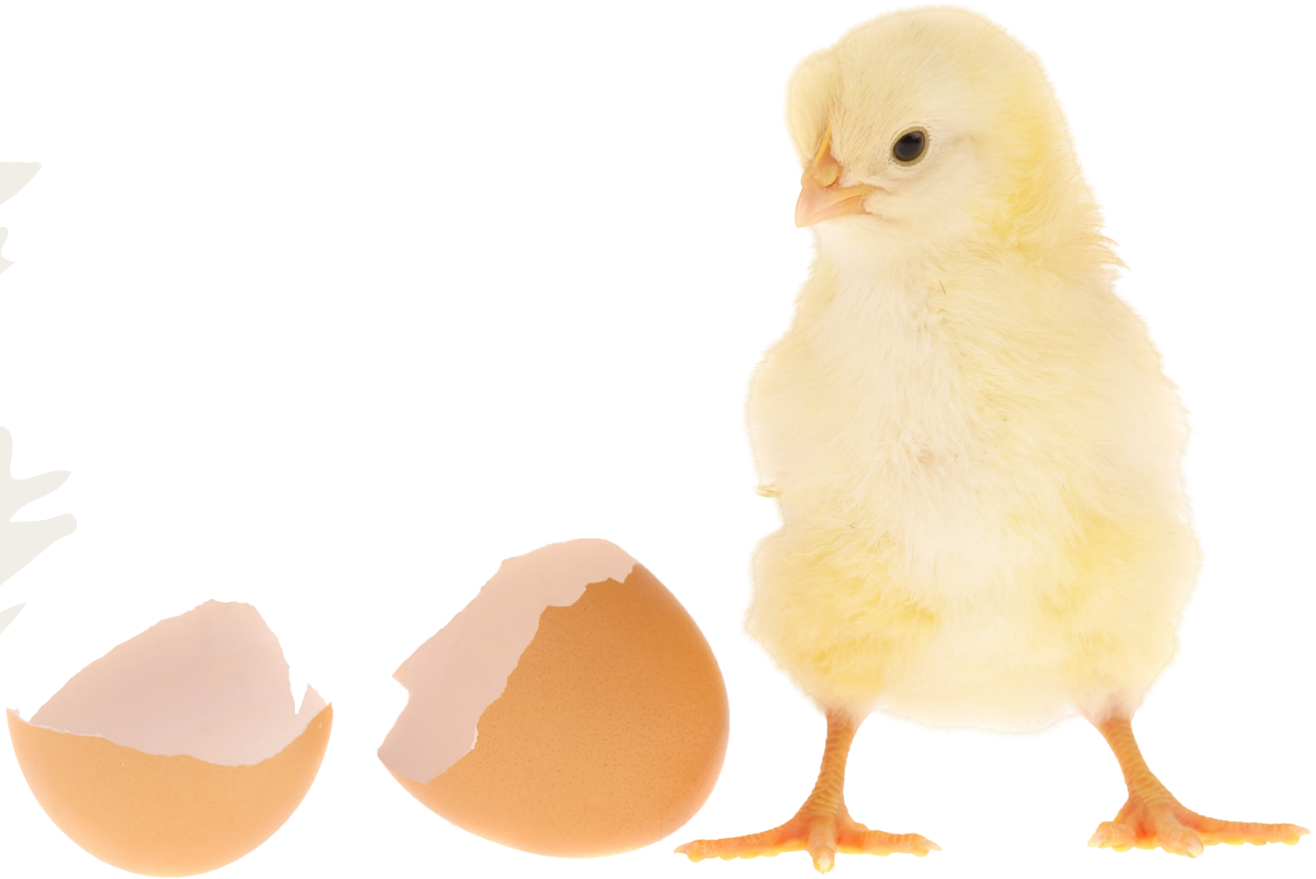
Effect of Creatine Monohydrate *in ovo* feeding (IOF) on progeny performance of young breeder flocks

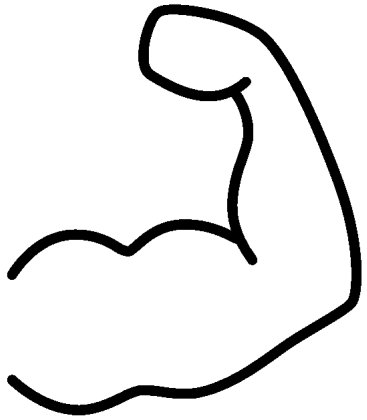
Corey-Ann B Firman*, **Vivienne Inhuber**, David J Cadogan, William H E J Van Wettere, Rebecca E A Forder

