Dietary glycerol level effects on performance traits, glycerol kinase gene expression and gut microbiota in broilers

Zoidis E., Papadomichelakis G., Mountzouris K.C., Pappas A.C., Arvaniti A., Fegeros K.

Agricultural University of Athens

Dept. of Nutritional Physiology and Feeding

Introduction

➢ **Glycerol** is a by- / co-product of biodiesel production

✓represents about 10% on weight basis of the starting feedstocks (oil/fat) used

✓usage after refining in pharmaceuticals & cosmetics

✓usage as crude by-product in animal feeding (energy source)

➢ Glycerol dietary properties:

high energy content (17.2 MJ GE/kg pure glycerol; 14.4-14.7 MJ ME/kg feed grade),

high digestibility (> 70 %),

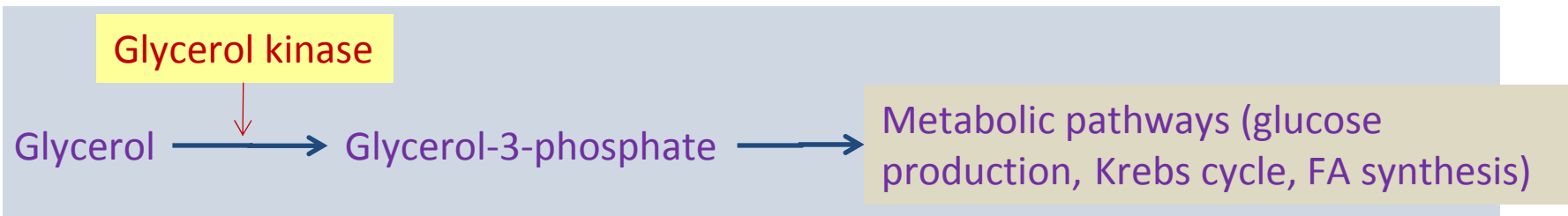
market price ? ?

→ Possible partial replacement of cereals (increasing cost….i.e. wheat at € 210-230/t) in broiler diets … to what extent ?

Introduction

Literature data indicate that glycerol inclusion levels of 5-10% have beneficial effects for broiler growth. However, there are indications that higher inclusion levels could be problematic

• **Glycerol kinase (GK)** has been proposed as the limiting step for the enzymatic activation of glycerol



Adapted from Bartelt & Schneider, 2002

• Could glycerol addition levels modulate GK gene expression and therefore glycerol utilization?

Introduction

- It is well known that gut microbiota plays a very important role for host nutrition and health.
- Accumulating scientific evidence suggests that diet modulates gut microbiota composition.
- Glycerol is widely used in microbiology for the cryo-preservation of microorganisms (working and stock cultures).
- However, the effect of dietary glycerol on broiler gut microbiota is largely unknown and needs to be studied.

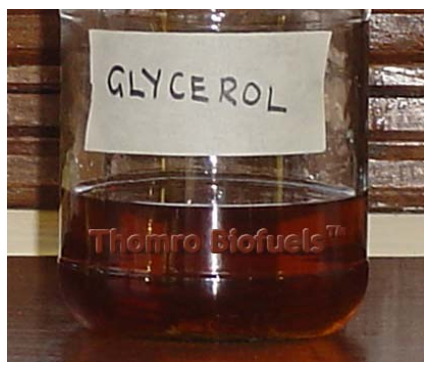
Aims & Objectives

To study the effects of adding crude glycerol at 7, 14 and 21 % (at the expense of maize mainly) in broiler diets, on:

- feed intake, body weight gain, FCR, water intake, excreta moisture, litter score, mortality

