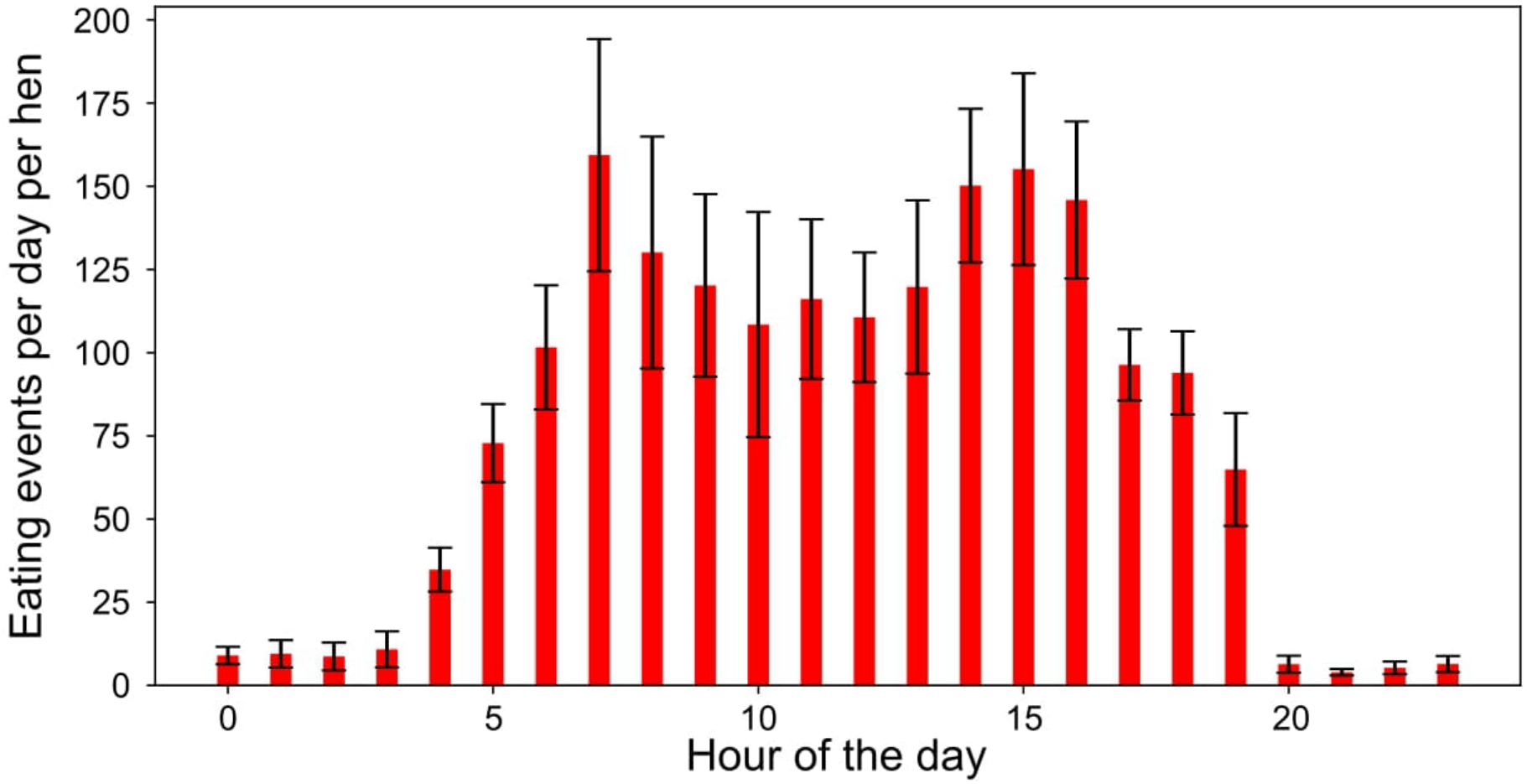
Mark Rusal and the chicken facility team

