

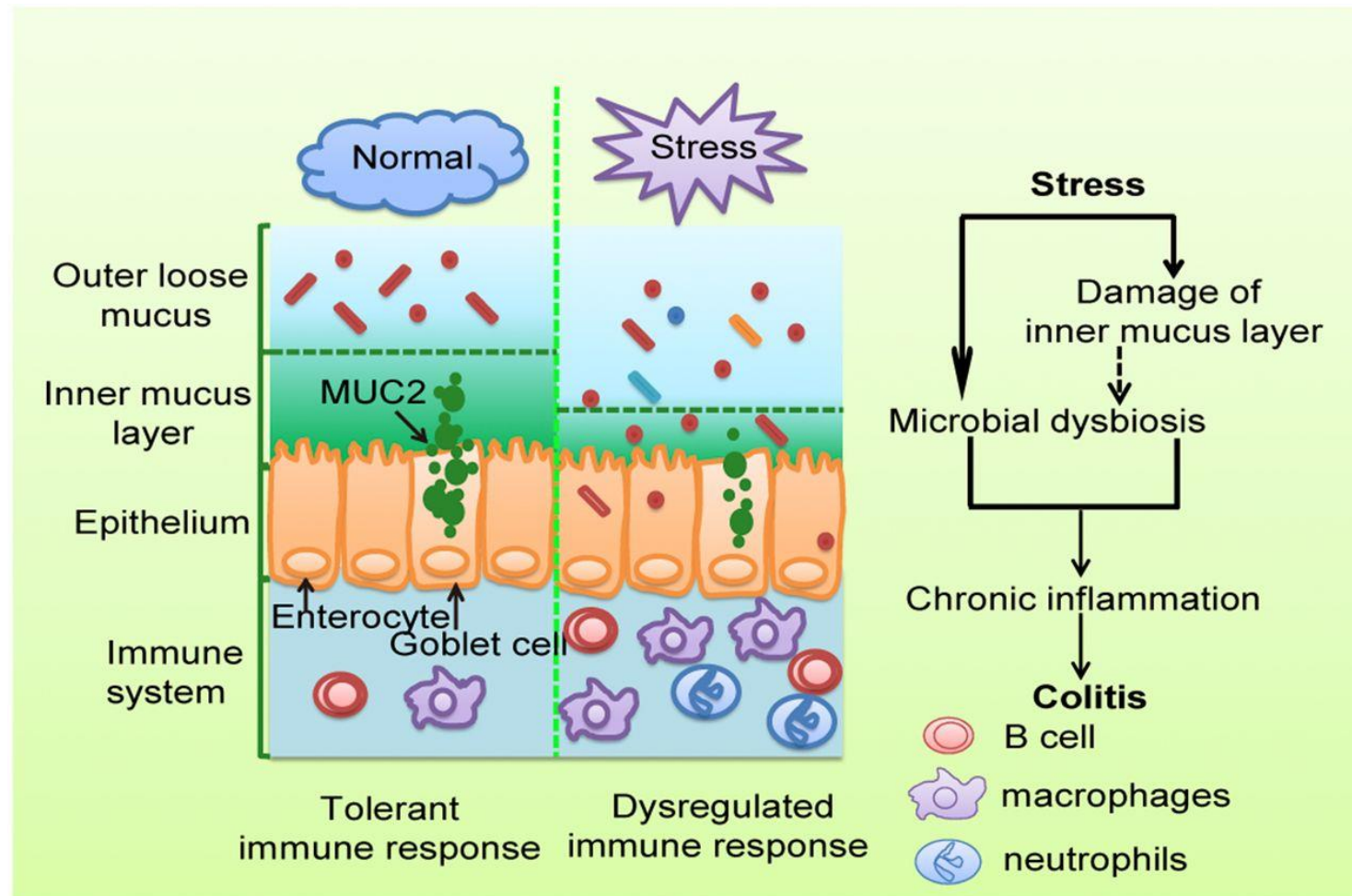
Effects of GOS delivered *in ovo* on performance and microbiota in chickens under heat stress

Anna Slawinska



*UTP University of Science and Technology, Faculty of Animal Breeding and Biology
Università degli Studi del Molise, Campobasso, Italy*

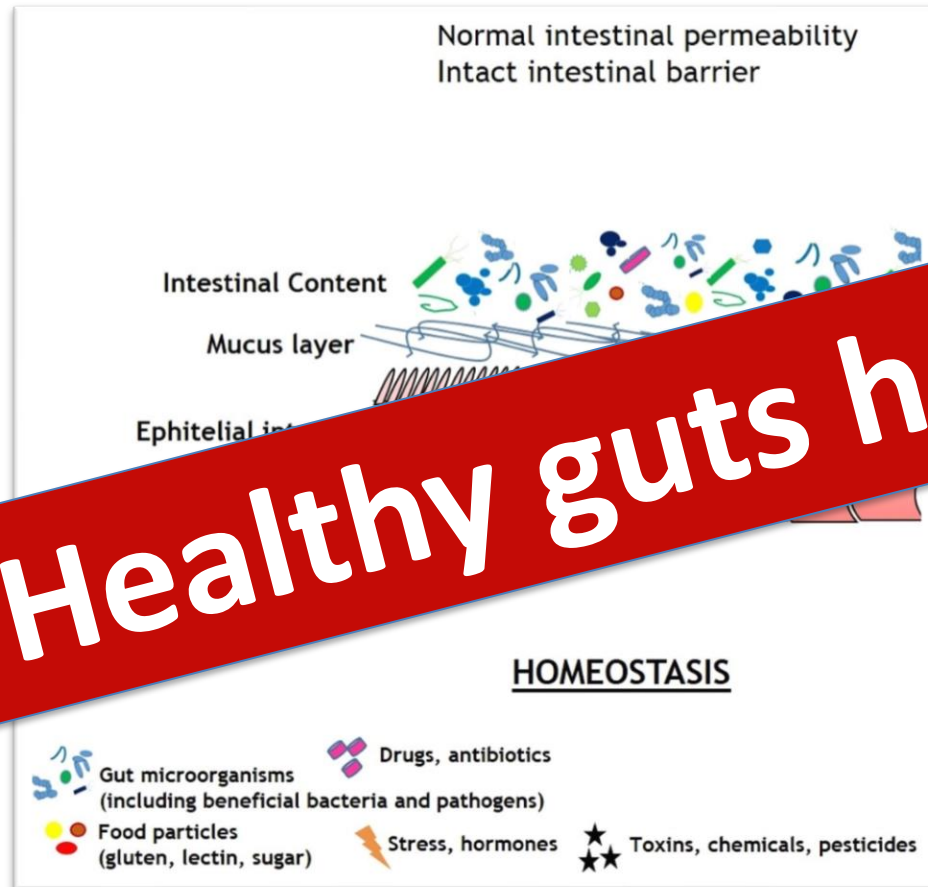
Heat stress disrupts the gut barrier function



