

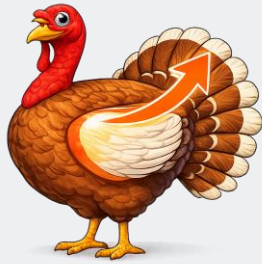


**THE ROLE OF CREATINE IN
CELLULAR ENERGY METABOLISM
AND THE EFFECTS ON TURKEY
PERFORMANCE**

Insa Bensmann



ENERGY CHALLENGE IN MODERN TURKEYS



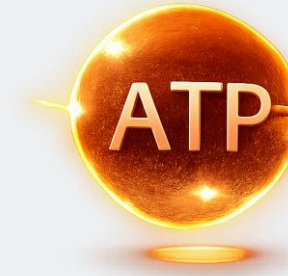
Rapid muscle growth creates an enormous and continuous demand for energy at the cellular level

ATP is consumed continuously

Muscle cells require immediate energy

Energy must be available when and where it is needed

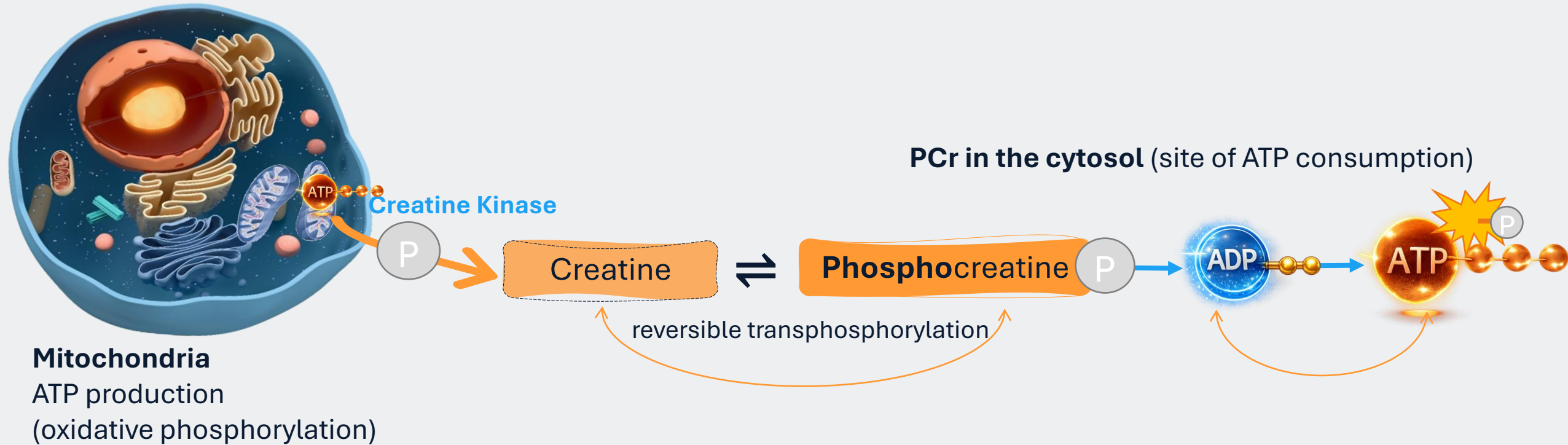
Creatine system



Fast ATP regeneration where it matters

CREATINE KINASE – PHOSPHOCREATINE SYSTEM

energy supply - recycling - transport



The phosphocreatine system rapidly regenerates ATP and transports energy within the cell

HOW CAN CREATINE LEVELS IN THE BODY INCREASE?



Creatine pool:

~95% of creatine is stored in skeletal muscle

Daily loss:

~1.7% of creatine is converted daily to creatinine



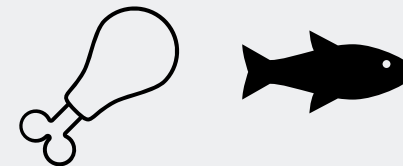
Continuous replenishment is required

Replacement via:

Endogenous synthesis



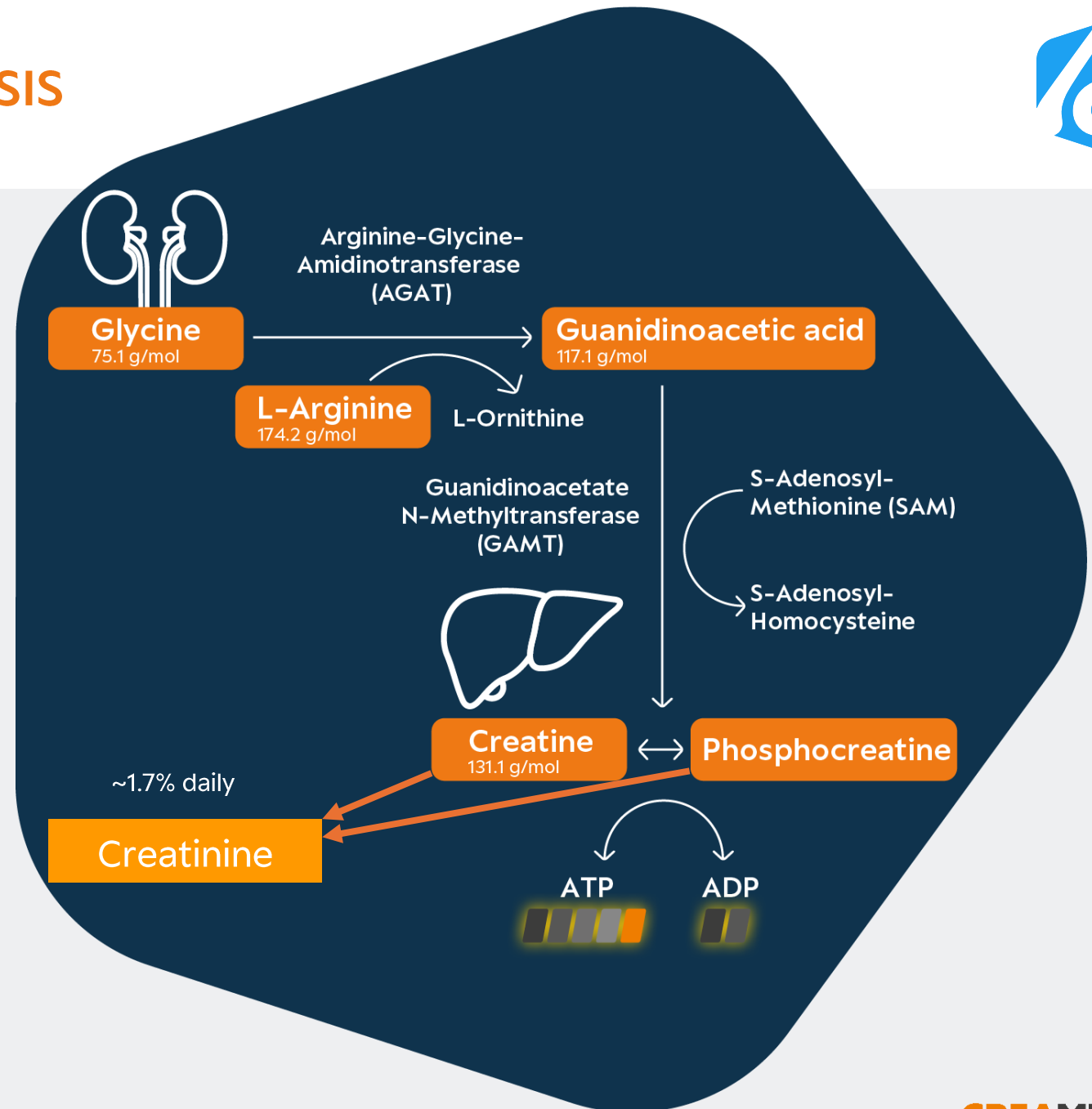
Dietary creatine



CREATINE ENDOGENOUS SYNTHESIS



- Creatine is synthesized from **glycine and arginine** in the kidney
- The enzyme **AGAT** forms **guanidinoacetic acid (GAA)**
- GAA is transported to the **liver**
- The enzyme **GAMT** methylates GAA using **S-adenosylmethionine (SAM)**
- This reaction produces **creatine**