Ilan Halachmi's group: Ran Shmulevitch and Liad Reshef

ISF for funding


Thank
You

The average hen exhibits eating events in every hour of the day



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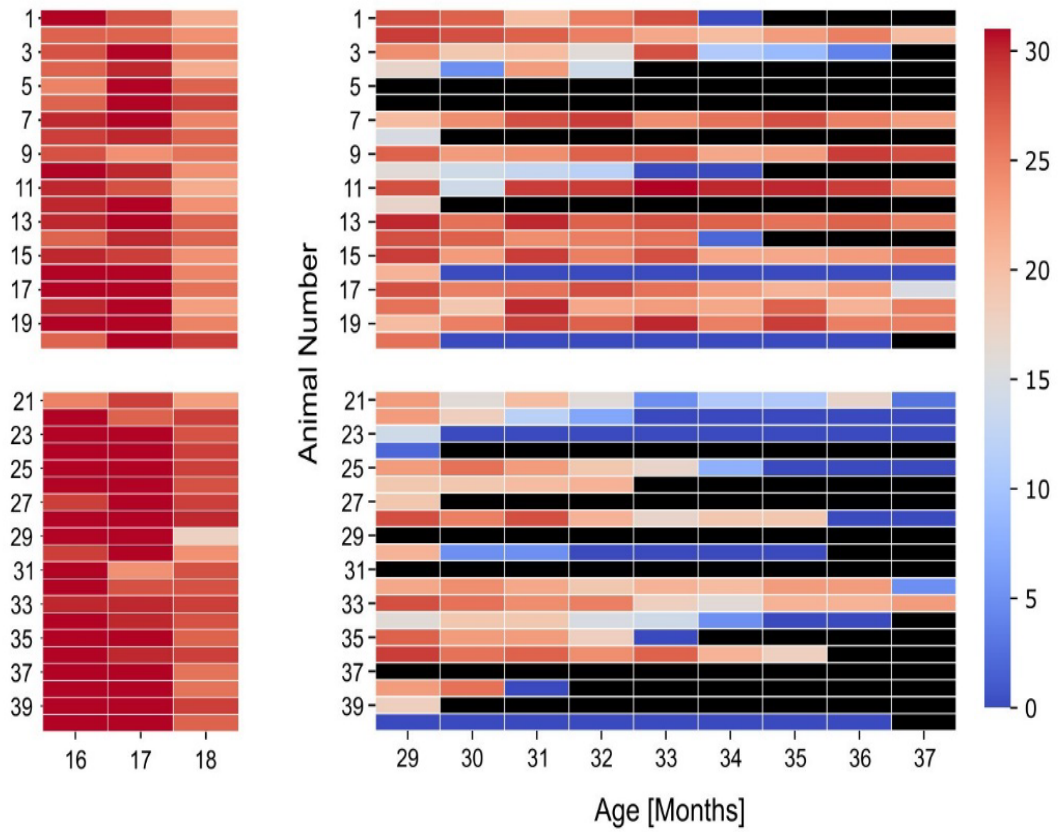
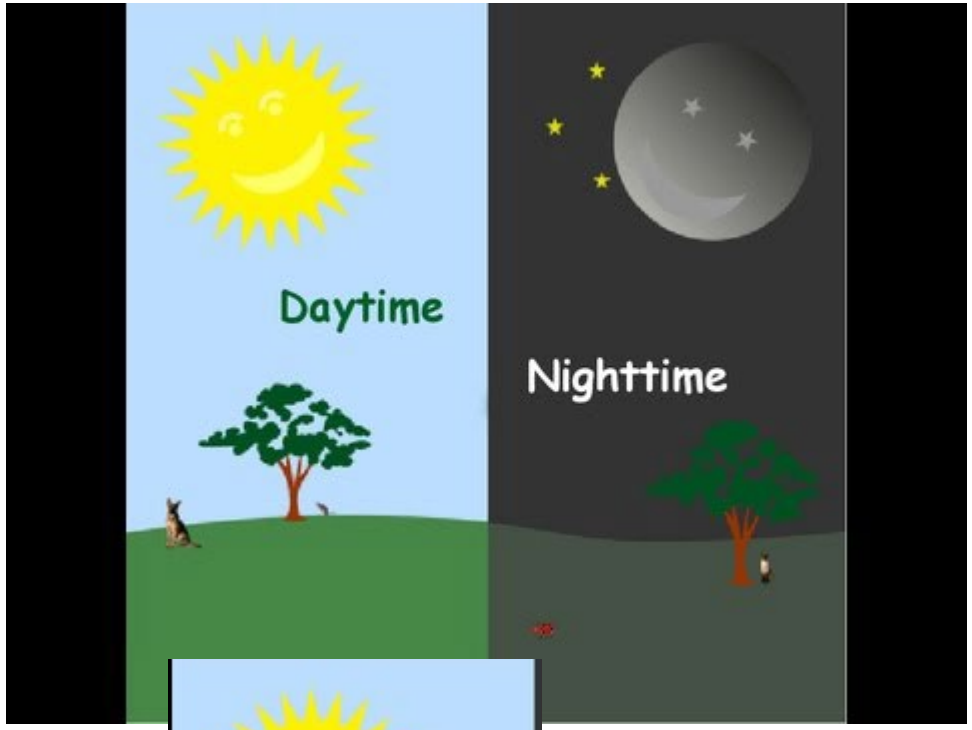