Healthy gut vs. leaky gut



Healthy gut



Leaky gut

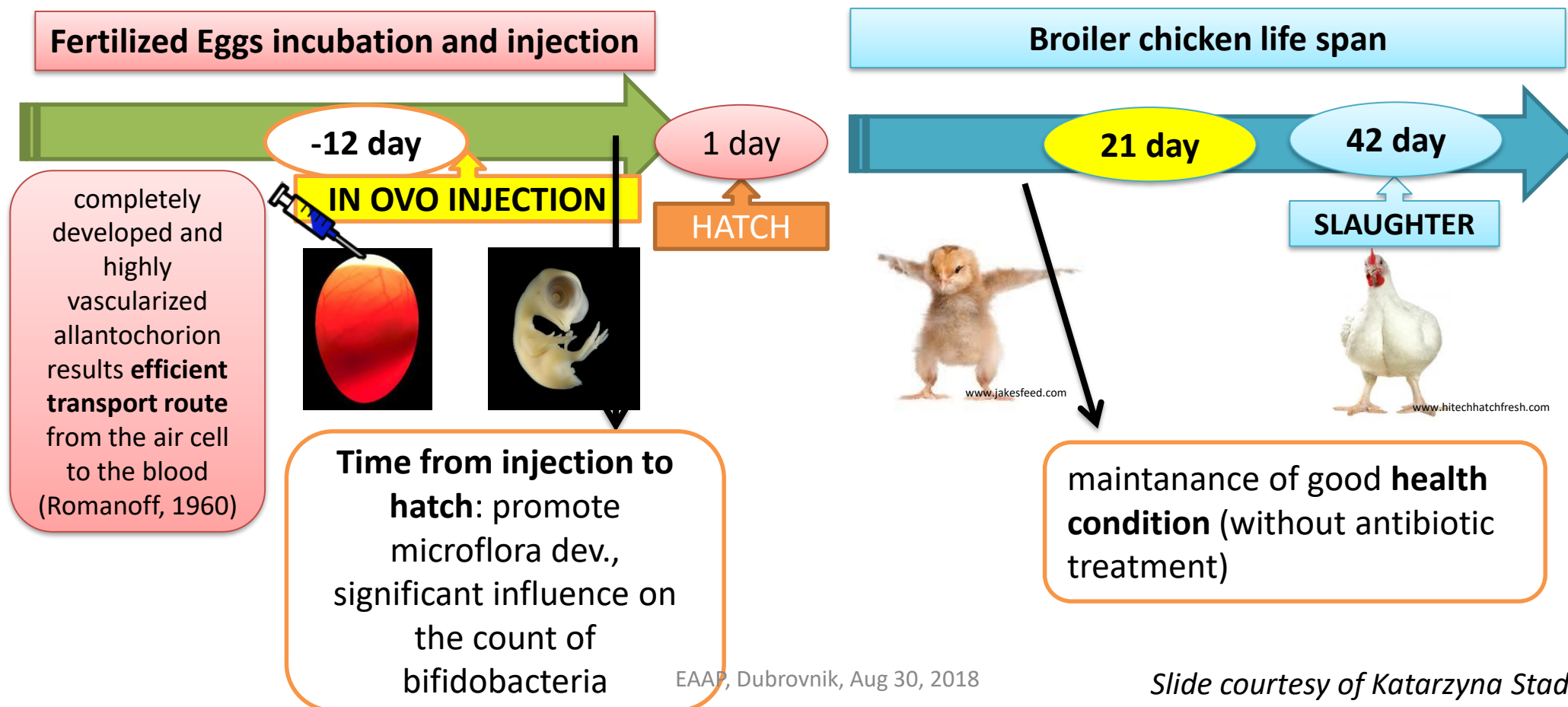


Healthy guts help to handle stress

In ovo method to improve gut health in chickens



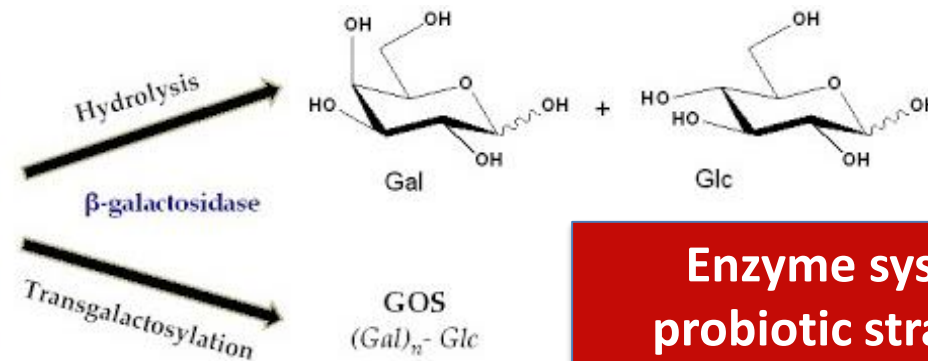
To ensure the best protection for the newly hatched individual, the external supplementation should be given as early as possible