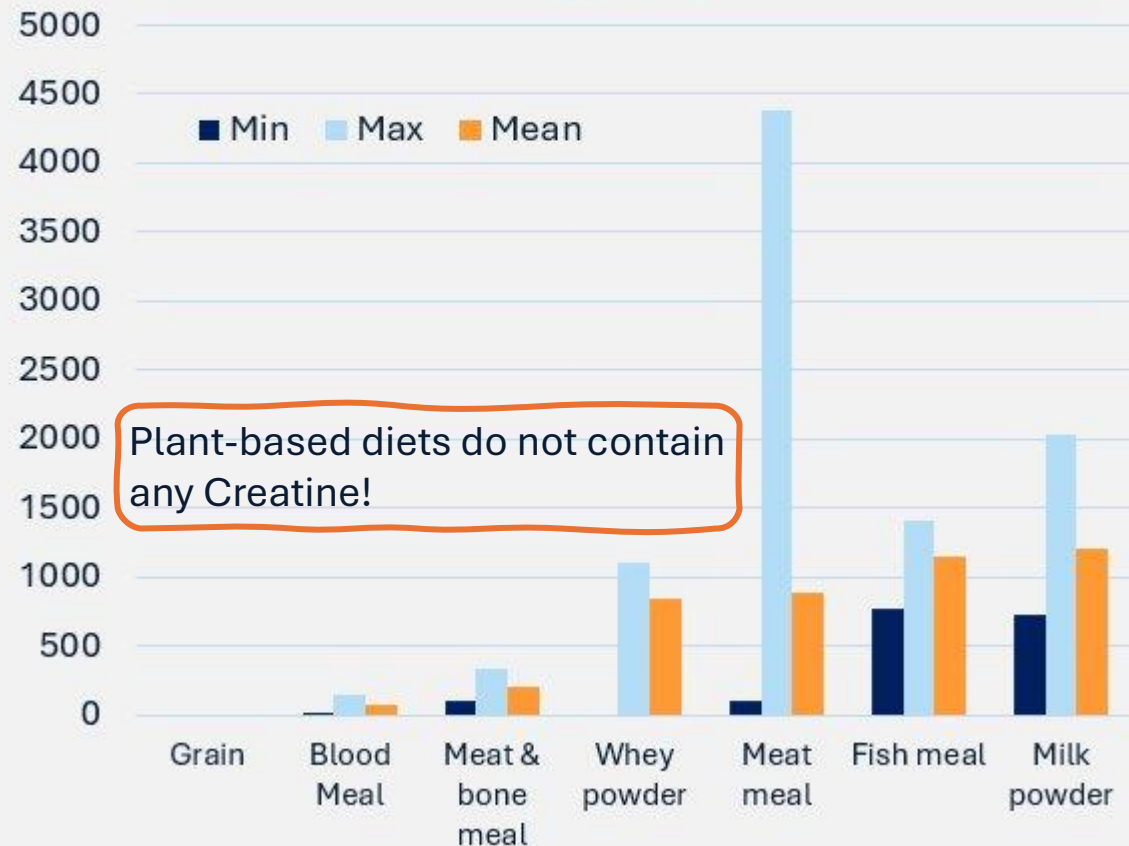
CREATINE INTAKE VIA FEED INGREDIENTS



Creatine supply from feed is unreliable because:

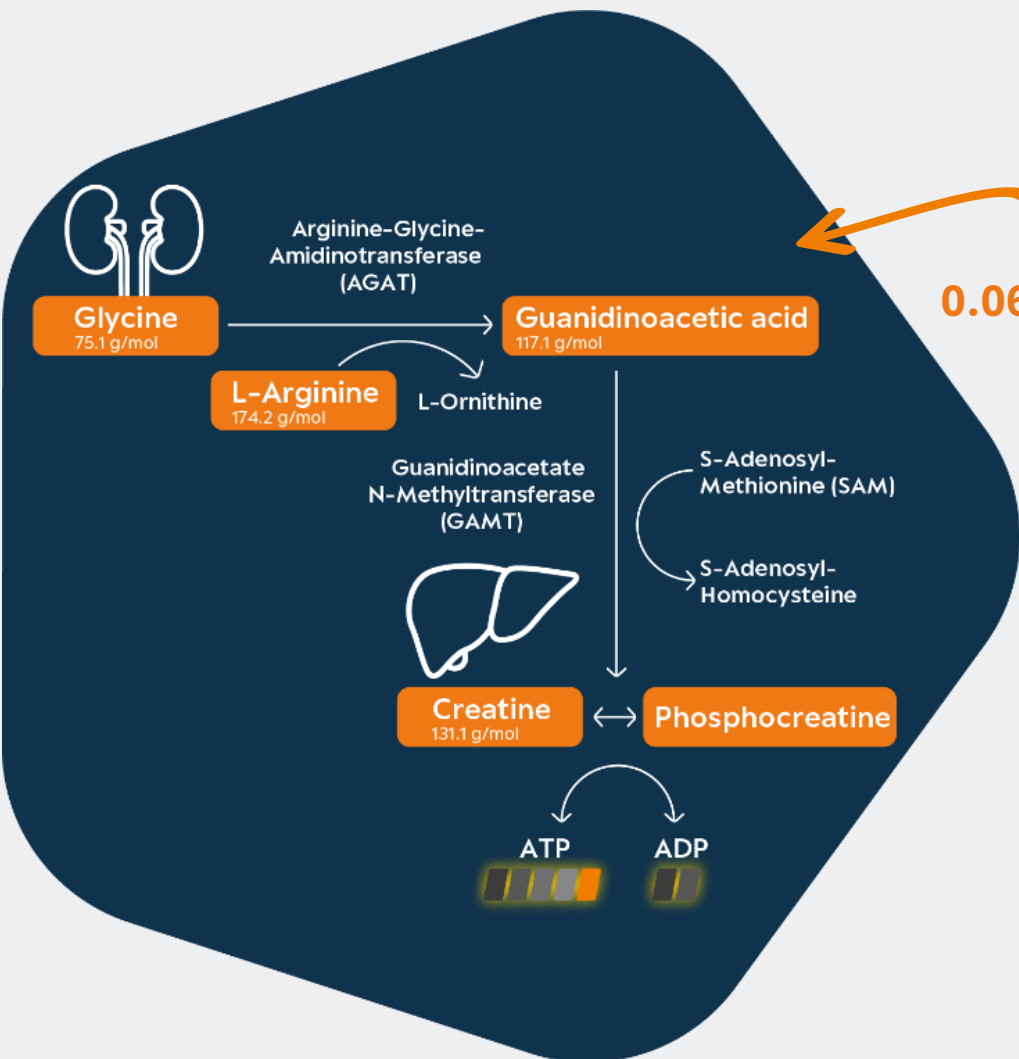
- absent in plant-based ingredients
- variable in animal by-products
- degraded during processing