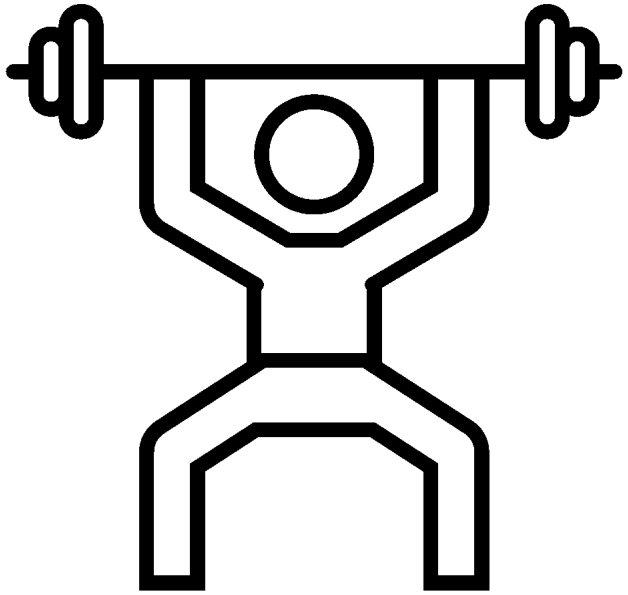
Lyon, EAAP Conference 2023
28 August 2023



* This presentation is part of a PhD project at the University of Adelaide.

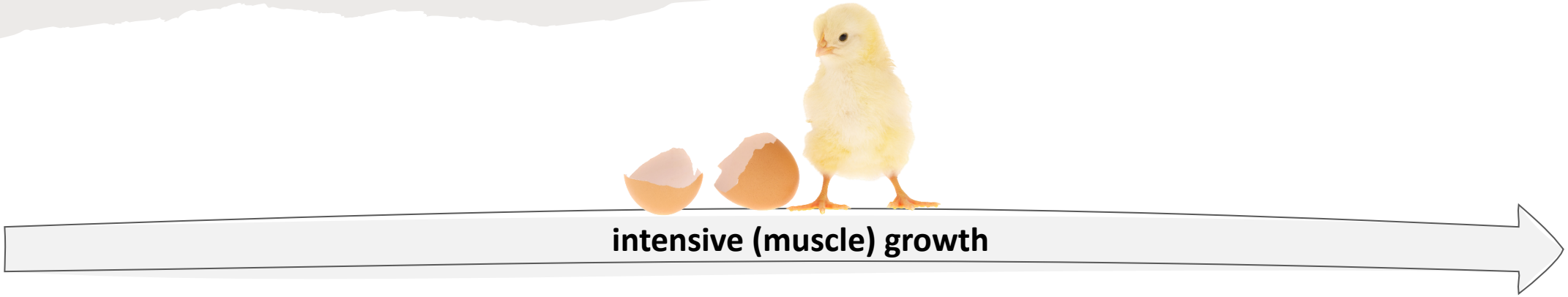
CREATINE …





… INTENSIVE MUSCLE GROWTH

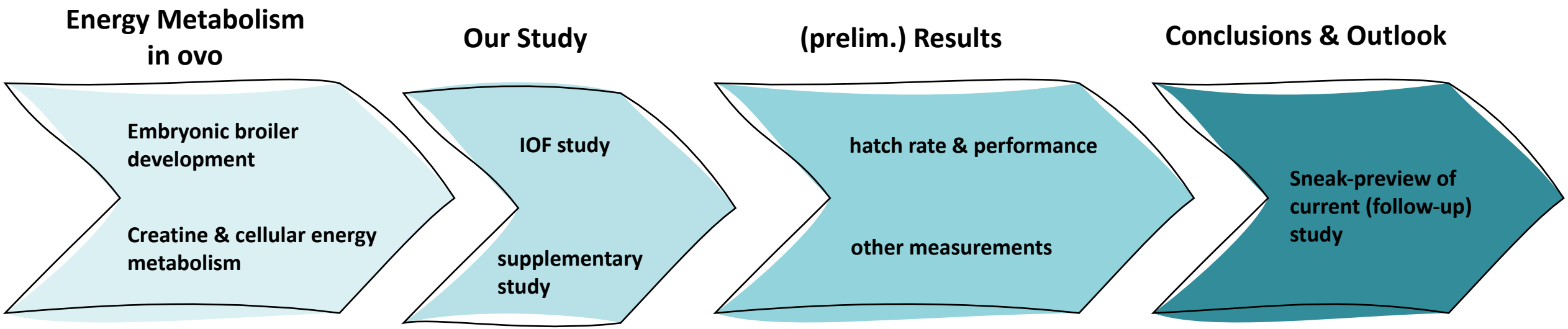
BROILER
PRE- and POST-HATCH DEVELOPMENT



IN-OVO-FEEDING OF CREATINE
FOR MORE VITAL HATCHLINGS AND BETTER POST-HATCH PERFORMANCE?