Every line is a hen, x-axis is the age in months, so each column refers to the egg production of all animals at the same age color code is the laying efficiency. Black refers to dead hens

There are almost no light-blue colors. For example, at 36 months of age, the difference between groups is due to the difference in the number of active hens. At 36 months, the ratio between synchronized to control hens is 9:3.


Daytime
Nighttime


Daytime


Nighttime

Synchronizing food availability with the natural rhythm dramatically improves egg production

Data

Levkovich et al 2024

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I am not from agriculture, and the first thing that I remember from the chicken facilities is the unlimited and continuous feeding sc

In hens, the common practice is to give them free access to feed all day long

In humans and rodents, unlimited feed availability is linked to metabolic disorders and worsening health

We, therefore, decided to test what happens with a synchronized eating scheme: allowing free access to feed during daytime, no access during nighttime

Next – the setup. We wanted to build an autonomic, reliable, and simple setup that regulates feed availability

The setup. In collaboration with Ilan Halachmi's group we have built this setup

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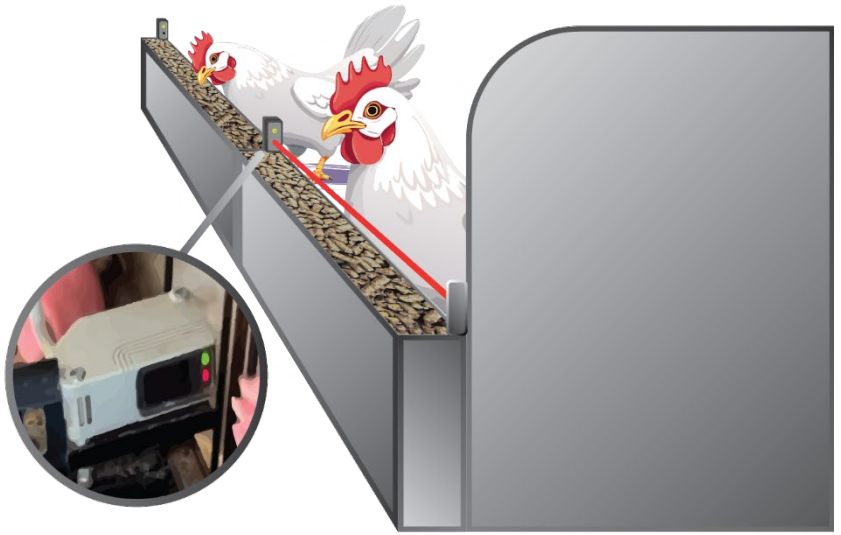