Galactooligosaccharides (GOS)



Milk lactose



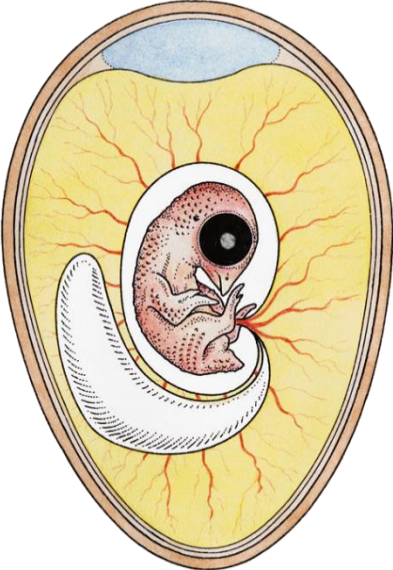
Enzyme system derived from probiotic strain *Bifidobacterium bifidum* NCIMB 41171 is highly selected towards beneficial bacteria (*Clasado Biosciences Ltd.*)

- Evidence exists (from *in vitro* and intervention studies in humans) that B-GOS has strong pro-health properties
- Used it in animal trials to increase immunocompetence in broiler chickens
- 30+ NCBI publications

GOS delivered *in ovo* improves gut health



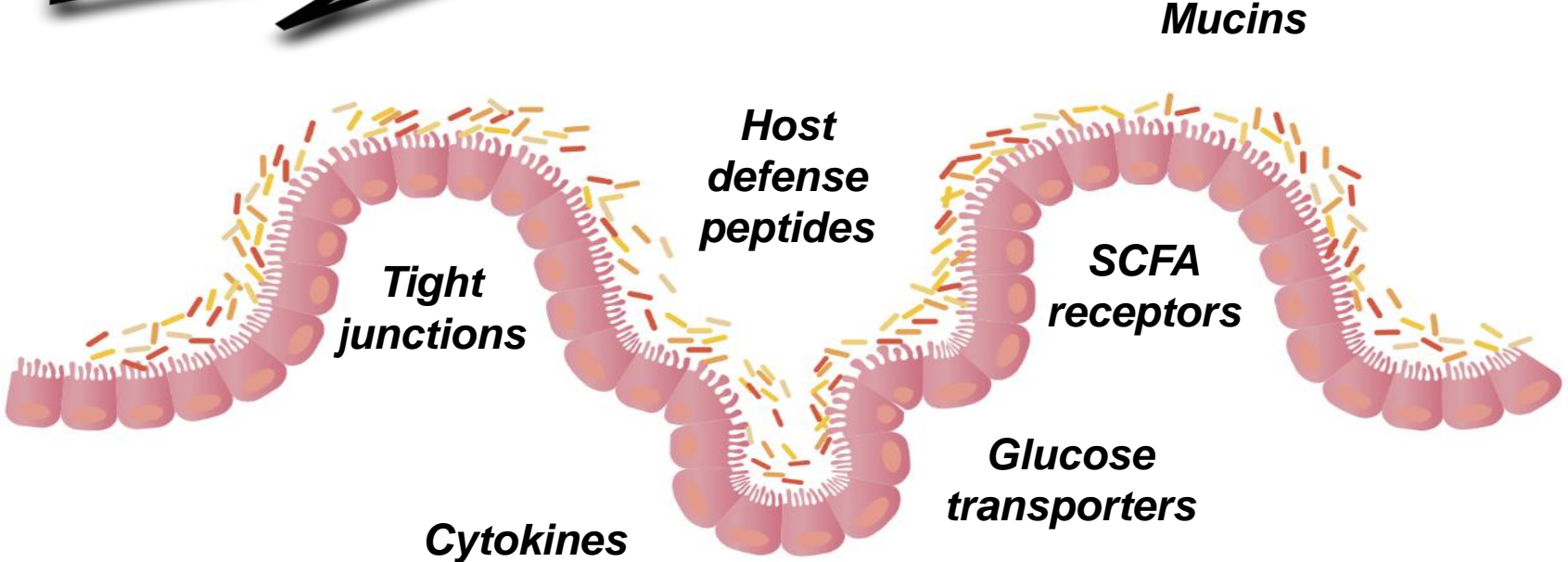
GOS prebiotic



In ovo
stimulation



Bifidobacteria



Motivation of the study

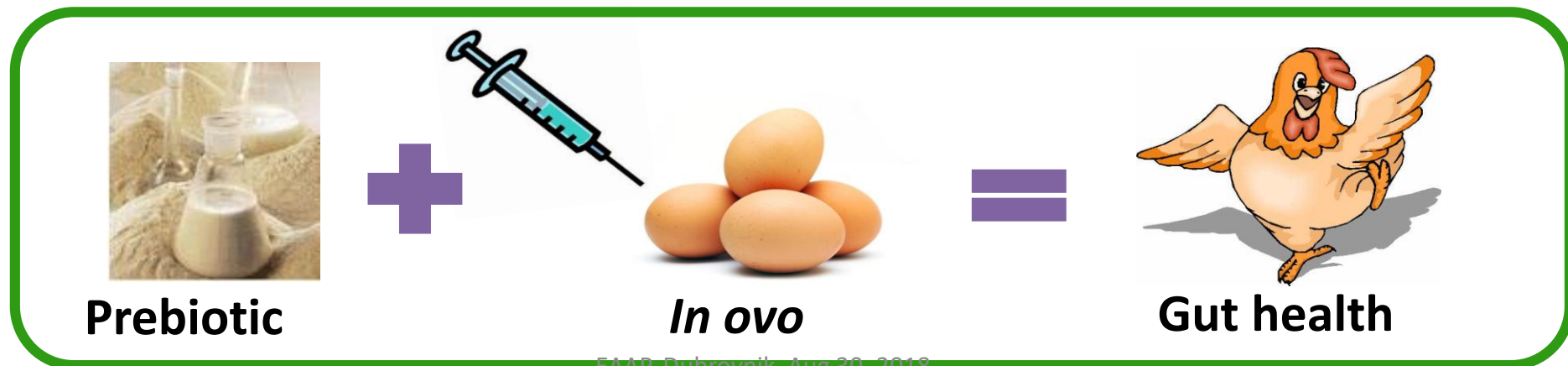


Heat stress effect