and Dayan *et al.*, 2023; Givisiez *et al.*, 2020

Today's agenda



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Energy Metabolism in ovo

- Embryonic broiler development
- Creatine & cellular energy metabolism

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- IOF study
- supplementary study

(prelim.) Results

- hatch rate & performance
- other measurements

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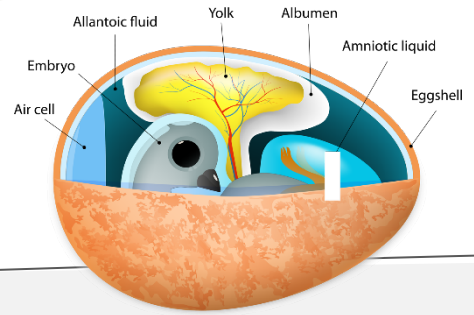
BROILER EMBRYONIC DEVELOPMENT

>33%

spent in ovo



requirements *in ovo*

heat, humidity, oxygen
nutrients & energy

resources *in ovo*

mostly water, lipids and proteins

performance-determining factors

hatch

post-hatch performance

Dayan *et al.*, 2023; Givisiez *et al.*, 2020

BROILER EMBRYONIC DEVELOPMENT

Energy Metabolism

first week

small **glucose** stores help to maintain metabolism

(Moran, 2007)

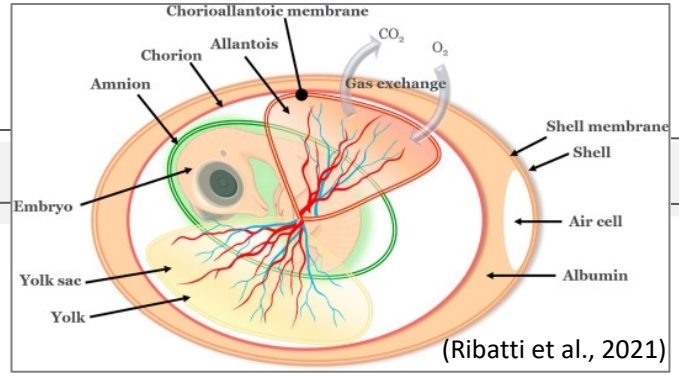
embryonic d17

(Omede et al., 2017)

- significant changes in the metabolism
- ingestion of amniotic fluid **substrates** become available to deposition as **glycogen** stores

(Uni and Ferket, 2003)

embryonic development



(Ribatti et al., 2021)

- metabolism needs **anaerobic catabolism of glucose**
- dependency on glycogen stores and gluconeogenesis pathway

(Uni and Ferket, 2004)

depletion of glycogen levels towards hatch

second week

extraembryonic membranes are formed and **lipids** serve as main energy source

(De Oliveira et al., 2008)

embryonic d19

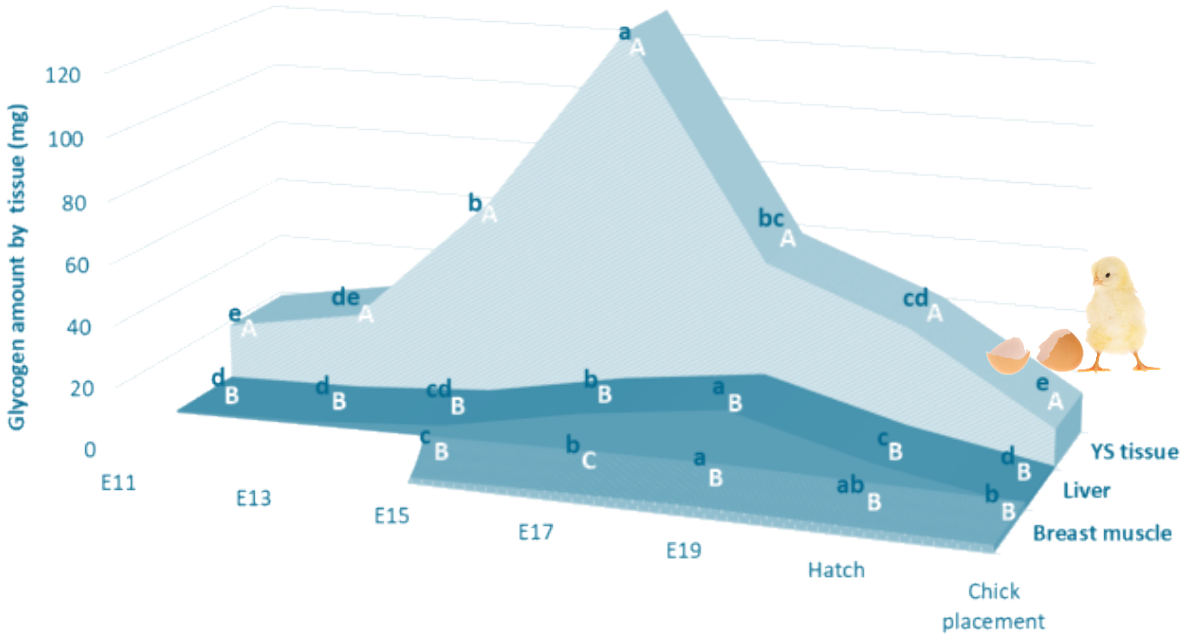
- rupture of chorioallantoic membrane (gas exchange) → decrease of O_2 availability
- fatty acid utilization becomes ineffective and does not meet the energy requirements anymore