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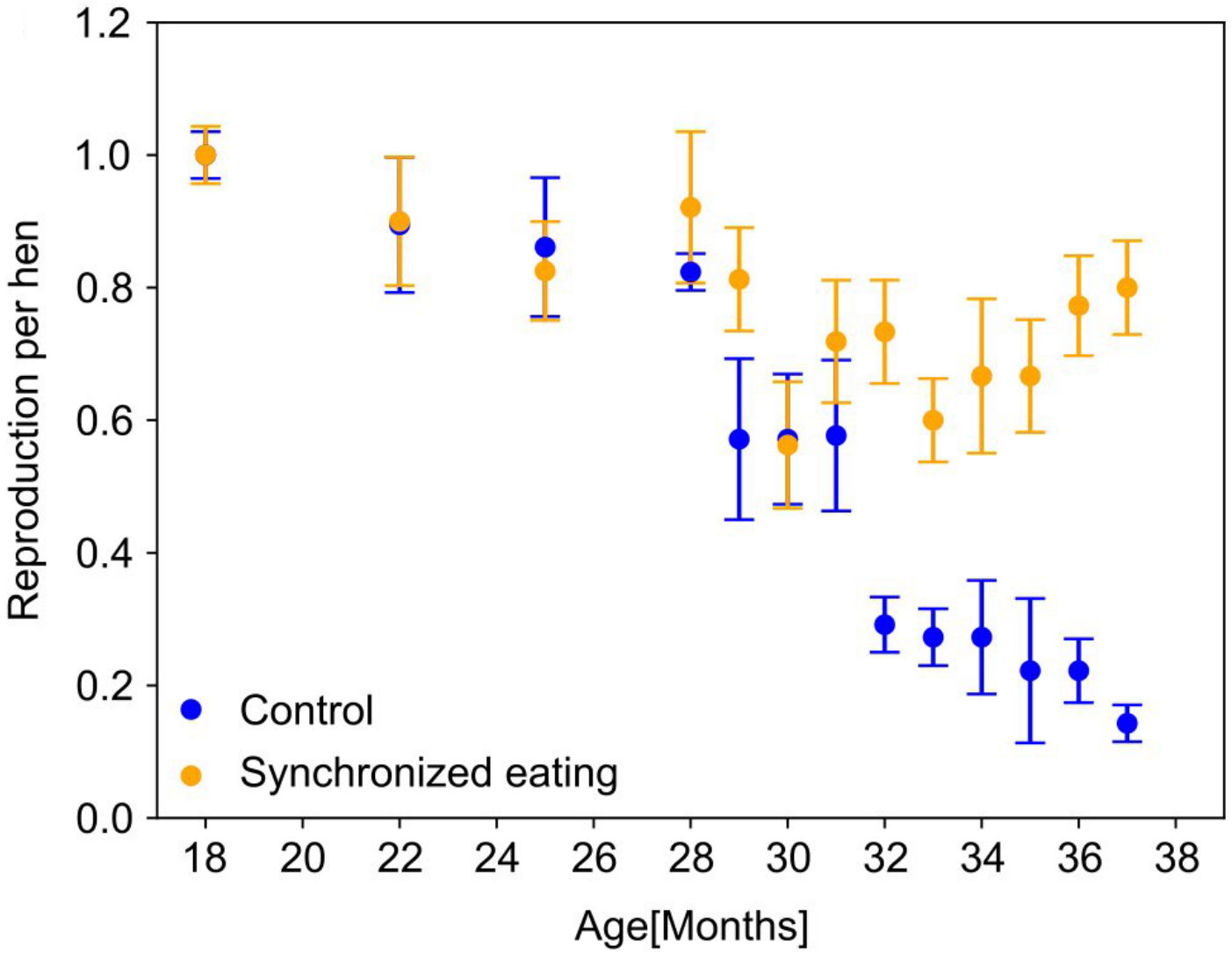

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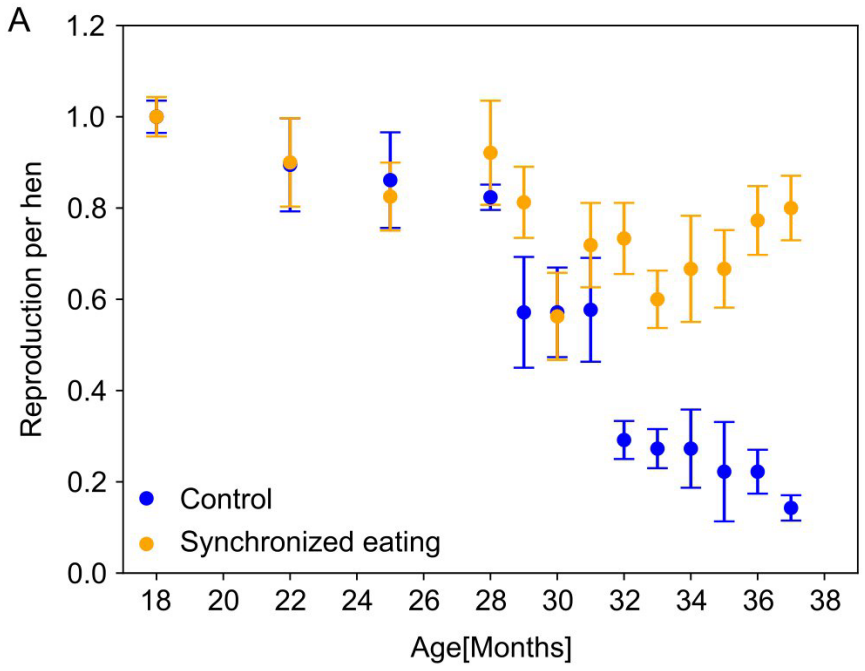

