POULTRYNSECT

D2.1 Report on growth performance of intermediate growing poultry genotype

Deliverable 2.1

Achille Schiavone, WP2 Leader

University of Turin, Italy

This project has received funding from transnational funding bodies, partners of the H2020 ERA-NETs SUSFOOD2 and CORE Organic Cofund, under the Joint SUSFOOD2/CORE Organic Call 2019. This document reflects only the author's view and the transnational funding bodies are not responsible for any use that may be made of the information it contains.

Abbreviations	
ADFI	Average Daily Feed Intake
ADG	Average Daily Gain
AW	Average Weight
BSF	Black Soldier Fly
CP	Crude Protein
DM	Dry Matter
FCR	Feed Conversion Ratio
MJ	Mega Joule
WP	Work Package

Content

Introduction

Introduction

The POULTRYNSECT Work Package 2 ***"Chickens in vivo feeding trials"*** aims to evaluate the Black Soldier Fly (BSF) live larvae inclusion as feed ingredient in chicken diet to reduce the feed soybean content and therefore increase sustainability of the chickens production. Animal welfare and environment issues frequently influence the consumer choices in terms of meat purchase (1; 2; 3). Therefore, considering that the use of soybean – which is the main feed ingredient in poultry diet – is nowadays critical for its unsustainability (4), the search for alternative protein sources and rearing systems is fundamental (5). Insects as the BSF could be an alternative to soybean, thanks to their nutritional profile, high feed conversion ratios and low greenhouse gases emission (6; 7; 8; 9). Some studies have already been conducted in laying hens, broilers and other avian species fed live insects evaluating the effects on birds' growth, health status and slaughtering performance (5; 6; 10; 11). However, no data are available about the BSF live larvae provision in medium-growing chicken breeds.

The WP2 has three different objectives:

1) perform in vivo poultry feeding trial to determine the optimal inclusion level of live HI larvae for organic chicken production;

2) assess the gender effect on performances, welfare and health of birds fed live insect larvae;

3) assess in two different genotypes model (with different growing-rate) the effect on performances, welfare and health of birds fed live insect larvae.

For the first trial, the Label Naked Neck hybrid (medium-growing genotype) was reared for 82 days. The growth performances were recorded during the trial to determine the Feed Conversion Ratio (FCR), Average Daily Gain (ADG), Average Daily Feed Intake (ADFI) and the average weight (AW) of the birds.

This Deliverable reports the growth performance preliminary results obtained from the first task of the *in vivo* trial performed with Label Naked Neck chicken by the UNITO project partner.

1. Material and Methods

A total of 240 twenty-day-old Label naked neck birds (**Fig. 1**) were purchased from a commercial rearing centre (sexed chicks, sex ratio 1:1) and transferred to the Avian Conservation Centre of Local Genetic Resources of the University of Turin (north-west of Italy) where the trial was carried out from the beginning of October to the beginning of December. The initial weight of the birds was of 515,02 g and 435,94 g for the males and females, respectively.

Figure 1. Females and males of Label naked neck birds

The birds were individually weighted and selected on the base of their average body weight and allotted in 24 pens. They were distributed in four experimental groups according to gender and treatment (10 chickens/pen, 60 birds/treatment):

1. males fed basal organic feed;
2. males fed basal organic feed +10% BSF supplementation;
3. females fed basal organic feed;
4. females fed basal organic feed +10% BSF supplementation.

The birds had always free access to clean and fresh water and organic feed. A first period diet was adopted until 35 days of age (22.92% crude protein, crude fat 6,19%, gross energy 18.73 MJ/kg) and a grower feed was provided from 35 to 82 days of age (20.52% crude protein, crude fat 5.12%, gross energy 18.61 MJ/kg) (Verzuolo mangimi s.r.l.). The feed composition was similar in both diets: corn, sunflower meal, soybean meal, peas, corn gluten, alfalfa meal were

the main ingredients, dicalcium phosphate, calcium carbonate, soybean oil, sodium chloride, sodium bicarbonate and potato flour the remain ingredients.
Feed labels of both diets are showed in **Figure 2**.
Natural ventilation and photoperiod (from 12L:12D in October, to 10L:14D in December) were applied for the entire duration of the trial. Outdoor access was ensured for all the birds from 49 days of age to the end of the experiment. Mortality and health status of the birds were checked and recorded daily. The animals were weighted weekly and the average weight (AW) calculated. Feed consumption was recorded and FCR, ADFI and ADG were calculated at the end of each rearing period (20-35d, 35-82d) and for the overall period (20-82d). The FCR in the treated groups was corrected on the base of the larvae dry matter (33.63%) content ingested from the birds.