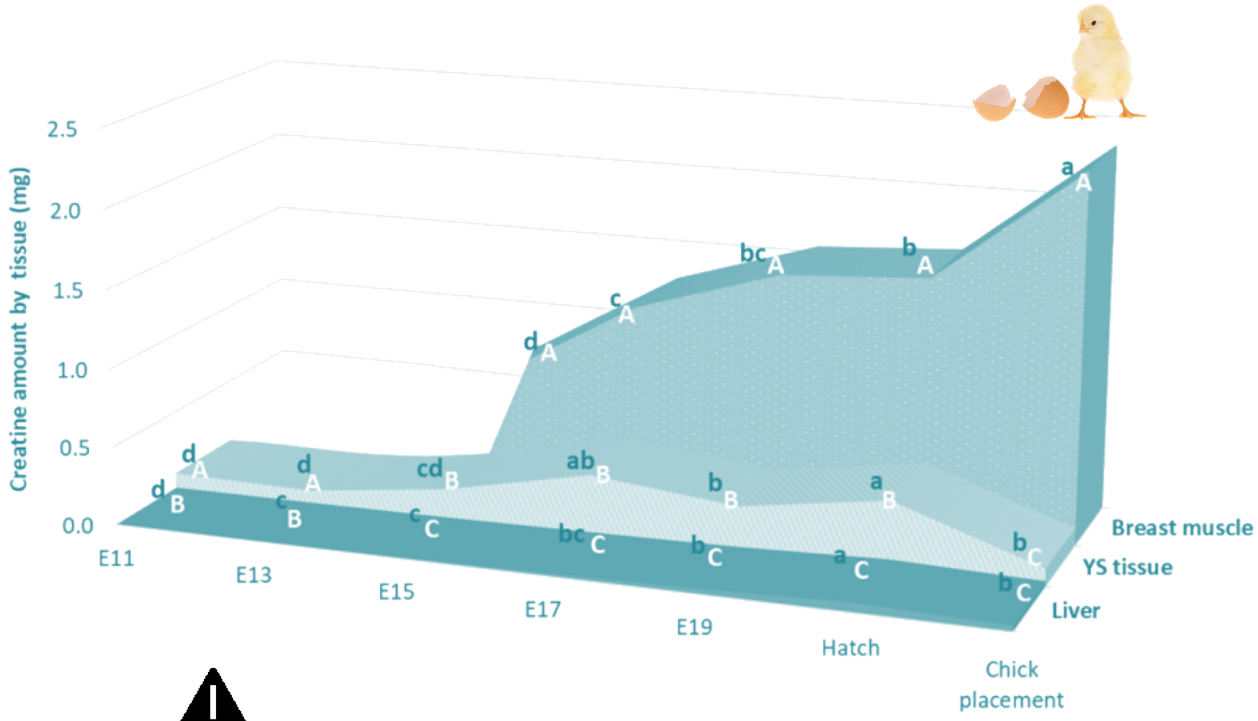
(Moran, 2007)

and Dayan *et al.*, 2023; Givisiez *et al.*, 2020

ENERGY RESOURCES AT HATCH

GLYCOGEN is stored mainly in the yolk sac tissue.
The sharp **decrease** in glycogen levels **at hatch** and chick placement implies energy limitation in hatchlings.





CREATINE is stored mainly in the breast muscle.
At chick placement, the high **creatine** levels in the breast muscle **serve as THE available energy source**.