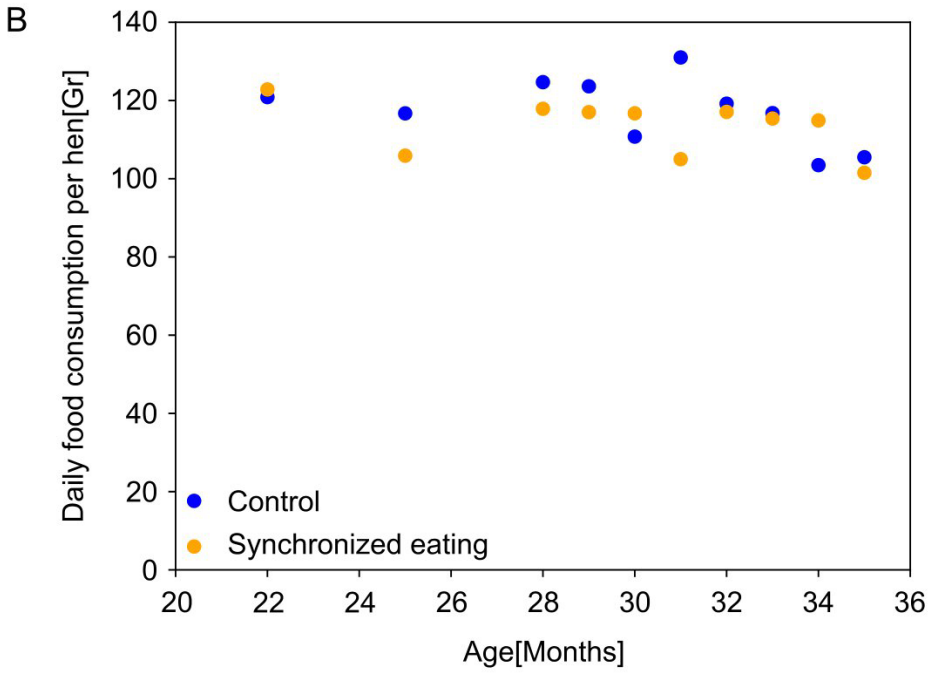

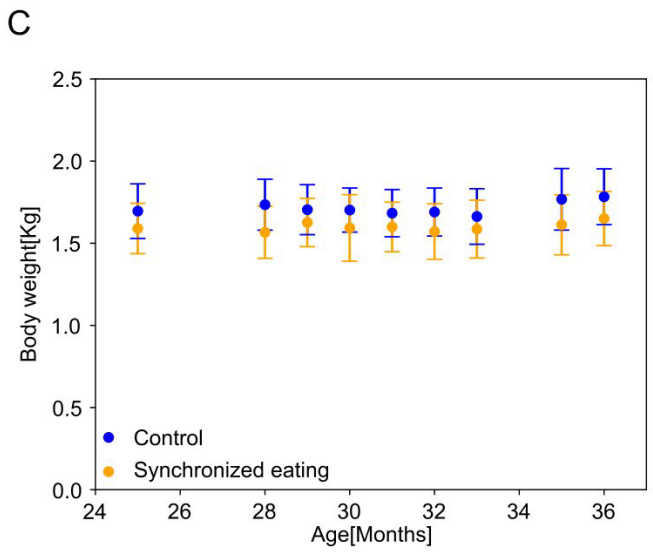