VERZUOLO BIOMANGIMI

Abello FIN-IMM s.r.l.
Via Provinciale Saluzzo 94 12039 VERZUOLO (CN)
STABILIMENTO Via Sottana 50 VERZUOLO (CN)
Tel 0175/87808 Fax 0175/88931

Iscrizione registro imprese 01998310047
Capitale sociale € 10.400
e-mail: info@verzuolobiomangimi.it
www.verzuolobiomangimi.it

A

A034b

MANGIME COMPLETO PER POLLI DA INGRASSO

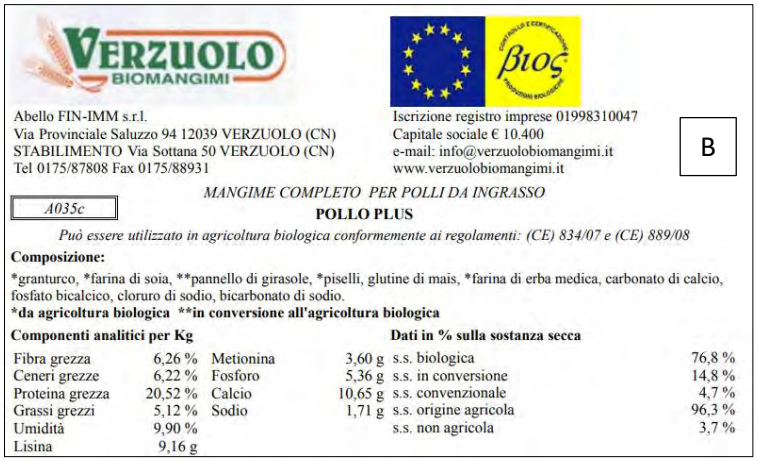
POLLO UNO

Può essere utilizzato in agricoltura biologica conformemente ai regolamenti: (CE) 834/07 e (CE) 889/08

Composizione:

*granturco, **farina di soia, *pannello di girasole, *farina di soia, *piselli, glutine di mais, *farina di erba medica, fosfato bicalcico, carbonato di calcio, **olio di soia, cloruro di sodio, bicarbonato di sodio, fecola di patate.
***da agricoltura biologica **in conversione all'agricoltura biologica**

Componenti analitici per Kg				Dati in % sulla sostanza secca	
Fibra grezza	5,85 %	Metionina	3,72 g	s.s. biologica	70,0 %
Ceneri grezze	7,81 %	Fosforo	7,10 g	s.s. in conversione	21,5 %
Proteina grezza	22,92 %	Calcio	14,10 g	s.s. convenzionale	3,5 %
Grassi grezzi	6,19 %	Sodio	1,98 g	s.s. origine agricola	94,9 %
Umidità	9,56 %			s.s. non agricola	5,1 %
Lisina	11,47 g				



VERZUOLO BIOMANGIMI

Abello FIN-IMM s.r.l.
Via Provinciale Saluzzo 94 12039 VERZUOLO (CN)
STABILIMENTO Via Sottana 50 VERZUOLO (CN)
Tel 0175/87808 Fax 0175/88931

Iscrizione registro imprese 01998310047
Capitale sociale € 10.400
e-mail: info@verzuolobiomangimi.it
www.verzuolobiomangimi.it

B

A035c

MANGIME COMPLETO PER POLLI DA INGRASSO

POLLO PLUS

Può essere utilizzato in agricoltura biologica conformemente ai regolamenti: (CE) 834/07 e (CE) 889/08

Composizione:

*granturco, *farina di soia, **pannello di girasole, *piselli, glutine di mais, *farina di erba medica, carbonato di calcio, fosfato bicalcico, cloruro di sodio, bicarbonato di sodio.
***da agricoltura biologica **in conversione all'agricoltura biologica**

Componenti analitici per Kg				Dati in % sulla sostanza secca	
Fibra grezza	6,26 %	Metionina	3,60 g	s.s. biologica	76,8 %
Ceneri grezze	6,22 %	Fosforo	5,36 g	s.s. in conversione	14,8 %
Proteina grezza	20,52 %	Calcio	10,65 g	s.s. convenzionale	4,7 %
Grassi grezzi	5,12 %	Sodio	1,71 g	s.s. origine agricola	96,3 %
Umidità	9,90 %			s.s. non agricola	3,7 %
Lisina	9,16 g				

Figure 2. Feed labels of the poultry diets: Label **A** (first period) and Label **B** (grower)

2. Preliminary results and discussion

Overall, the growth performances were not influenced by the live larvae provision indicating no negative effects of this supplementation in chicken diet (P>0.05). Similar growth curves were obtained from the treated and control groups belonging to the same gender (**Figure 3**). As far as growth parameters are concerned, significant differences were recorded among the groups taking into account the three periods considered.

The supplemented groups revealed a better FCR than the control ones during the first period (28-35d) (P=0.001) (**Figure 4**). The interaction between diet and gender had a significant effect on both the ADG and FCR. More in detail, the ADG as well as the FCR were better in the treated males compared to the control ones during the first period (28-35d) (P<0.01 and P=0.001, respectively) (**Figure 5 and 6**). Finally, the FCR in the second (35-82d) (**Figure 7**) and whole period (28-82d) (**Figure 8**) was higher in the female larvae group compared to the female control group (P<0.05). This effect could be explained by the ADFI values provided by the guidelines that was the same for both males and females. During the trial the males namely displayed a higher ADFI than the females in each of the periods considered (P<0.001) (**Figure 9**). This means that the female groups received more than the established 10% supplementation of live larvae, with a related negative effect probably due to the chitin content. In conclusion, the live larvae provision could improve the FCR and ADG of young birds. Moreover, since positive results were observed exclusively during the first period, the live larvae supplementation should be promoted at this bird age.