Dayan *et al.*, Front. Physiol., 2023

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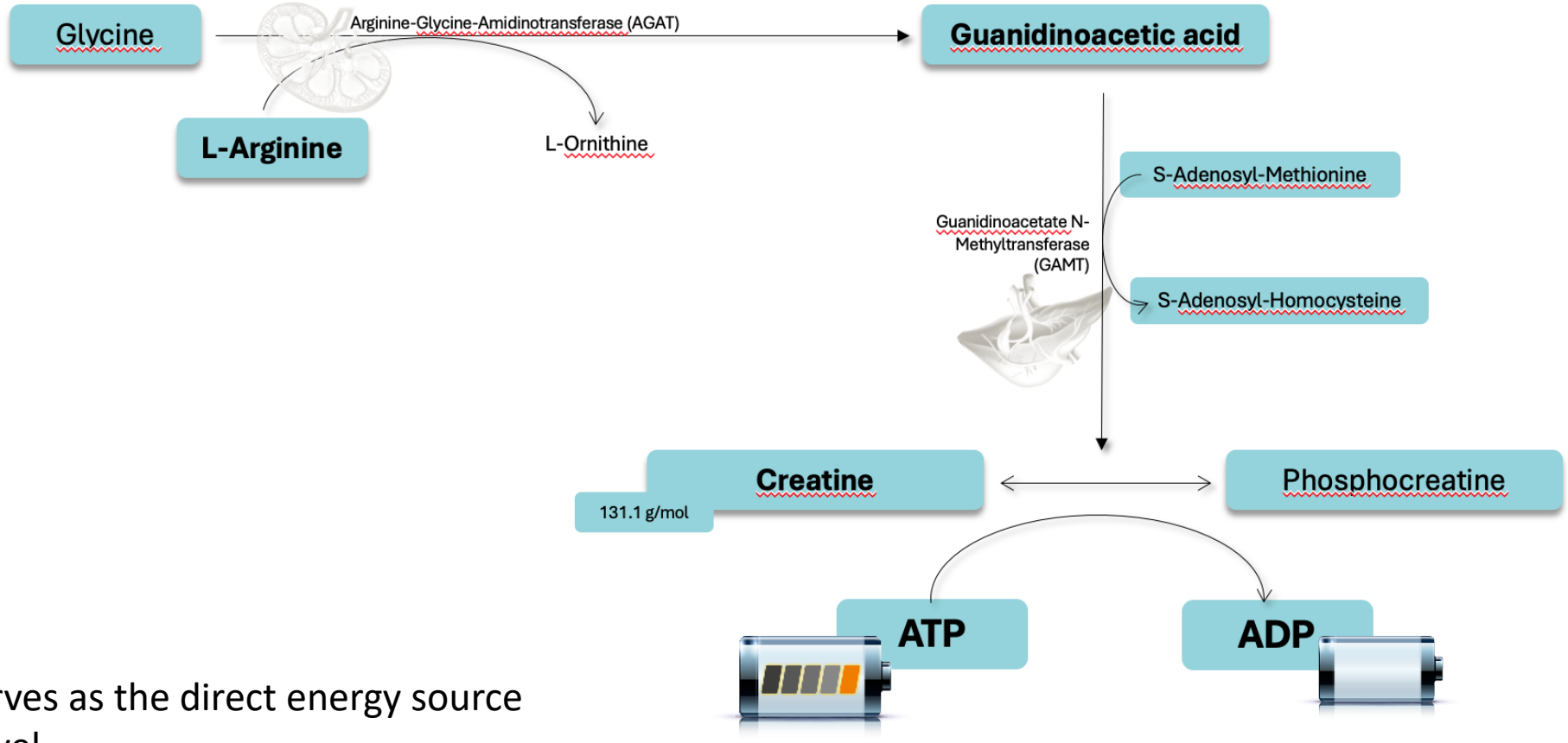
CREATINE

rapidly available energy, mainly stored in muscle tissue



CREATINE serves as the direct energy source on cellular level.
In its active form phosphocreatine (PCr) it replenishes ATP from ADP.

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STUDY DESIGN

IN-OVO-FEEDING OF CREATINE
FOR MORE VITAL HATCHLINGS AND BETTER POST-HATCH PERFORMANCE?

400 fertile eggs
obtained from 28-week-old Ross breeder hens

young breeder hens,
producing smaller egg yolks than
older breeder hens
→ **less nutrients for their progeny!**

treatment at embryonic d14
1) CON: no IOF treatment
2) IOF-CON: injection of 0.75% saline solution
3) IOF-CrM: 8.16 mg CrM in 0.75% saline solution

at hatch
24 birds/treatment

grow-out until d42
32 birds/treatment

dissection
(e.g., liver, heart and breast and hatching muscle samples)

SUPPLEMENTARY STUDY
(repetition of this study including additional measurements)