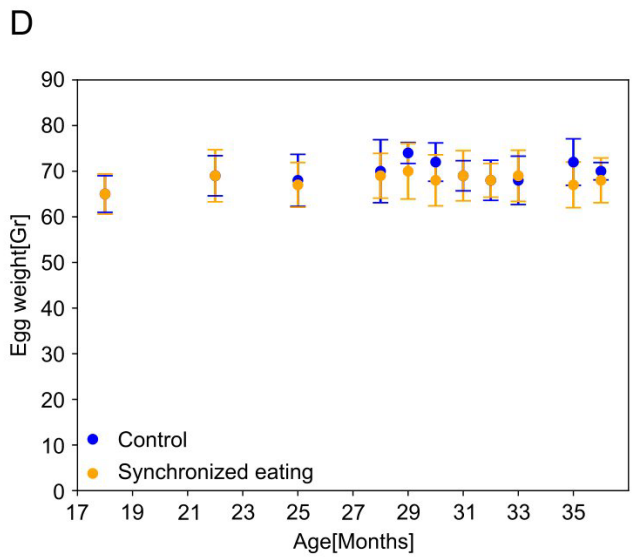

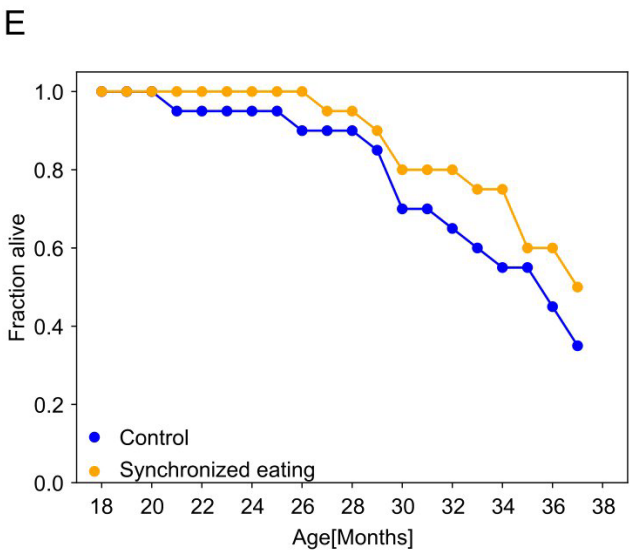

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