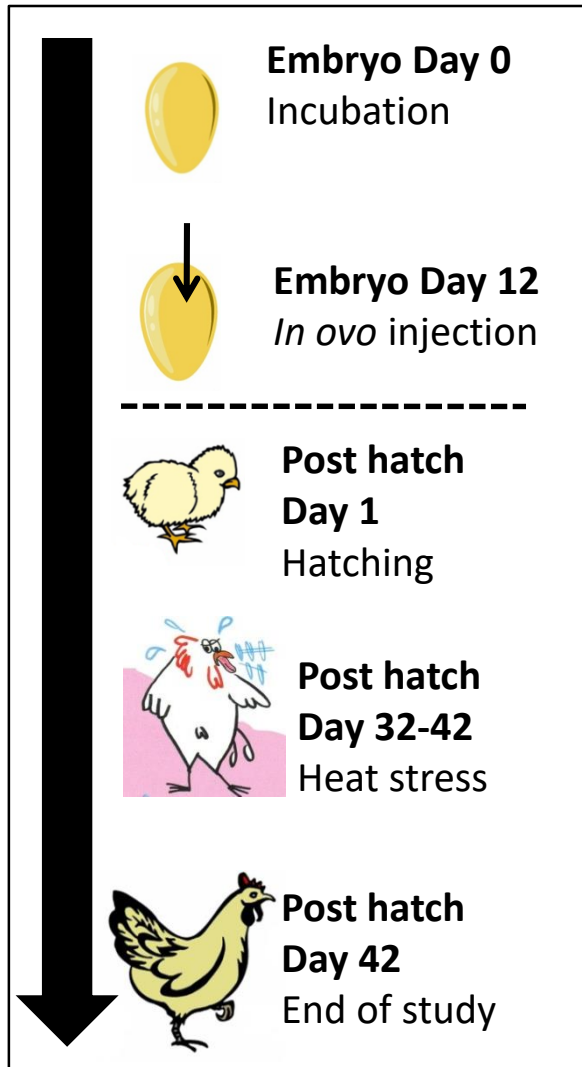
- Gut dysbiosis
- „Leaky guts”
- Heat-induced endotoxemia & systemic inflammation


How to mitigate?

- To improve intestinal microflora composition
- To enhance guts integrity
- To modulate immune responses and increase oral tolerance



Experimental design



 **Ross308 Broiler**
1000 eggs/group

GOS prebiotic
vs. uninjected/mock-injected eggs

Each group
6 pens x 25 ♂ per pen = 150 ♂

Heat stress
30°C
constant

Time (hours)

Sampling

Downstream analyses:

1. Body temperature
2. Performance traits:
 - Body weight
 - Feed intake
 - Mortality
3. Microbiota composition

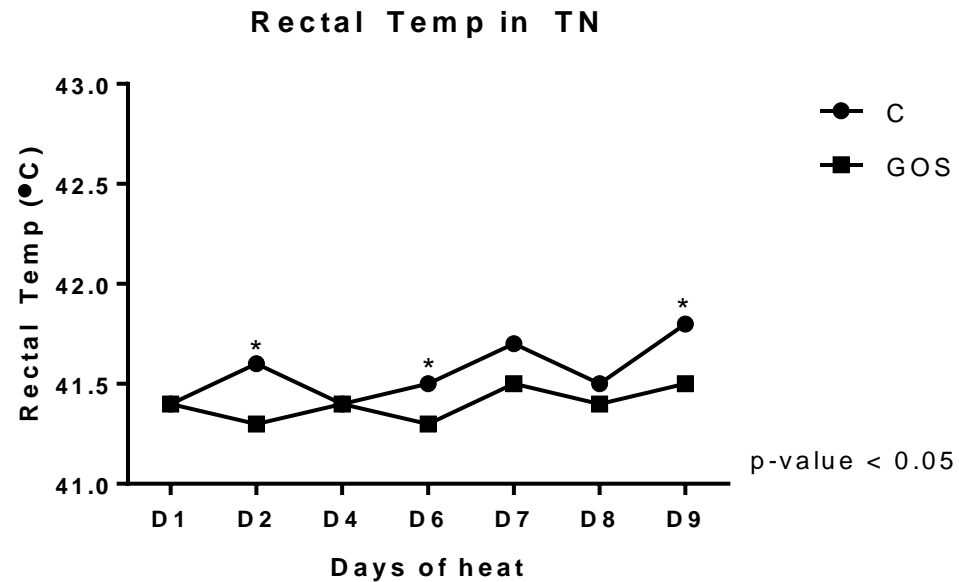


CHRONIC HEAT STRESS (10 DAYS)