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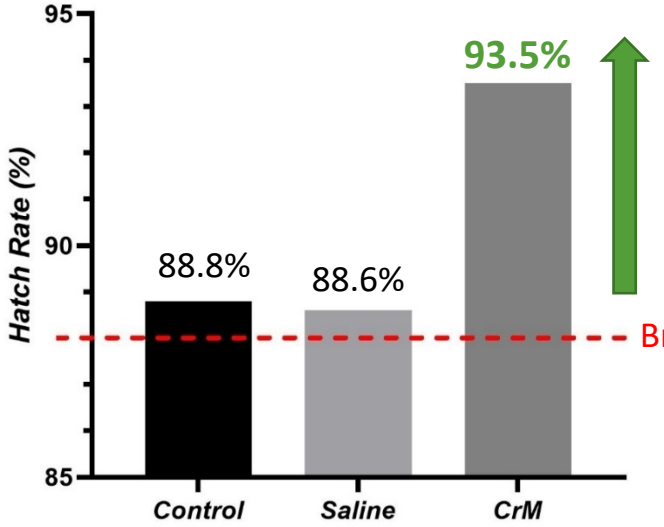
RESULTS

Performance

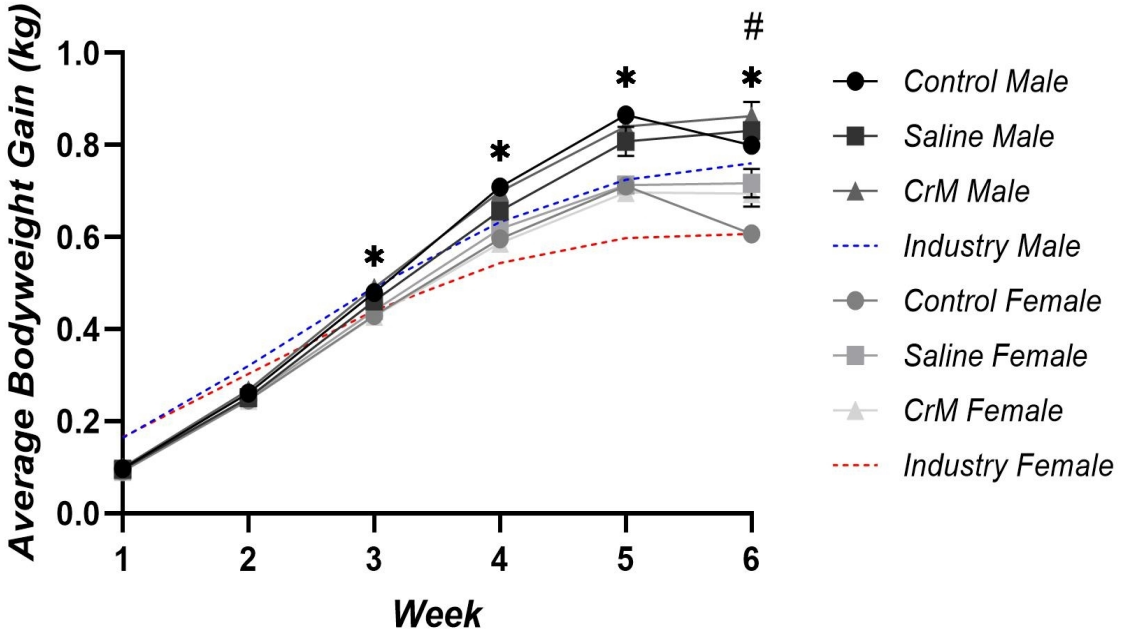
Hatch Rate



Breeder performance objective!