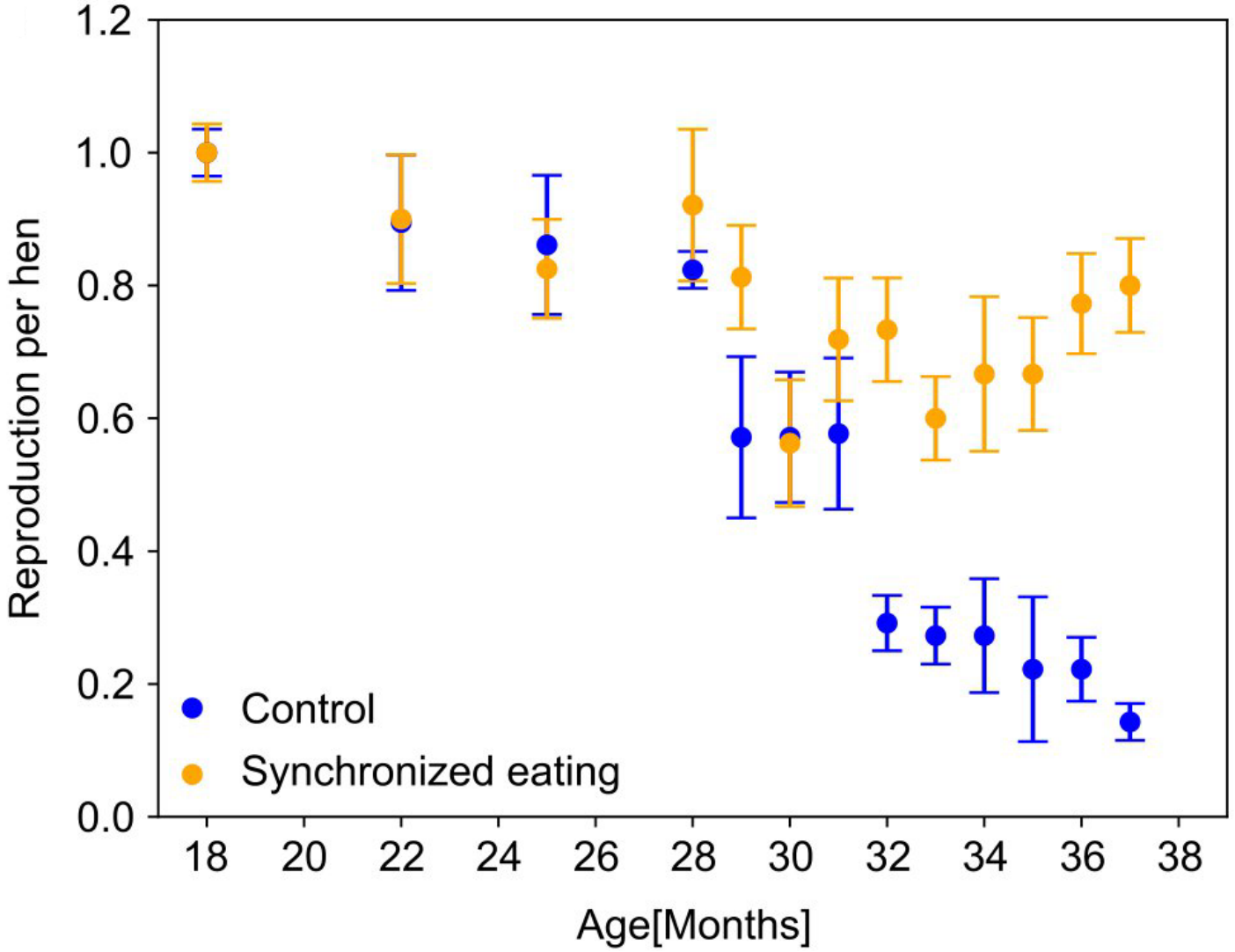
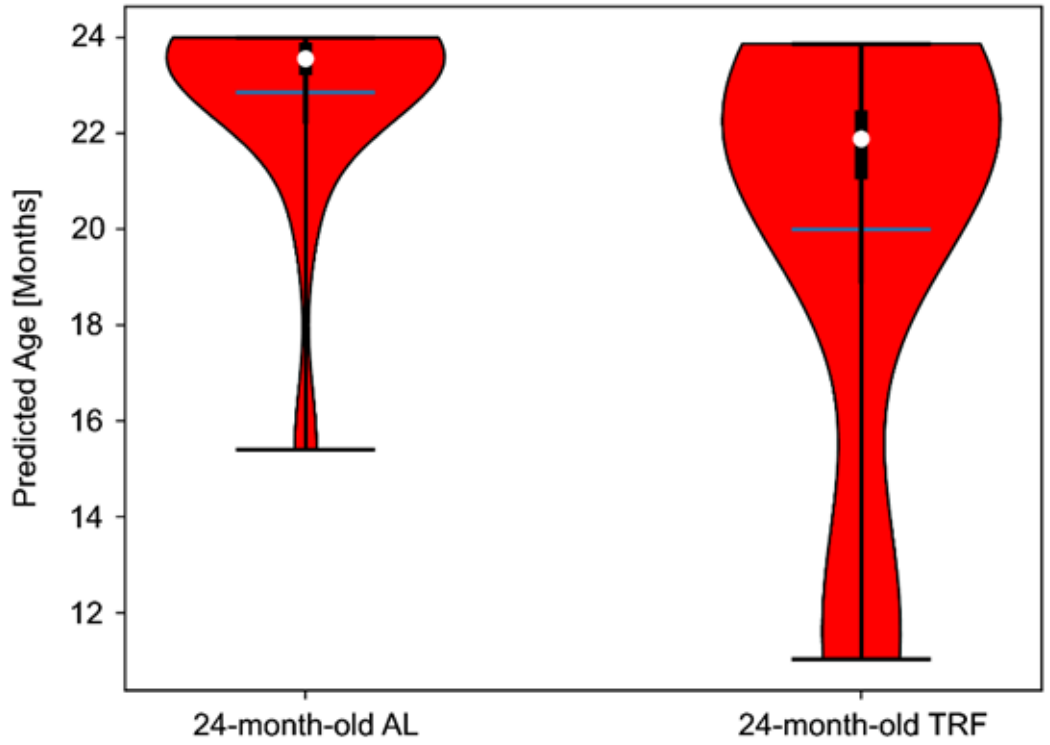