Creatine in raw materials (mg/kg)





HOW TO INCLUDE CREATINE INTO MODERN DIETS?



0.06-0.12 kg/t feed

Guanidinoacetic acid (GAA) serves as a direct precursor for creatine synthesis

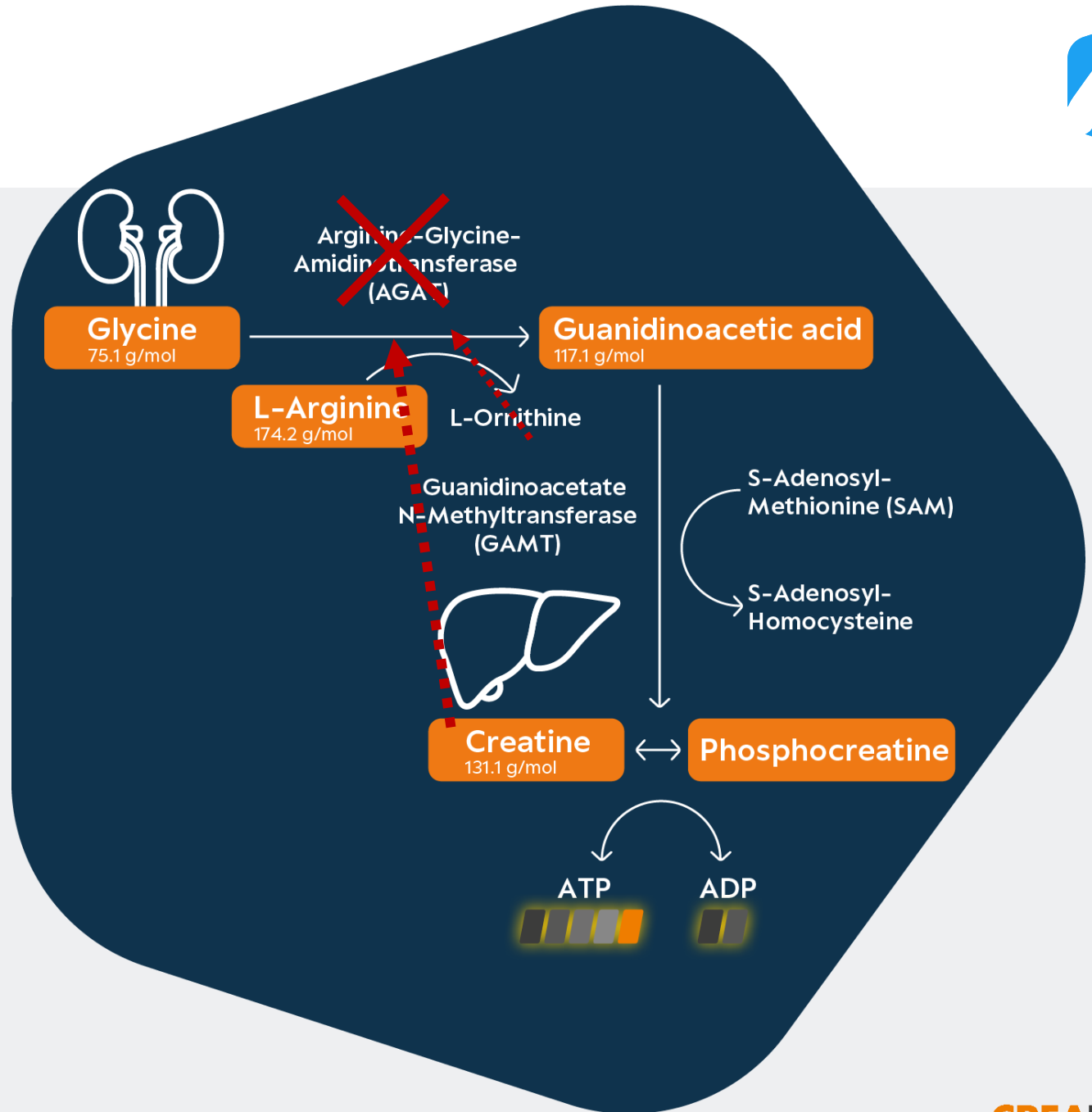
→ **Efficient strategy to increase muscle creatine availability**