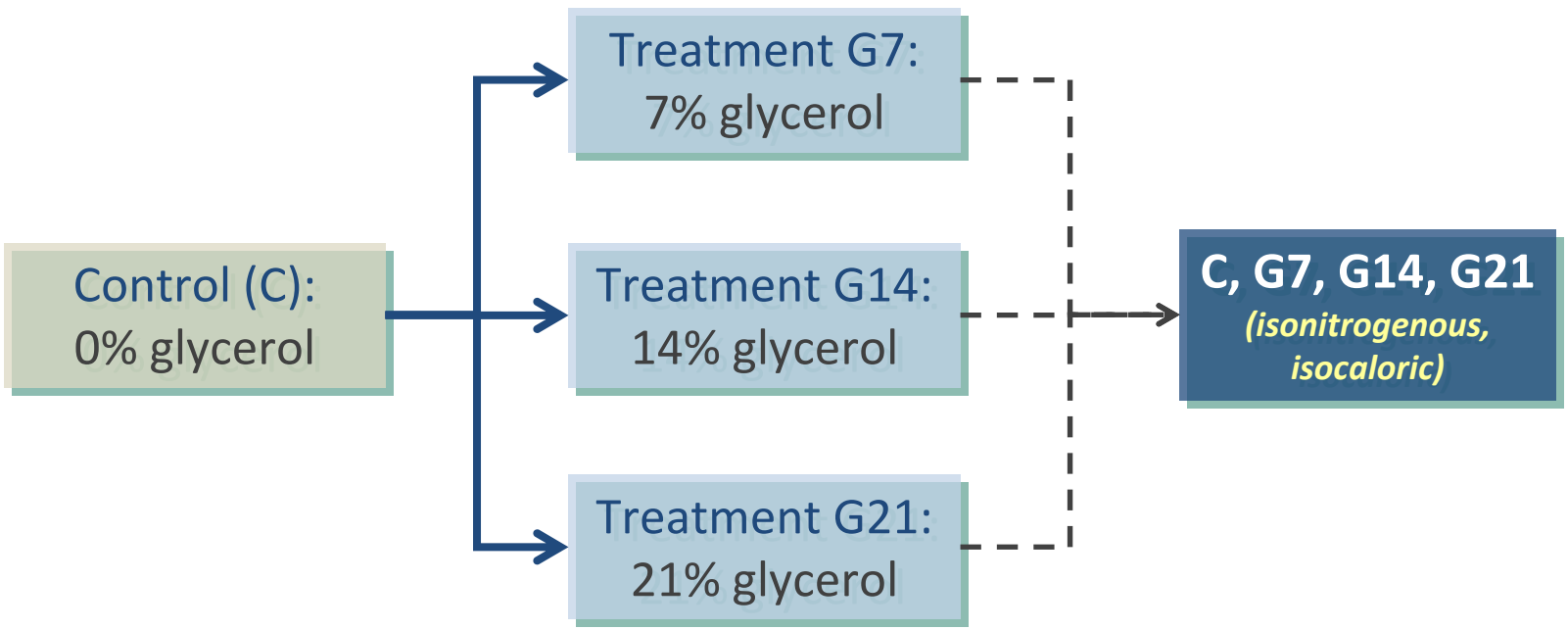
- Glycerol kinase (GK) gene expression in liver

- Selected constituents of gut microbiota monitored at the ileal and caecal level



Materials and Methods

- 400 Cobb broilers (aged 1 d, average BW=45g)
- allotted in 4 treatments Control (C), G7, G14 and G21, of 5 replicates each (20 broilers per replicate)



Materials and Methods

Main ingredients and chemical composition of finishing-phase diets and crude glycerol (%)

	Treatment				
	C	G7	G14	G21	
Corn	70.0	61.6	53.1	44.2	
Soybean meal	25.4	27.2	29.0	31.0	
Glycerol	-	7.0	14.0	21.0	Glycerol
Dry matter	89.3	89.8	90.4	91.0	97.7
ME (MJ/kg)	12.4	12.4	12.3	12.2	14.4
Crude protein	17.5	17.5	17.5	17.5	-
Ether extract	3.1	2.8	2.6	2.3	0.52
Sodium	0.28	0.28	0.28	0.42	2.14

Materials and Methods

- Performance, water intake, excreta moisture, litter score
- At the end (42 days of age) of the trial