notable difference between treatment groups

Bodyweight Gain

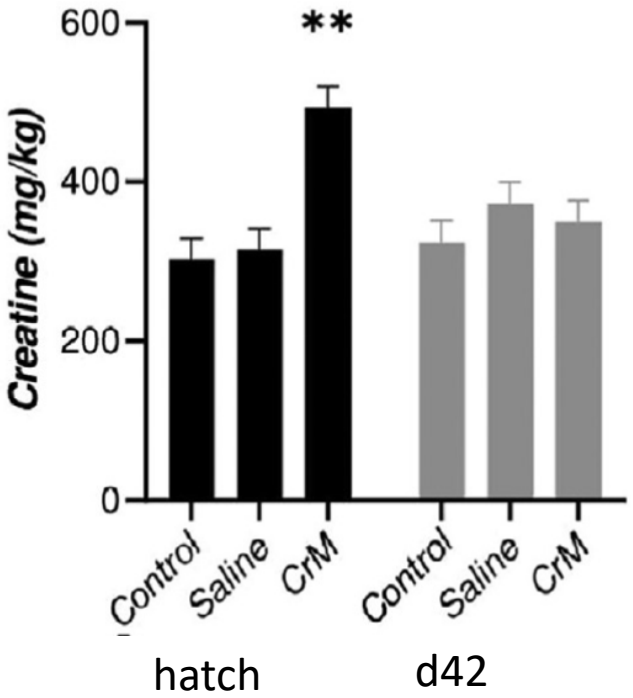


no statistical difference between treatment groups, but a significant sex effect

RESULTS

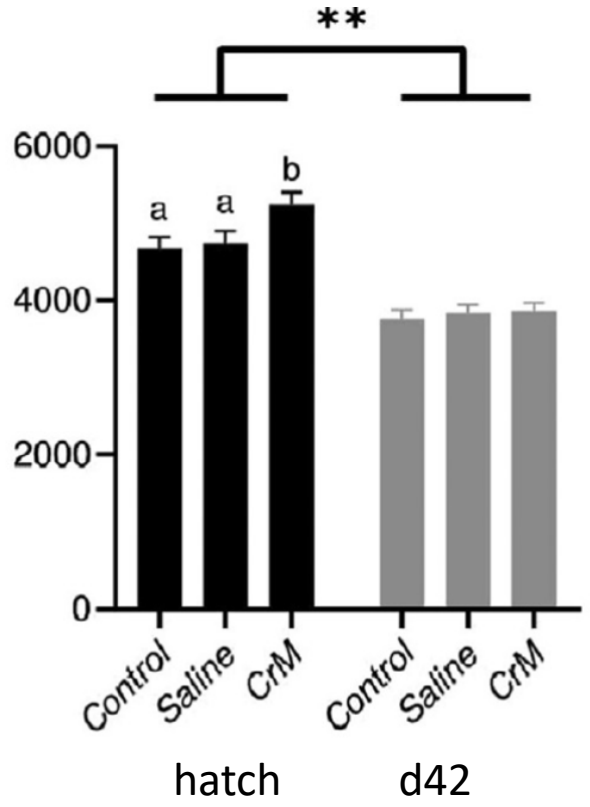
Tissue Analyses

Liver Creatine



CrM birds had higher ($p<0.05$) liver Creatine at hatch

Heart Creatine



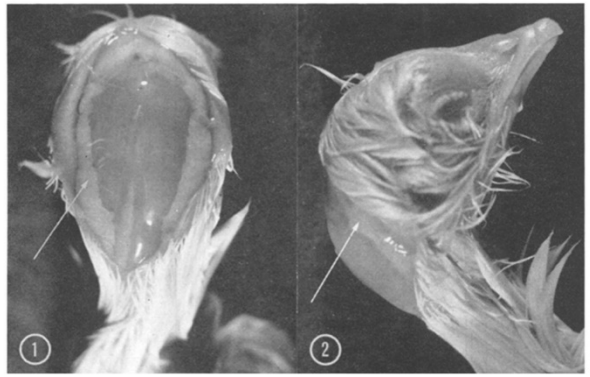
CrM birds had higher ($p<0.05$) heart Creatine at hatch;
heart Creatine was higher ($p<0.05$) at hatch than at d42

RESULTS

supplementary study

No significant difference between groups in:

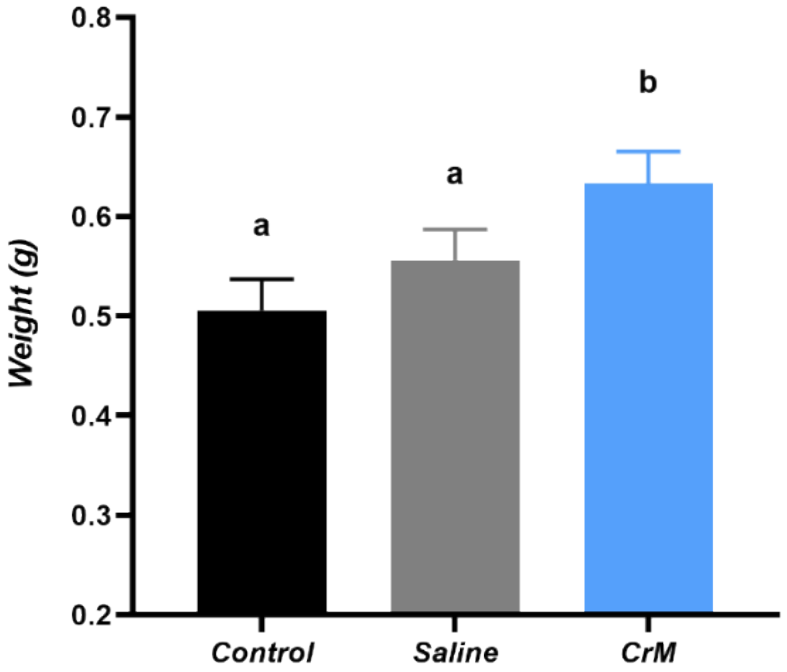
- Hatch weight
- Weekly weight



Dorsal and lateral view of hatching muscle in chick at embryonic day 19. Arrows indicate the large lymph glands (Smail, 1964)