GAA

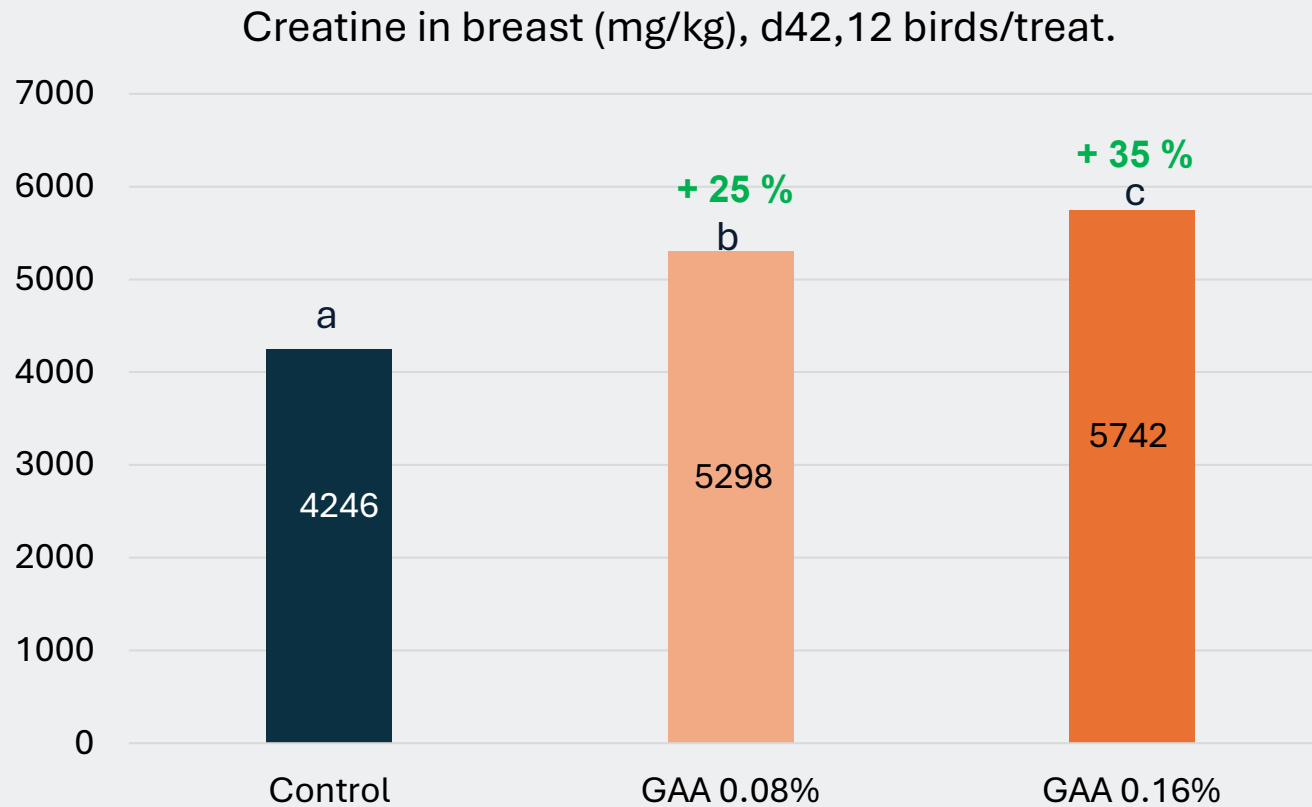
NEGATIVE FEEDBACK



- Negative feedback is important to not waste resources (amino acids) and energy!
- Factors influencing negative feedback by **inhibiting AGAT** activity:
→ serum concentration of **Cr and ornithine**
- GAMT is not regulated by negative feedback.