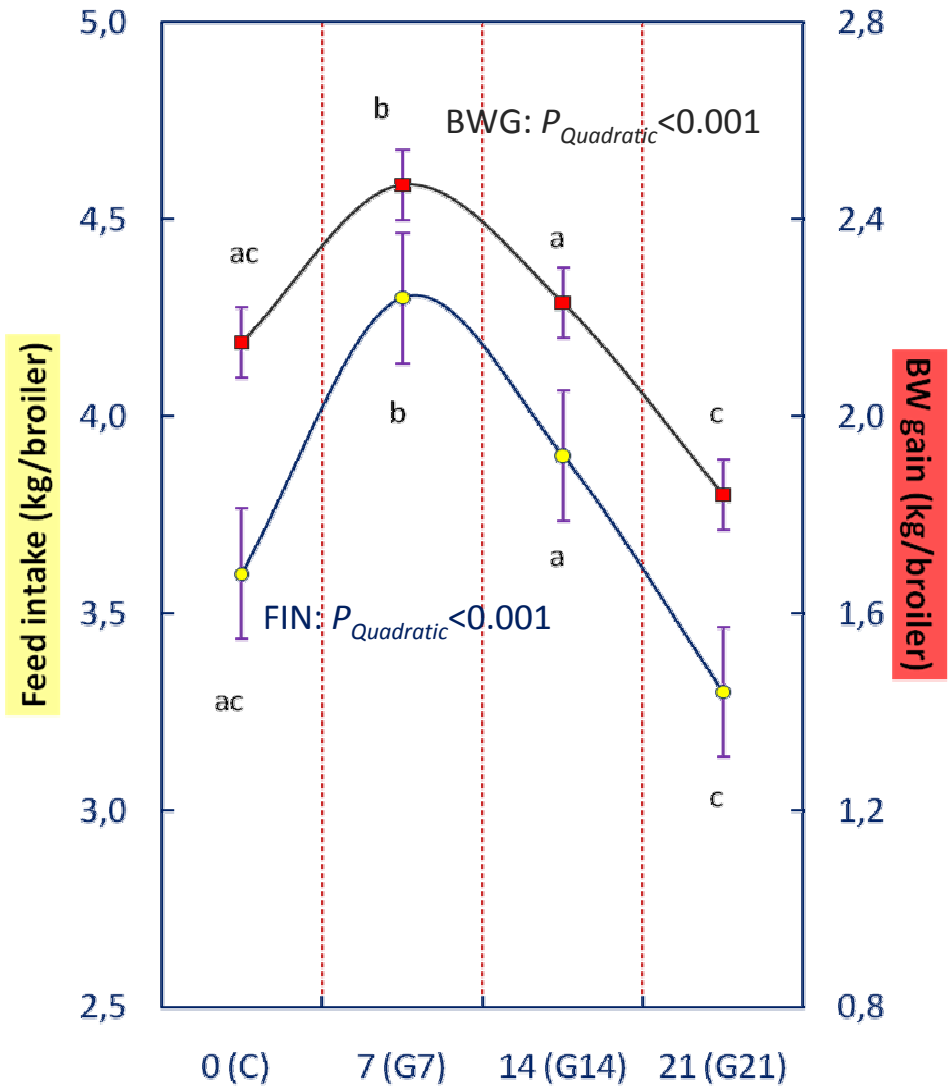
  - liver GK gene expression analysis (calculated as GK/18S ratio)

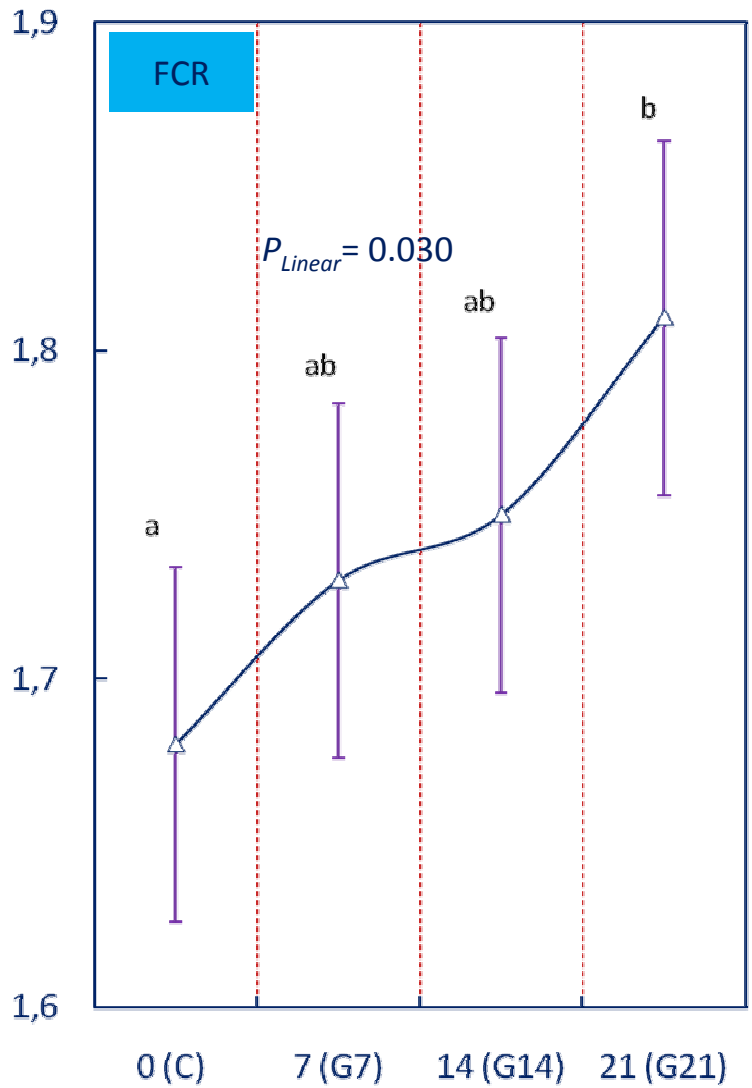
  - ileum and caecum were analyzed for selected constituents of microbiota composition (expressed as log CFU/g wet digesta)