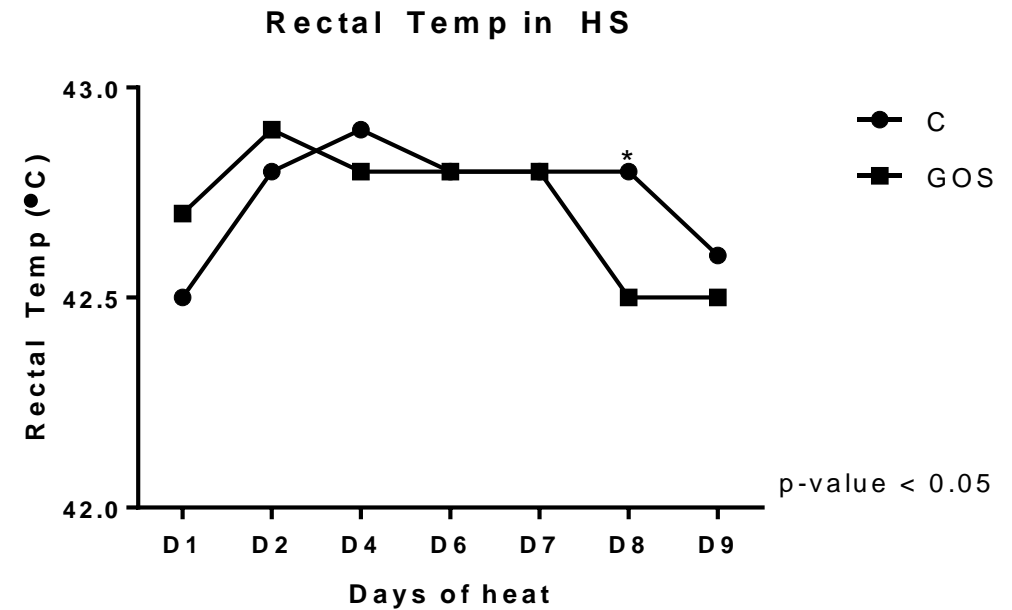
Body temperature in response to heat



A.



B.



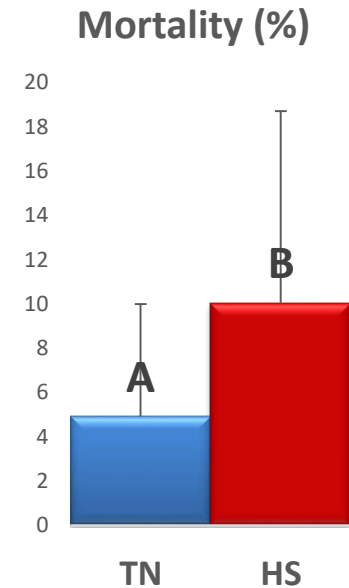
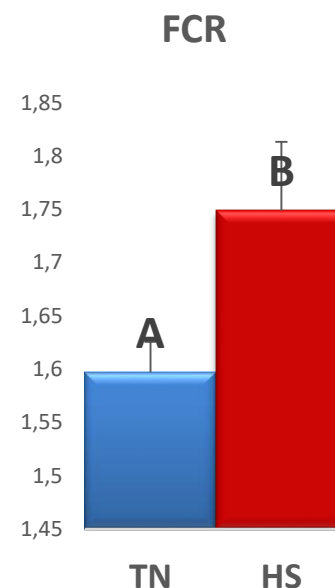
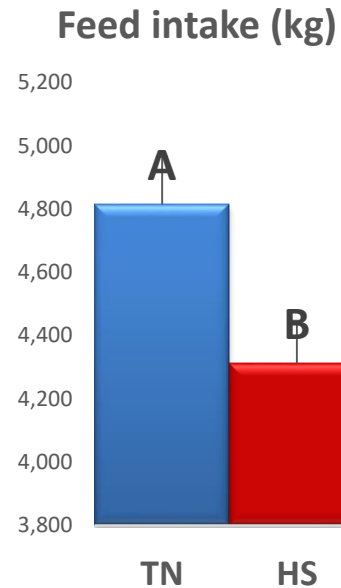
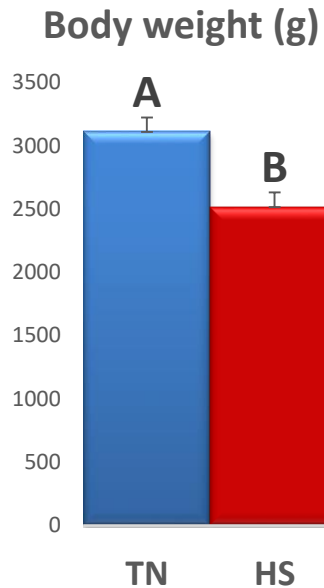
Thermoneutral vs. Heat stress



Starter

Grower

Finisher



10 days of cyclic heat stress caused serious deterioration in performance parameters of broiler chickens