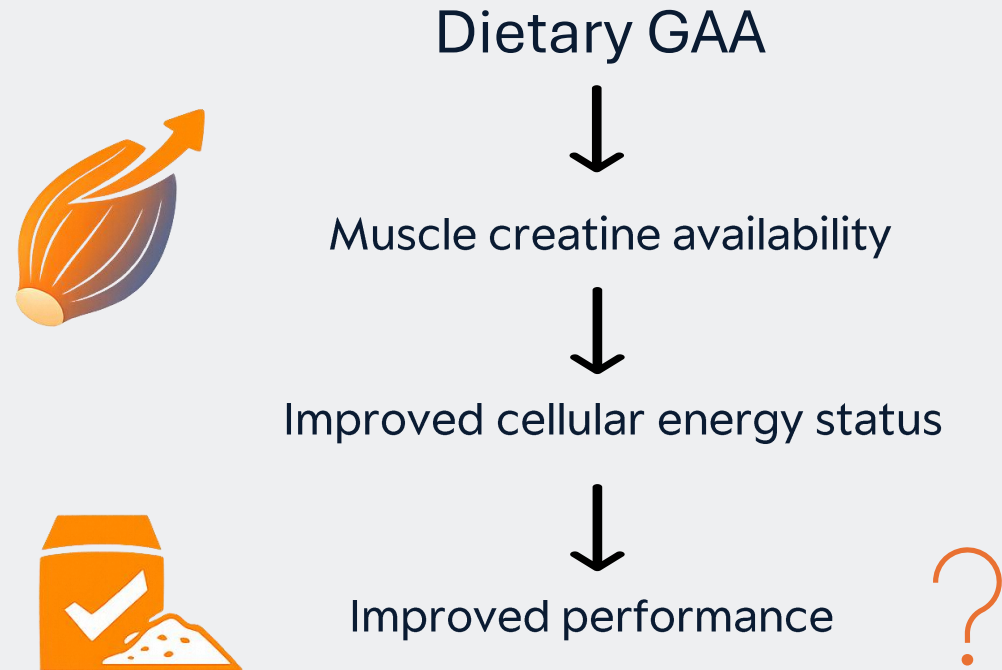


CREATINE CONCENTRATION IN THE BREAST MUSCLE OF TURKEYS



Muscle creatine levels improved by 25 - 47 % (compared to control)

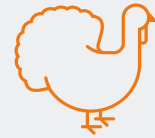
FROM MUSCLE CREATINE AVAILABILITY TO PERFORMANCE?



TURKEY TRIAL- NETHERLANDS 2024



Experimental Design



Genetics BUT 6
Sex toms
Number of Animals 320 (62.8g at start)