- Linear and quadratic effects of dietary glycerol were studied by using polynomial contrasts (SPSS v.17.0)

Results

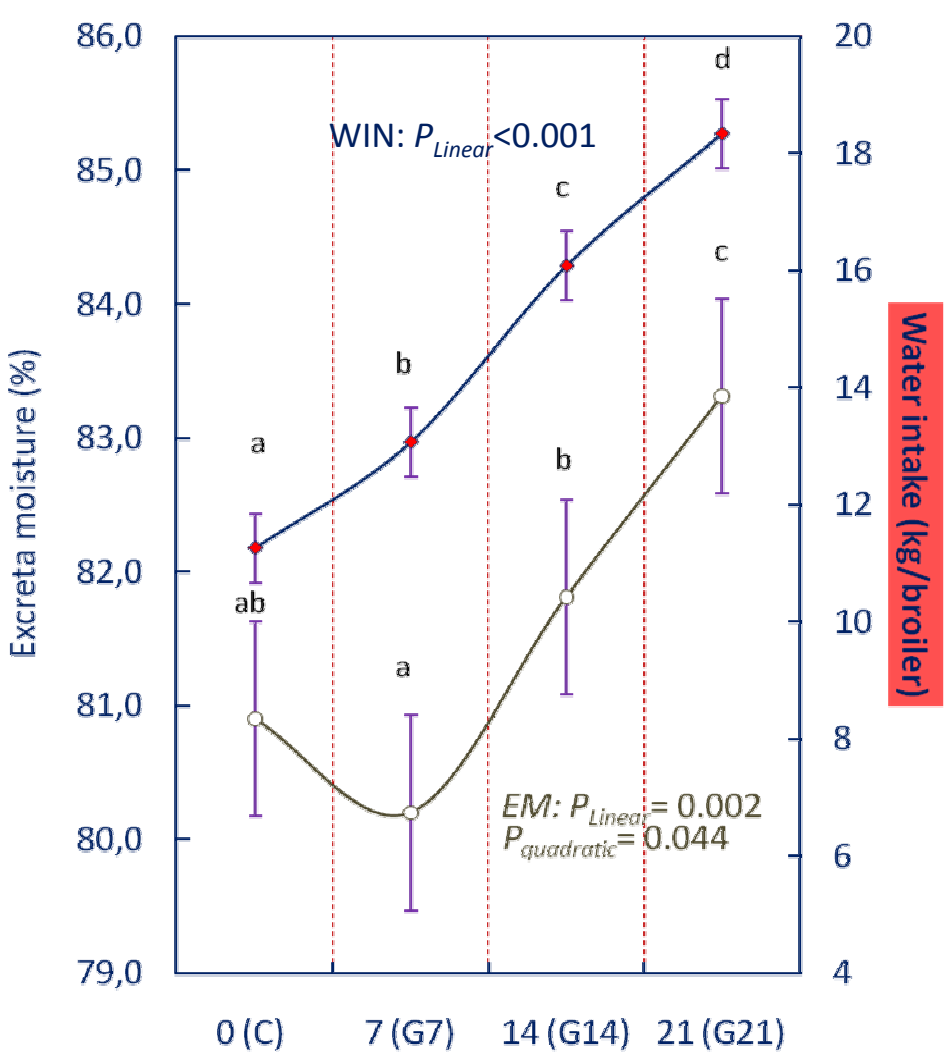
Overall (1-42 days) feed intake (FIN), body weight (BW) gain and FCR

