

## Black Soldier Fly larvae reared on feed mixed with recycled sewage sludge accumulate Ca and P

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### Introduction

Phosphorus (P) use is accompanied by environmental concerns (1). To lower the amount of P-losses through organic waste, P recycling is necessary (2). However, there are concerns about toxic compounds and heavy metals in products with recycled P (3). Black soldier fly larvae (BSFL) are suggested as alternative sources of protein for broilers (4), and is able to change the concentration of some elements in their body in response to the diet (5). This study investigates whether BSFL can be enriched with P and other minerals based on sewage sludge recycle products.

### Materials and Methods

A positive control diet (chicken feed; 12.5 MJ ME/kg DM; 210 g/kg DM crude protein) was used to assess the potential growth of BSFL (Figure 1). A Gainesville diet based on corn meal, wheat bran, alfalfa was modified with the addition of sugar beet pulp to reduce dietary P-content (GD; 7.9 MJ ME/kg DM; 154 g/kg DM crude protein). The GD was then supplemented either with 4% of carbonisate ((Carb) recycle derived from sewage sludge pyrolysis using the PYREG®-process; 6) or SSP (recycle derived from sewage sludge incineration using the Ash2®Phos process; 7) at the expense of wheat bran and corn meal.

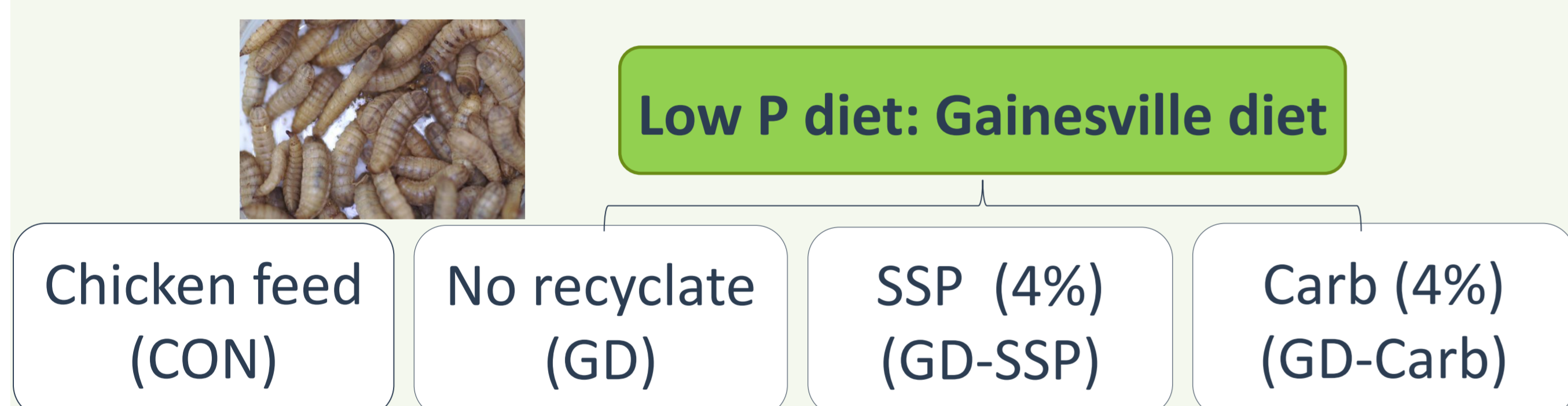


Figure 1. Experimental groups

Larvae (6 replicates/diet) were reared on the experimental diets between days 1 to 18 post hatching. The larvae were harvested, weighed, and frozen for analyzing mineral content.

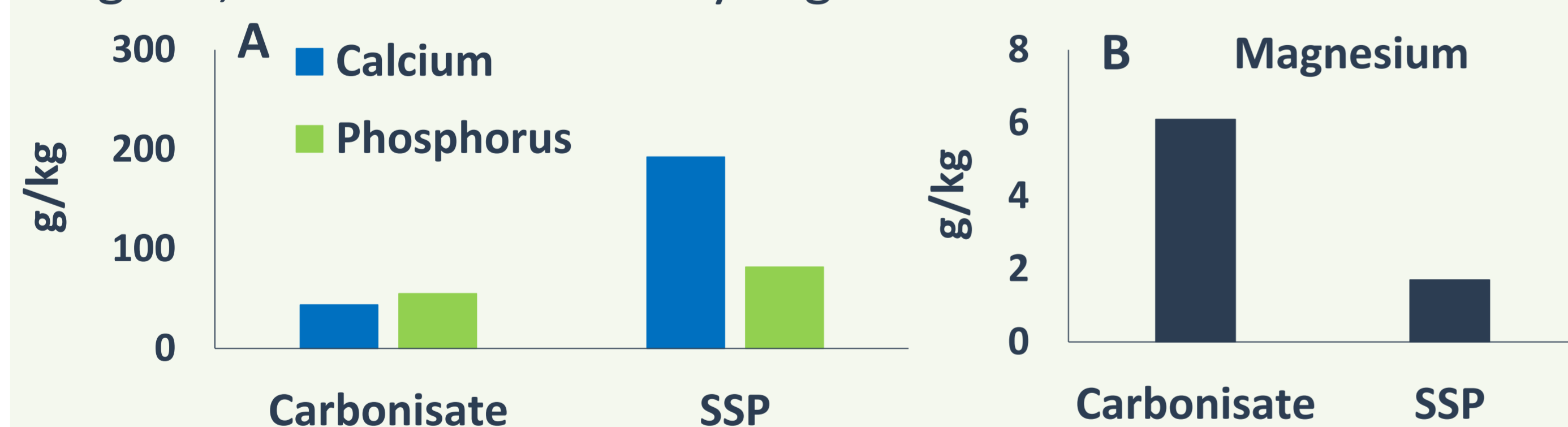


Figure 2. Calcium, phosphorus (A) and magnesium (B) content of recycles

### Results

Higher calcium (Ca) and phosphorus (P) content of SSP recycle (Fig. 1) resulted in higher Ca and P in the BSFL (Fig. 2), however, BSFL fed a diet containing SSP recycle had reduced body weight (BW), crude protein (CP) and crude fat (CF) content ( $P < 0.05$ ). In addition, larvae reared on chicken feed had higher CF and lower CP than those reared on GD.