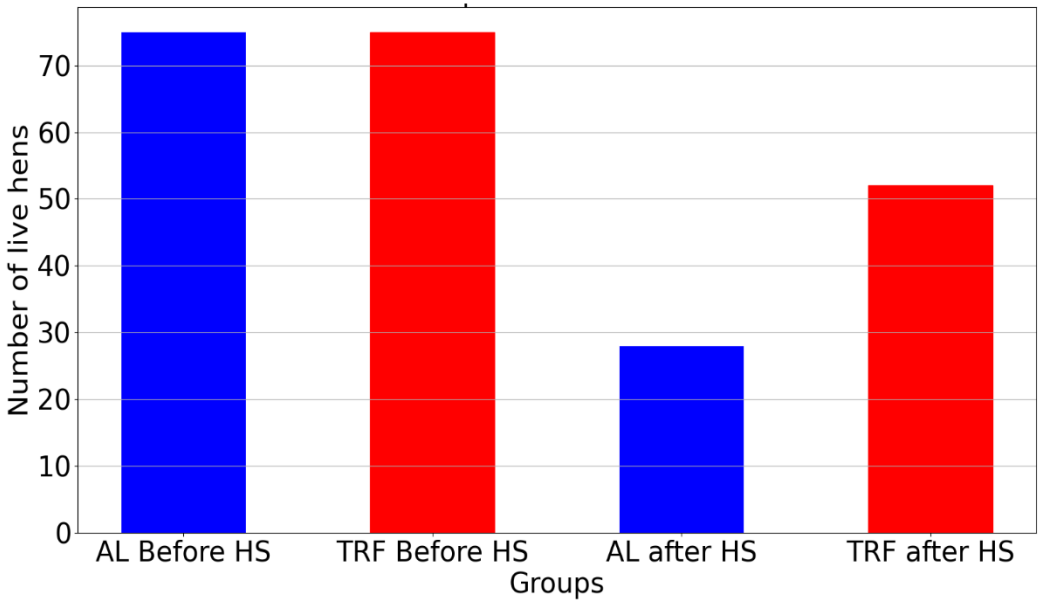
Validation: include TRF hens in the machine learning model



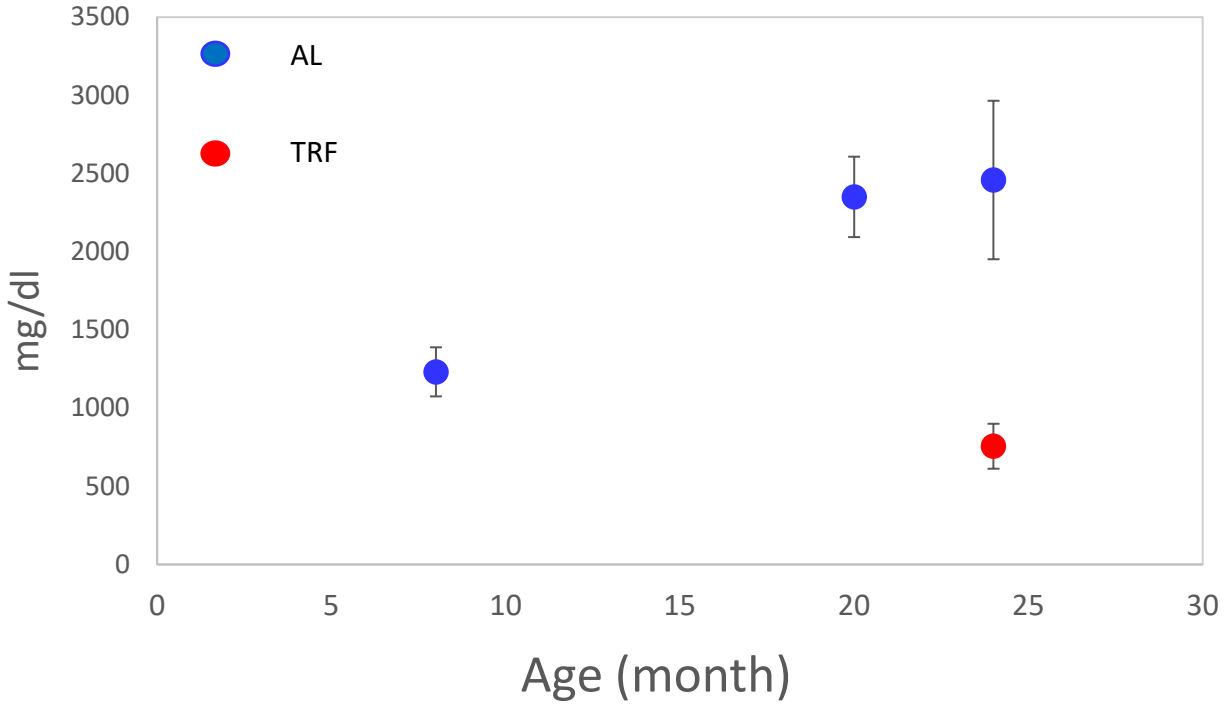
Validation: TRF animals appear younger than their chronological age (p = 0.005) (RF regressor)

TRF animals are physiologically younger

TRF improves resistance to heat stress



TRF reduces triglycerides levels



Additional blood chemistry and cytokines also support this conclusion (on going)