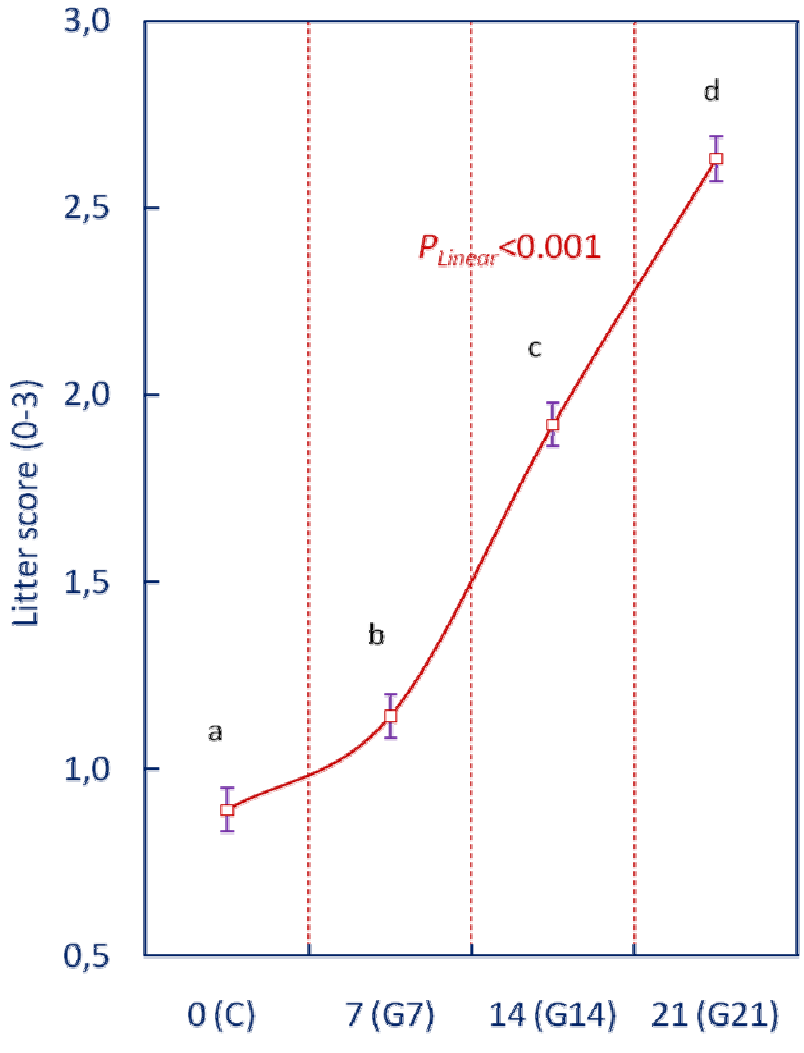




Dietary glycerol addition level (%)