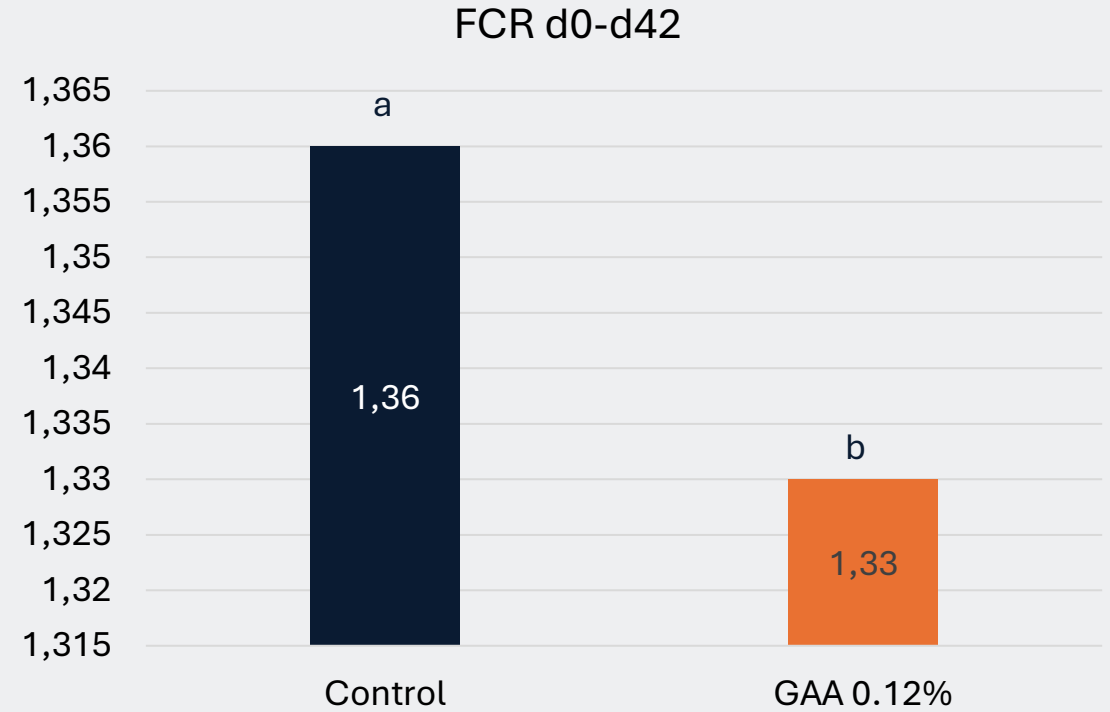
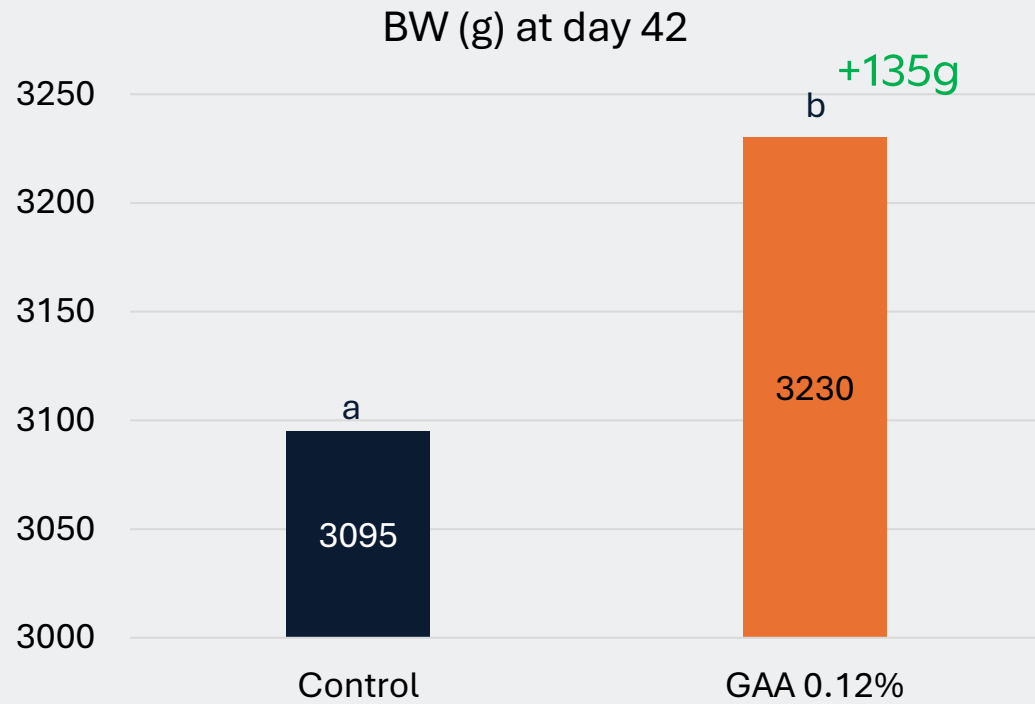


Dietary Treatments CON (no GAA), GAA on top with 0.12%
Replicates/Treatment 8; 20 toms/pens
Supplementation Phase Grown to 43 days of age, phase I: 0-21 days, phase II: 22-43
Feed Composition Diets based on maize, wheat and soybean meal