TN + GOS vs. HS + GOS

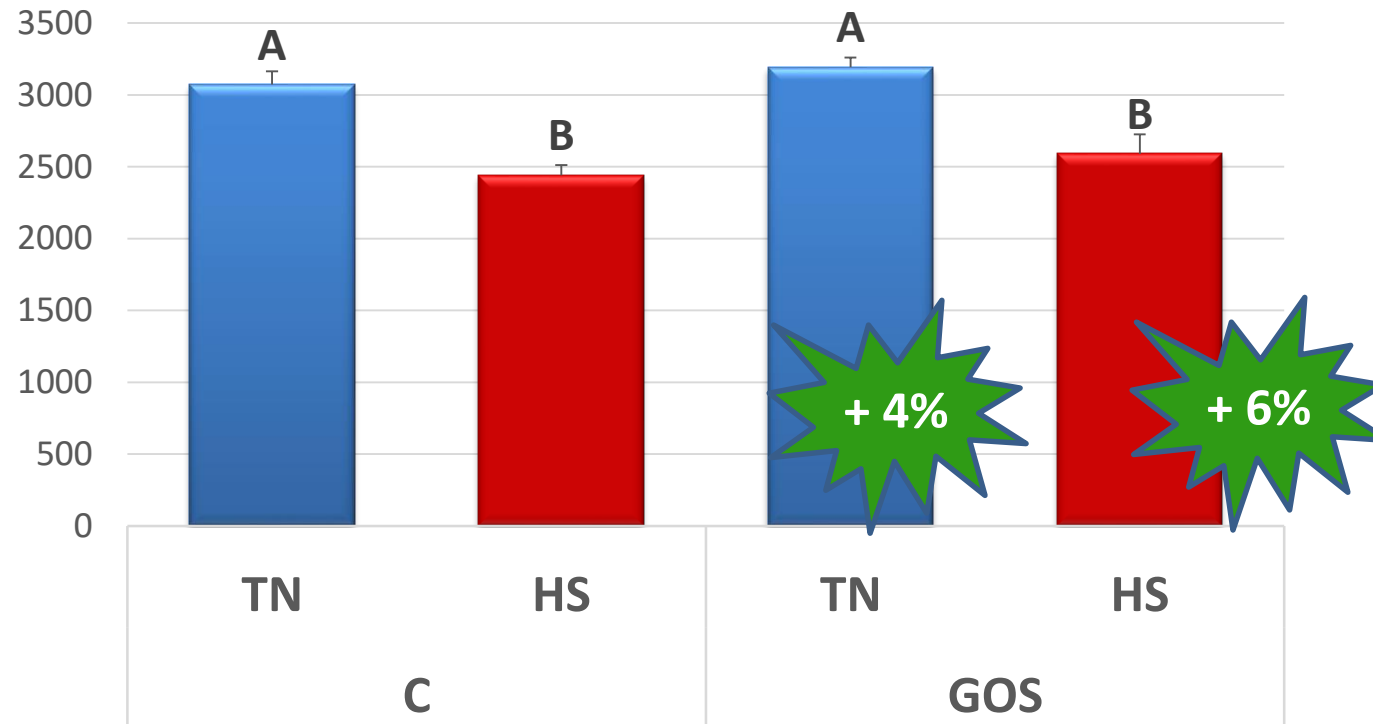


Starter

Grower

Finisher

Body weight (g)



ANOVA

Temperature ($P < 0.001$)

Treatment *in ovo* ($P = 0.0078$)

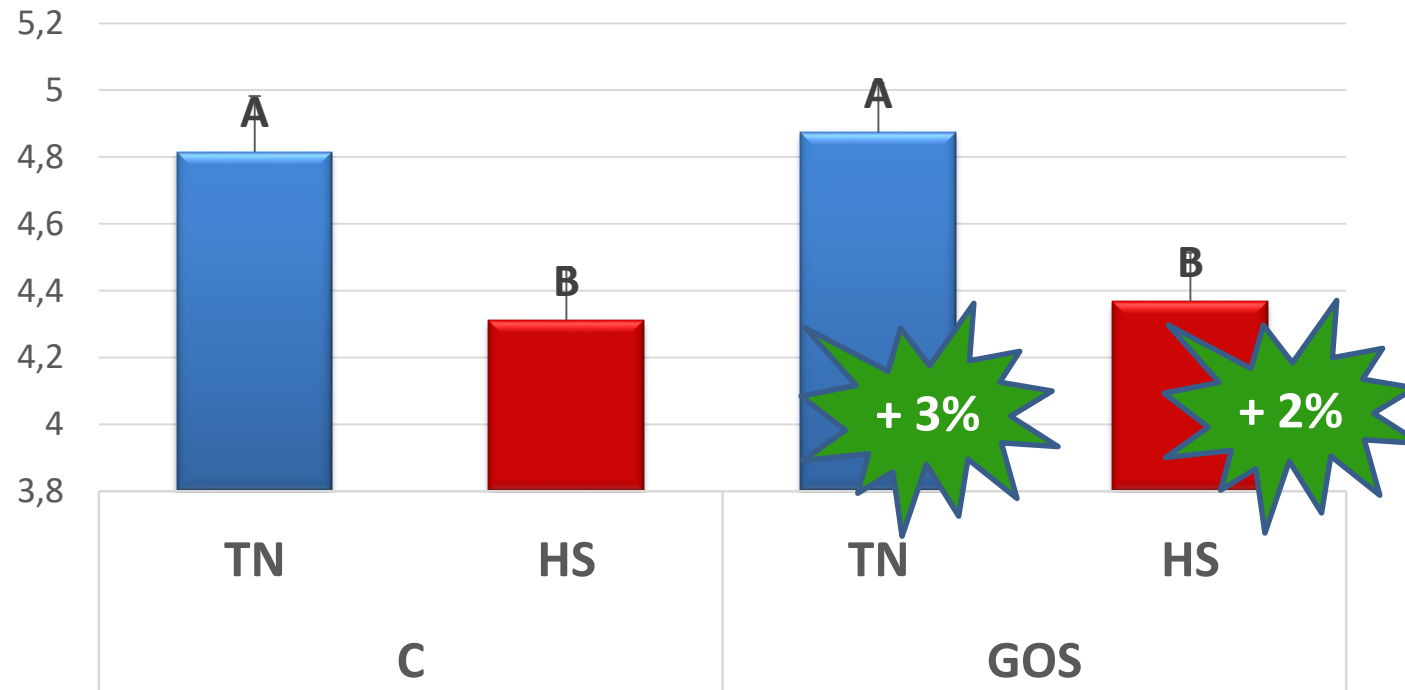
Temperature x Treatment *in ovo* (ns)

Tukey post hoc a, b ($P < 0.05$) A, B ($P < 0.001$)

TN + GOS vs. HS + GOS



Feed intake (kg)