Overall (1-42 days) water intake (WIN), excreta moisture (EM) and litter score

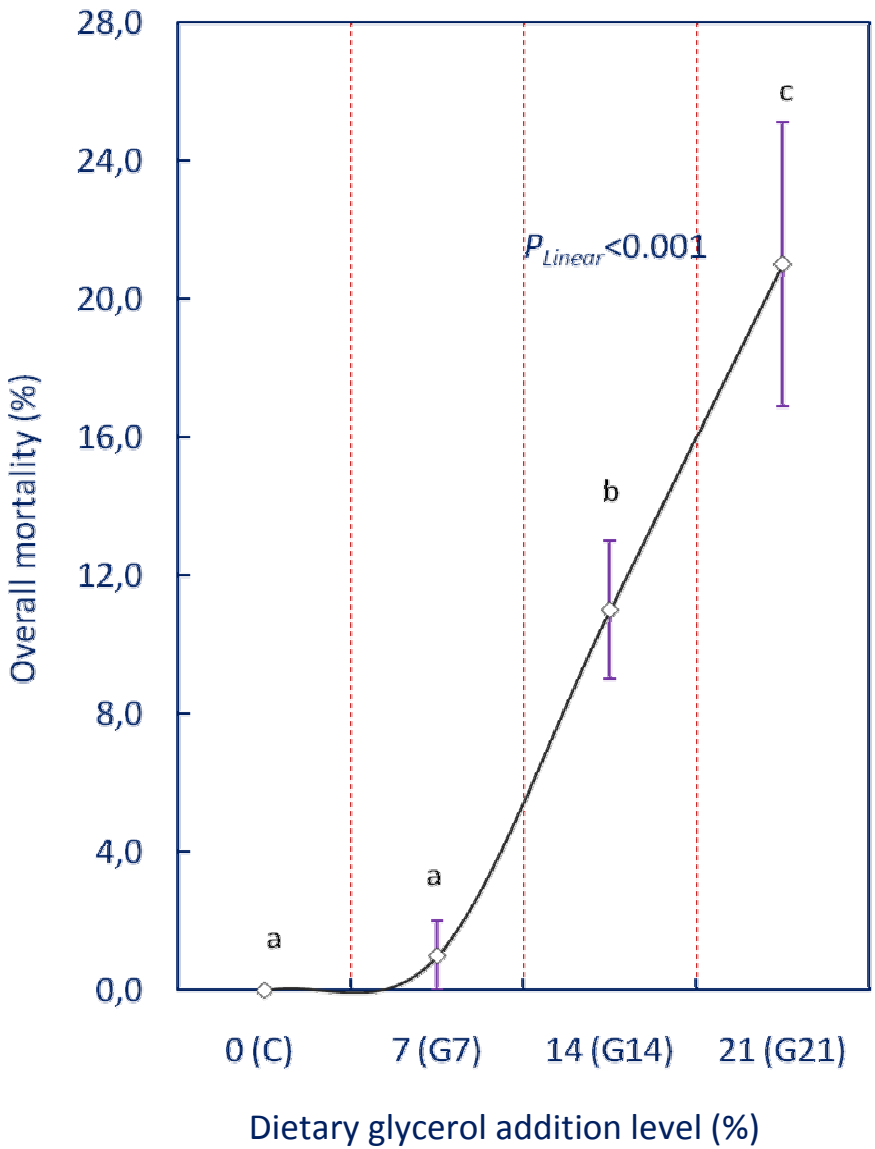




Dietary glycerol addition level (%)

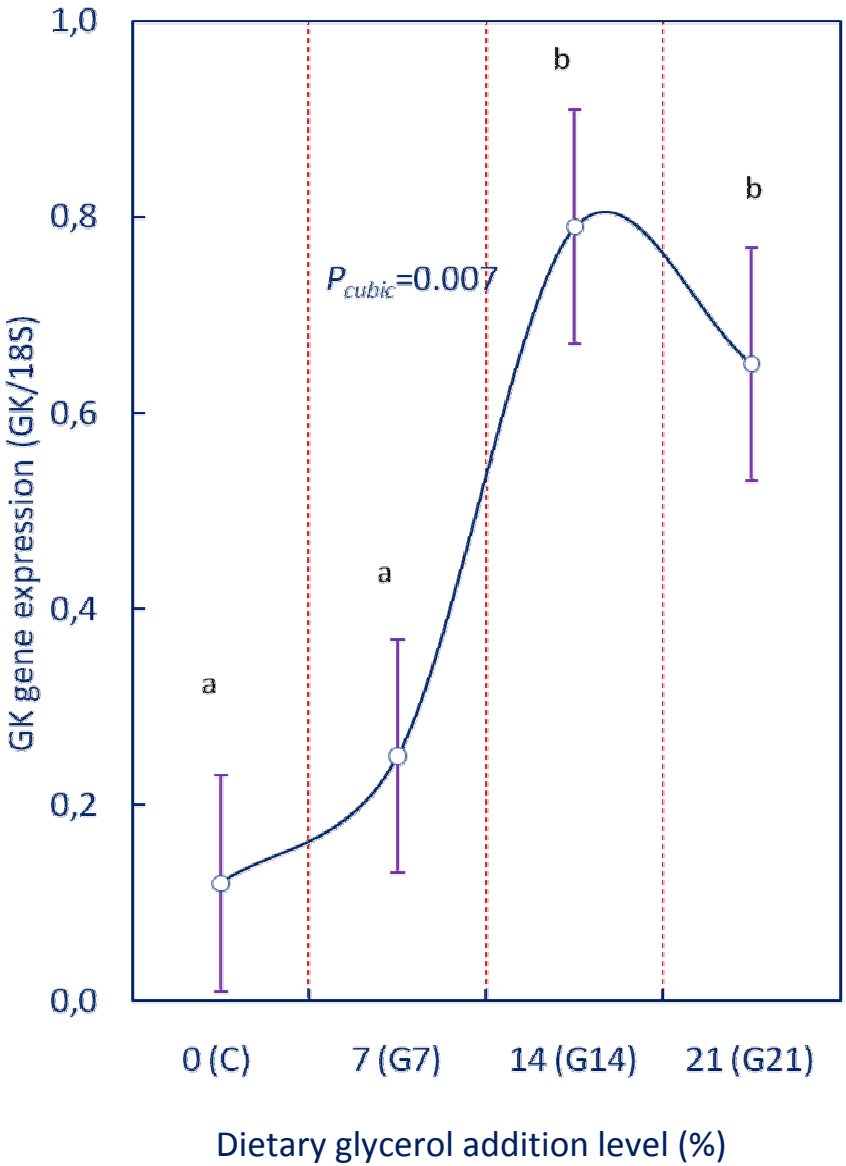
Results

Overall mortality (at 42 days of age)