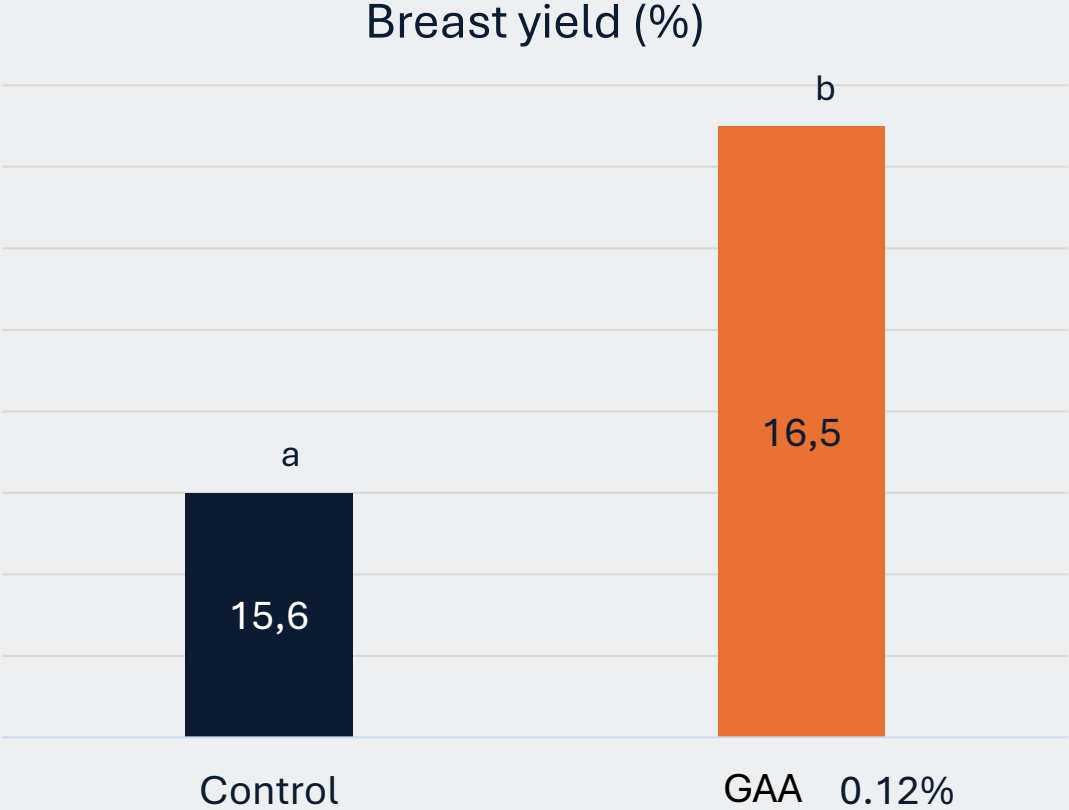


Parameters Performance

TURKEY TRIAL – NETHERLANDS 2024 - RESULTS



TURKEY TRIAL – NETHERLANDS 2024 - RESULTS

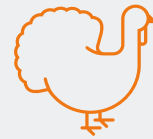


Improved breast yield by 6%

TURKEY TRIAL AT THE UNIVERSITY OF WARMIA – POLAND 2025



Experimental Design



Genetics	Hybrid converter ^{novo}
Sex	toms
Number of Animals	406



Dietary Treatments	CON (no GAA), GAA on top with 0.12%
Replicates/Treatment	7; 29 toms/pens
Supplementation Phase	Grown to 140 days of age
Feed Composition	Diets based on wheat, soybean meal, corn



Parameters	Performance
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TURKEY TRIAL AT THE UNIVERSITY OF WARMIA – POLAND 2025 – RESULTS



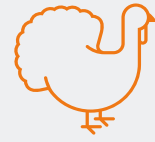
Parameter	Group	Mean	SEM	P-value
Final body weight (kg)	Control	22.98	0.12	0.0026
	GAA	23.53	0.08	
Feed intake d0–140 (g/d)	Control	462.5	2.93	0.14
	GAA	453.3	4.66	
Feed conversion ratio d0–140	Control	2.673	0.017	0.0027
	GAA	2.588	0.015	

-9p FCR

COMMERCIAL INTEGRATOR RESEARCH FARM – USA 2022



Experimental Design



Genetics Nicolas select
Sex toms
Number of Animals 2976



Dietary Treatments CON (no GAA), GAA on top with 0.08%
Replicates/Treatment 16; 93 toms/pens
Supplementation Phase Grown to 139 days of age
Feed Composition Conventional diets



Parameters Performance and carcass composition

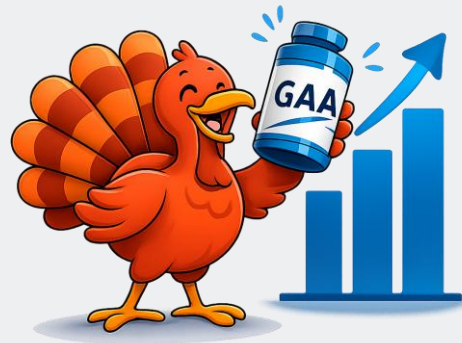
COMMERCIAL INTEGRATOR RESEARCH FARM – USA 2022 - RESULTS



	Control	GAA	
Livability		+3.7%	
Body Weight	21.86 kg	22.04 kg*	+180g
ADG	156 g	157 g	
FCR	2.48	2.45	
Breast Meat Yield	5.59 kg	5.83 kg	+240g

Body weight and carcass yield were significantly increased!!

KEY TAKEAWAYS



- **Creatine/PCr buffers ATP** and supports rapid energy regeneration in muscle.
- **Modern plant-based diets provide little creatine**, and creatine is unstable during processing.
- **GAA is a direct precursor** supporting endogenous creatine synthesis.
- **Dietary GAA increases muscle creatine availability.**
- **Improved creatine availability can translate into better performance parameter in turkeys.**