ANOVA

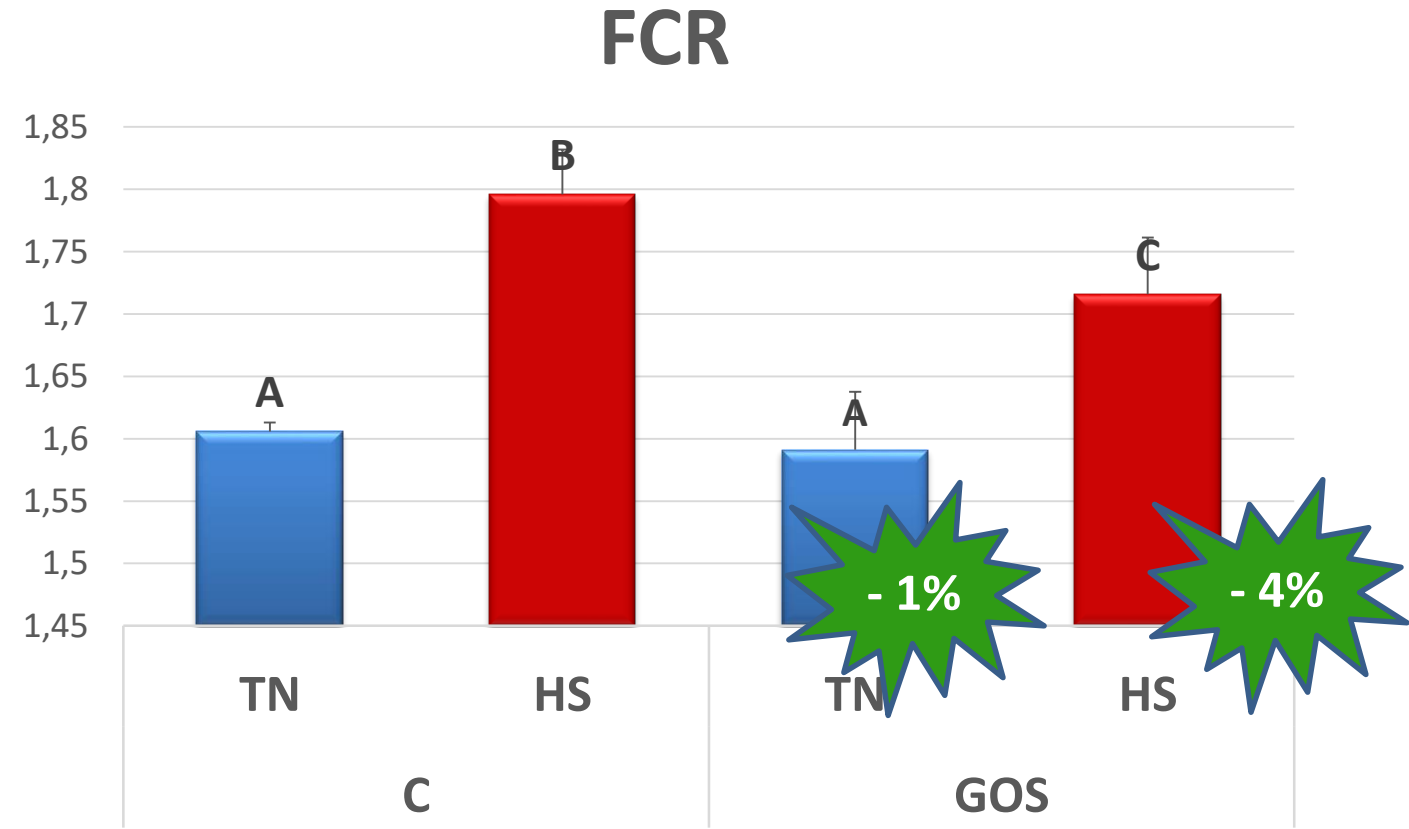
Temperature ($P < 0.001$)

Treatment *in ovo* ($P = 0.0078$)

Temperature x Treatment *in ovo* (ns)

Tukey post hoc a, b ($P < 0.05$) A, B ($P < 0.001$)