Results

GK gene expression (at 42 days of age)



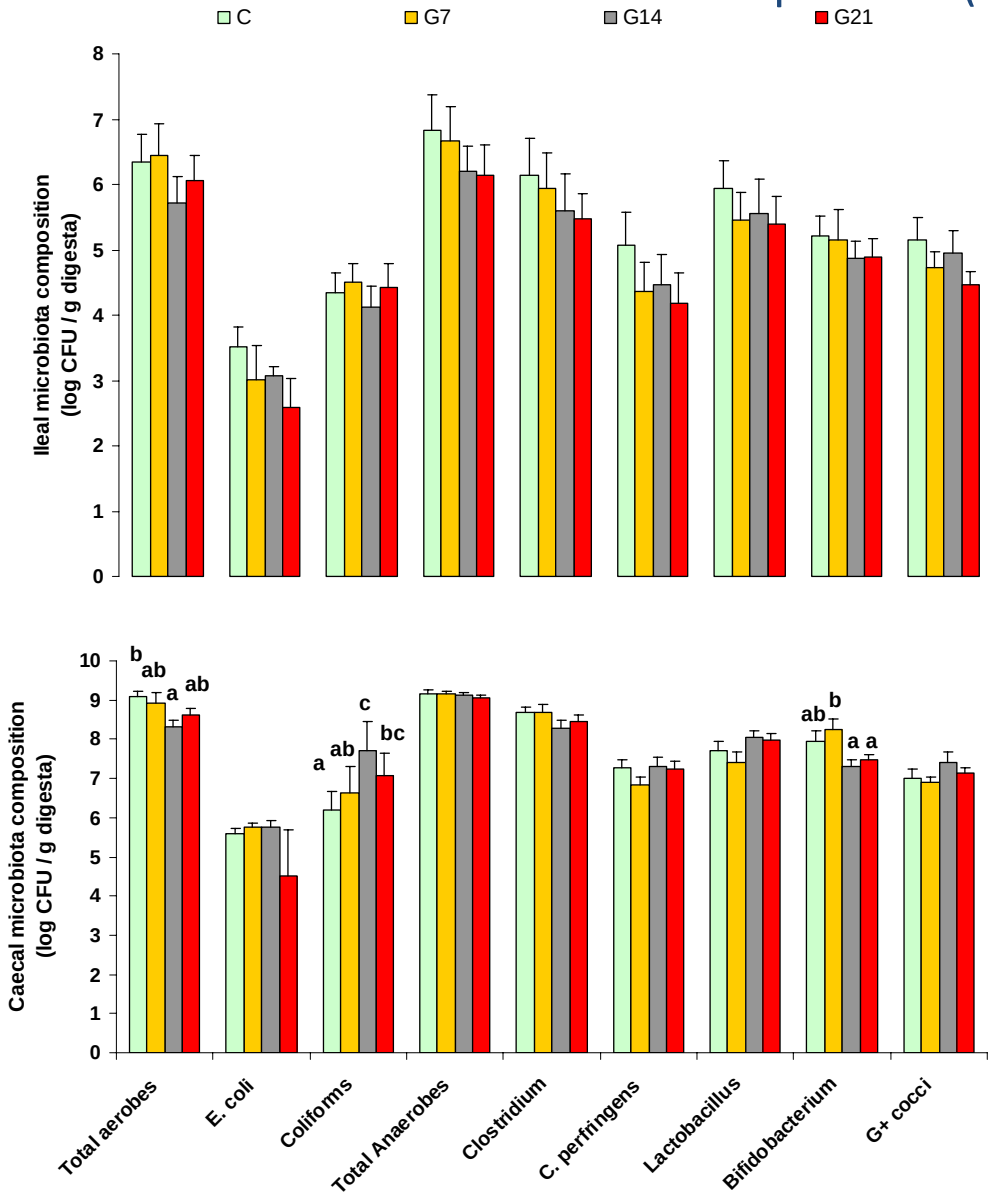
GK gene expression increased with glycerol addition up to 14%