#### References:

- Liu et al., 2008, Journal of Industrial Ecology, 12, 229-247.
- Bergfeldt et al., 2018, Agriculture, 8,187
- Kim et al., 2019, Agriculture, 9, 221
- Dörper et al., 2020. J. Insects as Food and Feed, 1-20

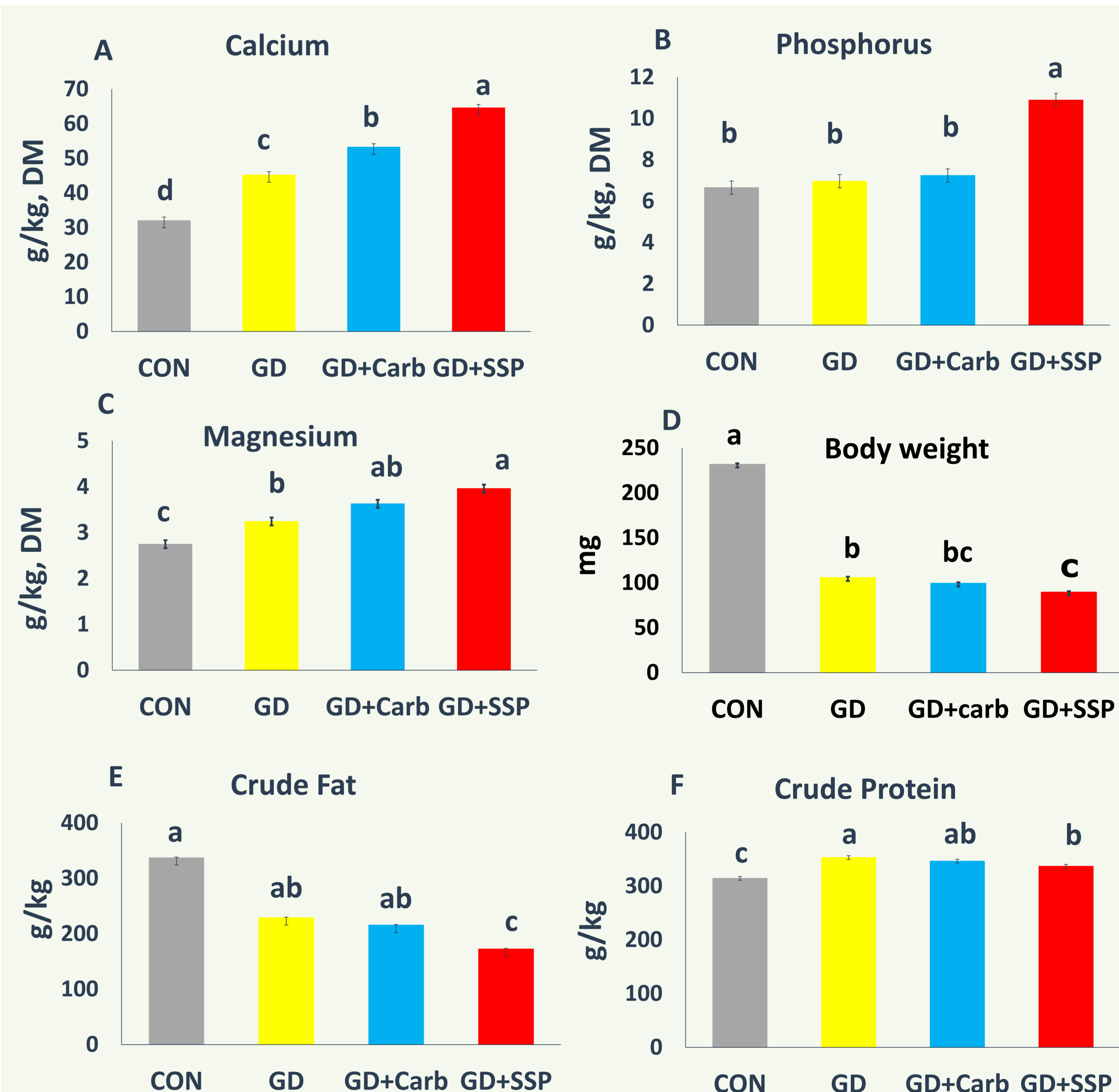


Figure 2. Mineral content (A-C), body weight (D), crude fat (E) and crude protein (F) content of BSFL; Diet effect for all parameters  $P < 0.01$ .

### Conclusion

Using recycled minerals we show that BSFL accumulated Ca and P, and confirm our hypothesis that BSFL is able to accumulate elements in their body. In addition, we conclude that higher BW of BSFL due to a higher energy and protein content in the CON diet is associated with higher CF and lower CP content in their body reservoir. Therefore, this should be taken into consideration when rearing BSFL to be used in animal diets.

- Proc et al., 2020, Science of The Total Environment, 723, 138125
- Fesharaki and Rath, 2018. Verkohlungsanlage Pyreg. European Patent Office Patent no. EP 3 358 253 A1.
- Cohen et al., 2019, International Fertilizer Society (30 May 2019)