TN + GOS vs. HS + GOS

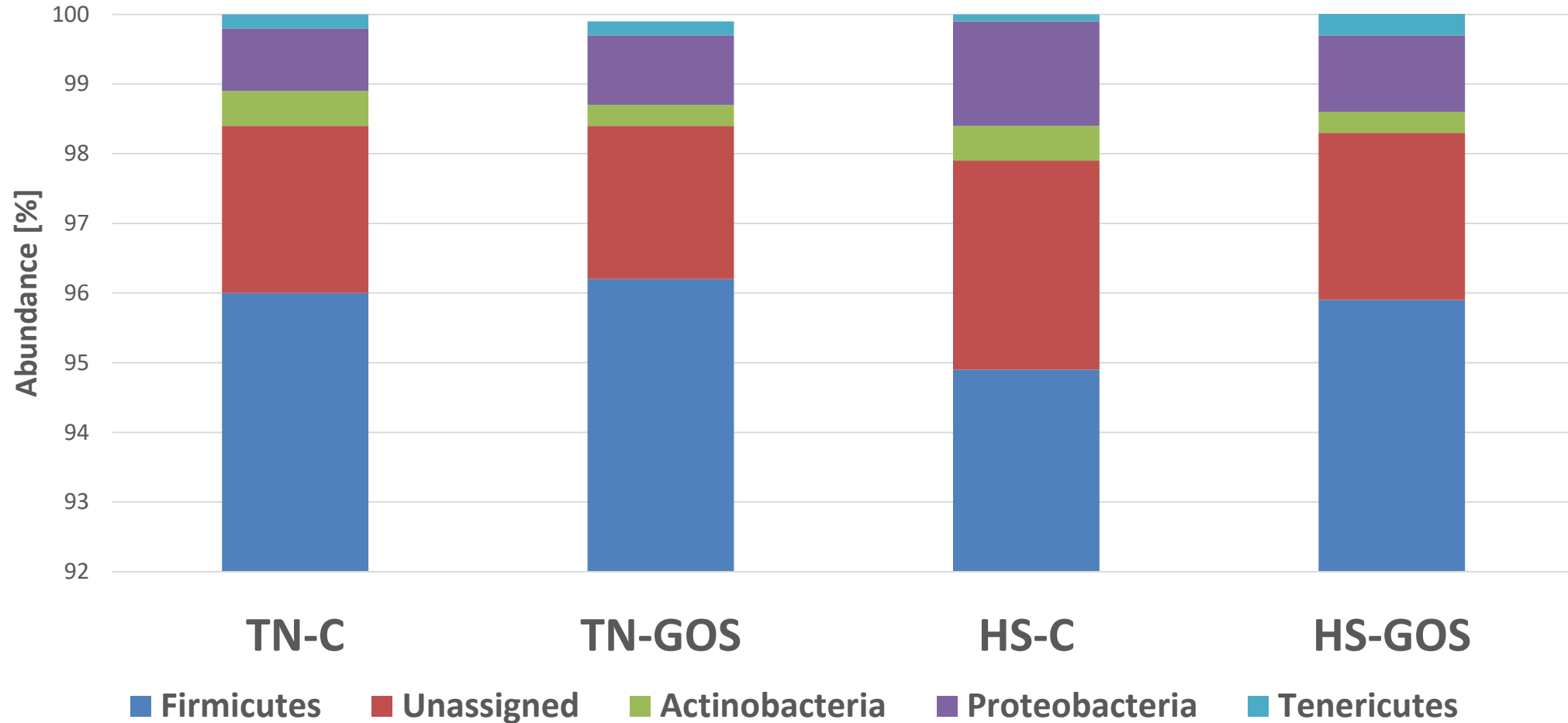


ANOVA
Temperature ($P < 0.001$)
Treatment *in ovo* ($P < 0.05$)
Temperature x Treatment *in ovo* ($P < 0.05$)
Tukey post hoc a, b ($P < 0.05$) A, B ($P < 0.001$)

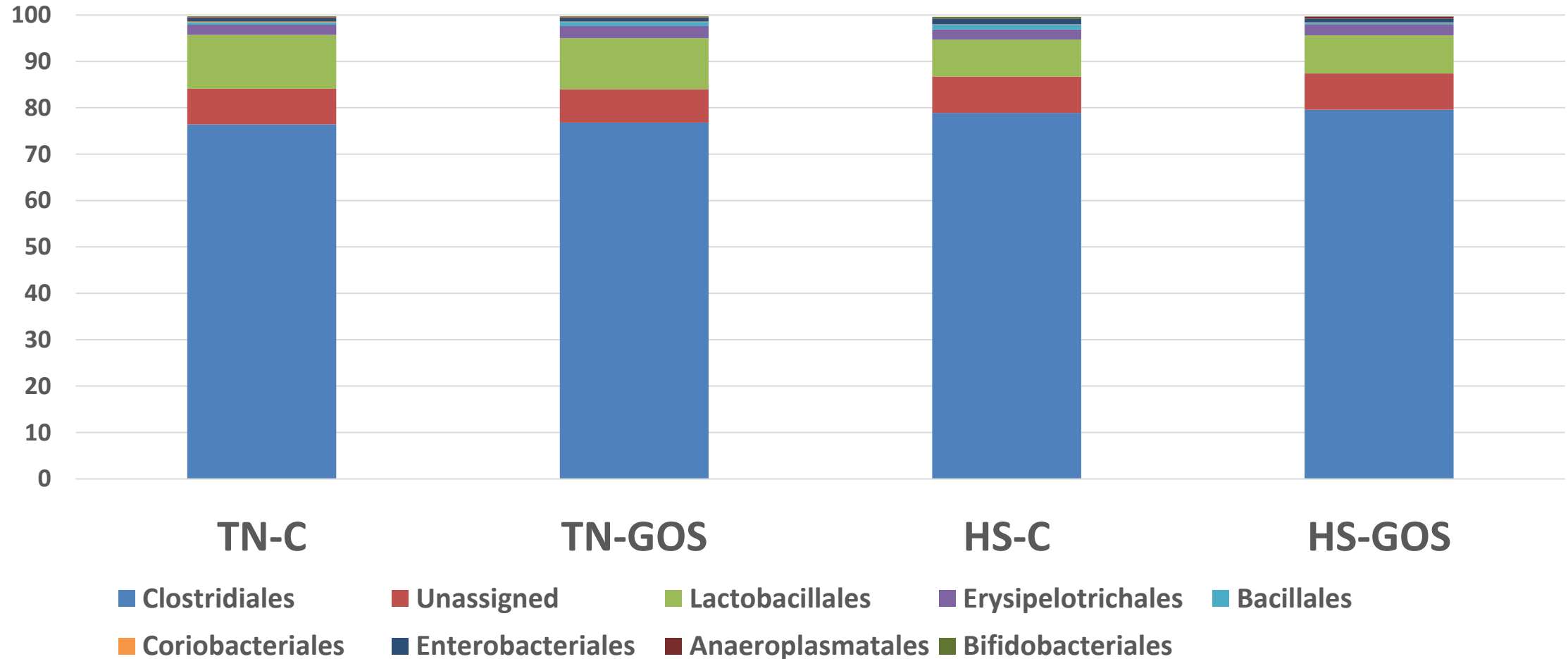


EFFECTS ON MICROBIOTA?

Microbiota: phyla level



Microbiota: order level



Microbiota: species level



- The most abundant species (in all groups):
 - *Faecalibacterium prausnitzii*
 - *Eubacterium hallii*
 - *Eubacterium desmolans*
- The differentiating species
 - *Blautia glucerasea* (0.1% in C-GOS vs. 0.8% in HS-GOS)

Novel strain, first isolated in dogs

***Blautia glucerasea* belongs to phylum Firmicutes, class Clostridia**

Can hydrolyze plant glucosylceramide to ceramide

Conclusions



1. Acute heat stress causes immune and oxidative stress, which were successfully mitigated by GOS
2. Heat stress decreased body weight, feed intake and increased FCR and mortality in broiler chickens on the day 42 ($P < 0.001$)
3. GOS delivered *in ovo* improved performance parameters
4. Microbiota on last day of trial was not significantly different between experimental groups
5. We suppose that the long-term effects are shaped during early microbiome programming and we observe only phenotypic (not microbial) differences in the adults

Acknowledgements



OVOBIOTIC TEAM:

University of Molise

Giuseppe Maiorano
Siria Tavaniello
Rossella Mucci



University of Bologna

Adele Meluzzi
Federico Sirri
Marco Zampiga
Paolo Bosi
Paolo Trevisi
Micol Bertocci
Gerardo Manfreda
Alessandra de Cesare



UTP University of Science and Technology

Maria Siwek
Aleksandra Dunislawska
Arkadiusz Plowiec



MINISTERO DELL'ISTRUZIONE,
DELL'UNIVERSITÀ E DELLA RICERCA

SIR Project RBSI14WZCL