Finding is not in accordance with BWG and does not confirm the hypothesis that GK gene expression could be the limiting step in glycerol utilisation

GK & G3P dehydrogenase enzymatic activities: required

Results

Gut microbiota composition (log CFU/g wet digesta) at 42 days of age



- **No effects** of dietary glycerol inclusion level on **ileal** microbiota

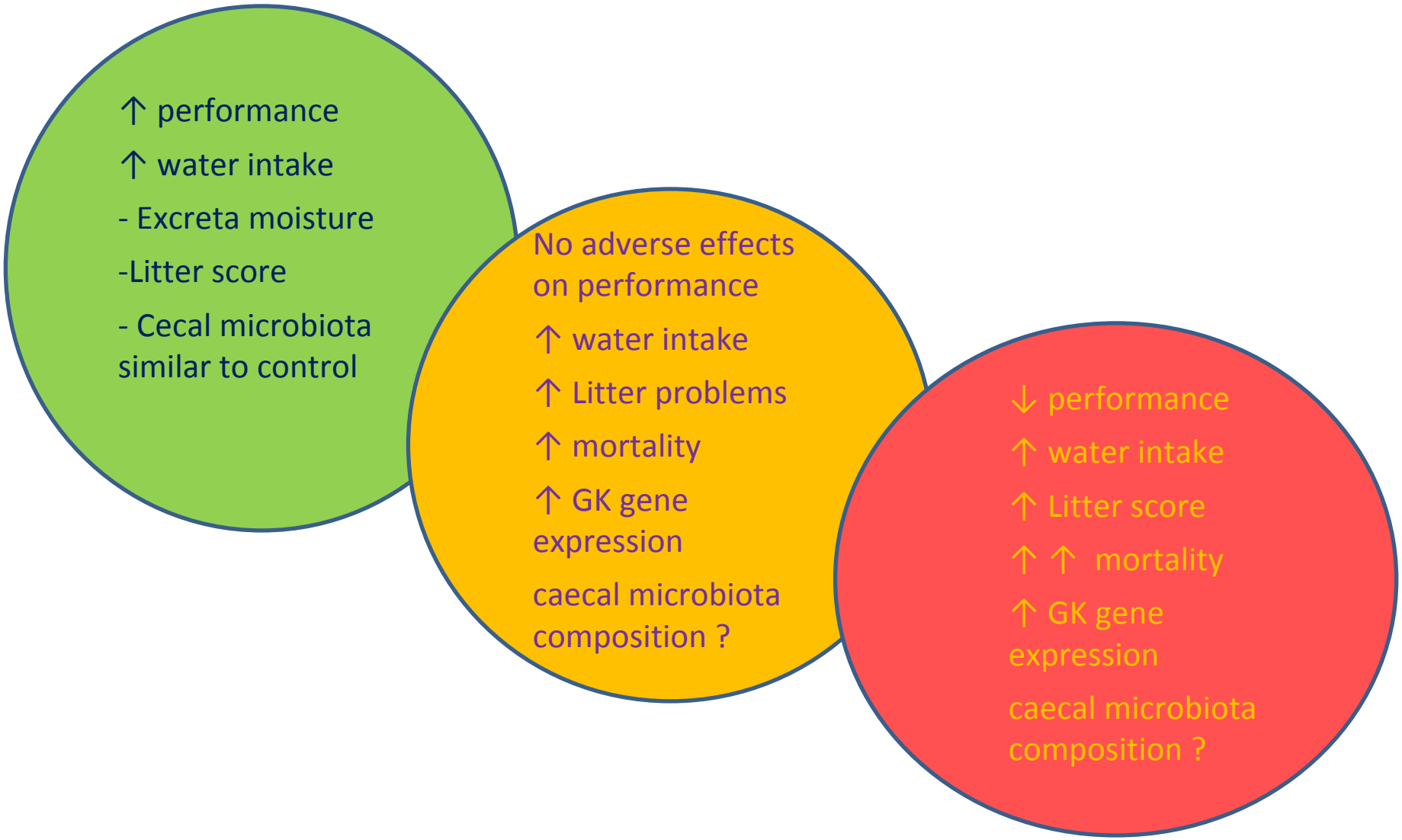
- However, in **caecum**:

Glycerol addition had an effect on Total aerobes, Coliforms and *Bifidobacterium* levels

G14 & G21 had: ⇧ Coliforms

⇩ *Bifidobacterium*

Summary-Conclusions



7% glycerol addition

14% glycerol addition

21% glycerol addition

Thank you for your attention

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