CrM birds had a **heavier** ($p<0.05$) hatching muscle than CON and IOF-CON birds

Hatching Muscle



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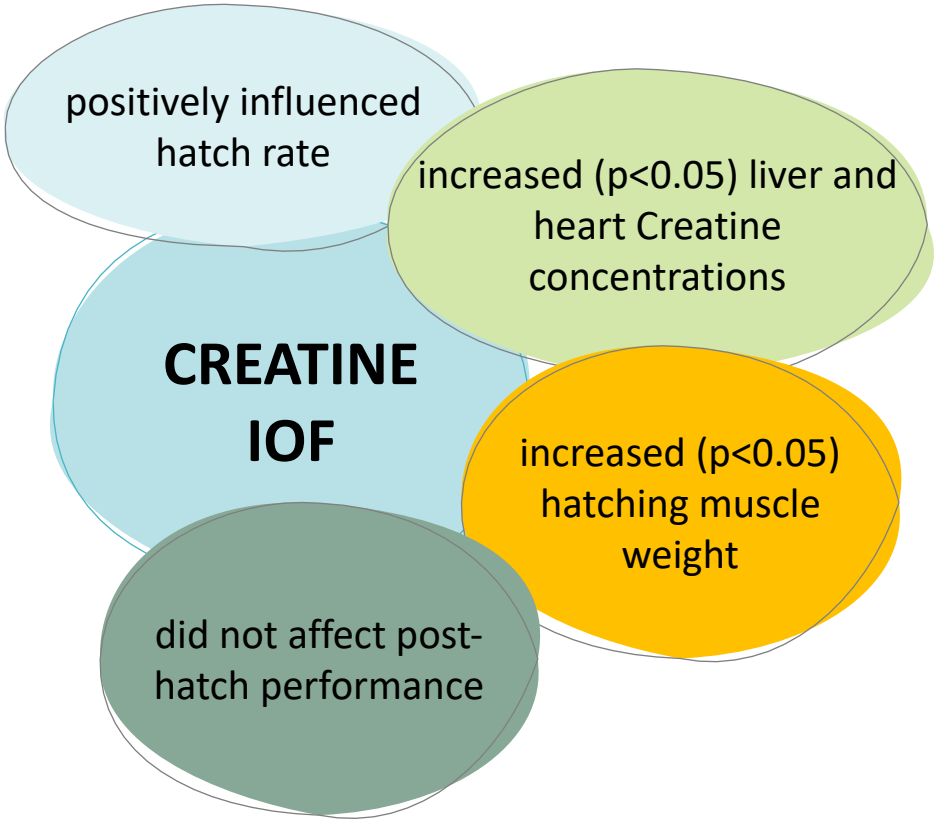
IN-OVO-FEEDING OF CREATINE FOR BETTER CHICK VITALITY AND POST-HATCH PERFORMANCE?

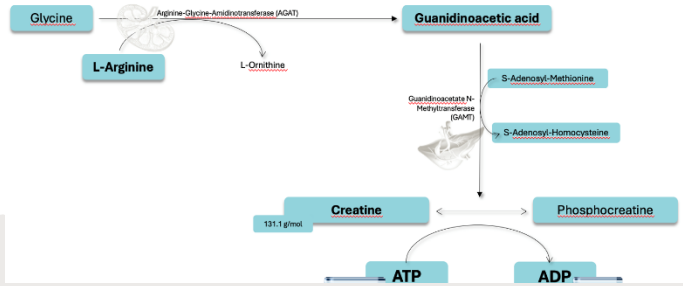


fill the puzzle

- analyses on **Creatine concentration in hatching muscle** and other tissues
- **behaviour data on chick vitality** min. 24h post-hatch

OUTLOOK

study with Creatine feed supplement (GAA, Creamino®) for breeder hens



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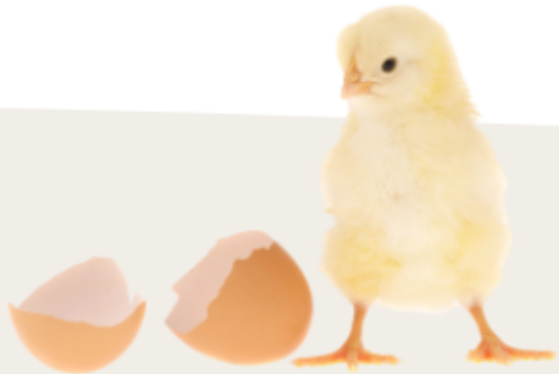
European Federation of Animal Science



THANK YOU FOR YOUR ATTENTION
AND THANKS TO ...

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