Figure 3. Growth curves of the four experimental groups

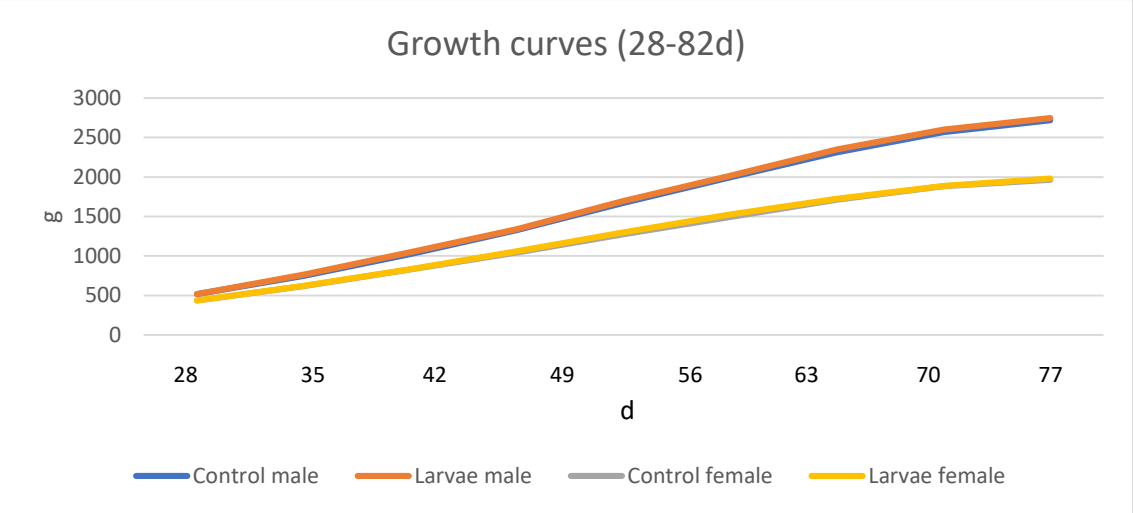


Figure 4. FCR of treated and control groups during the first period (28-35d) (n = 12 pen; 10 birds/pen). ***P=0.001

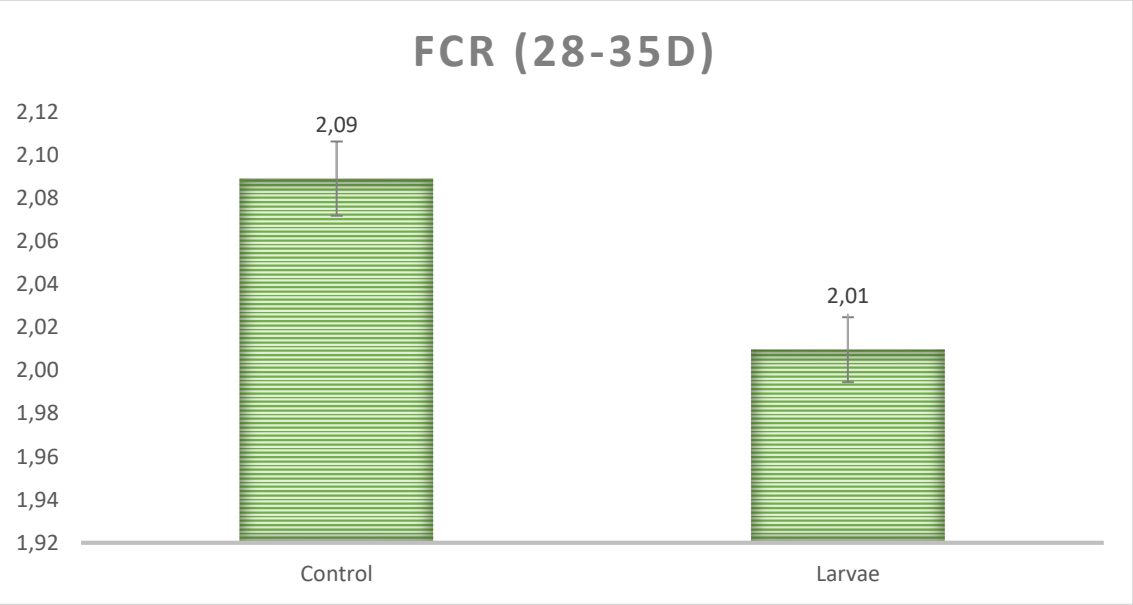


Figure 5. ADG of treated and control males during the first period (28-35d) (n = 6 pen; 10 birds/pen). **P<0.01

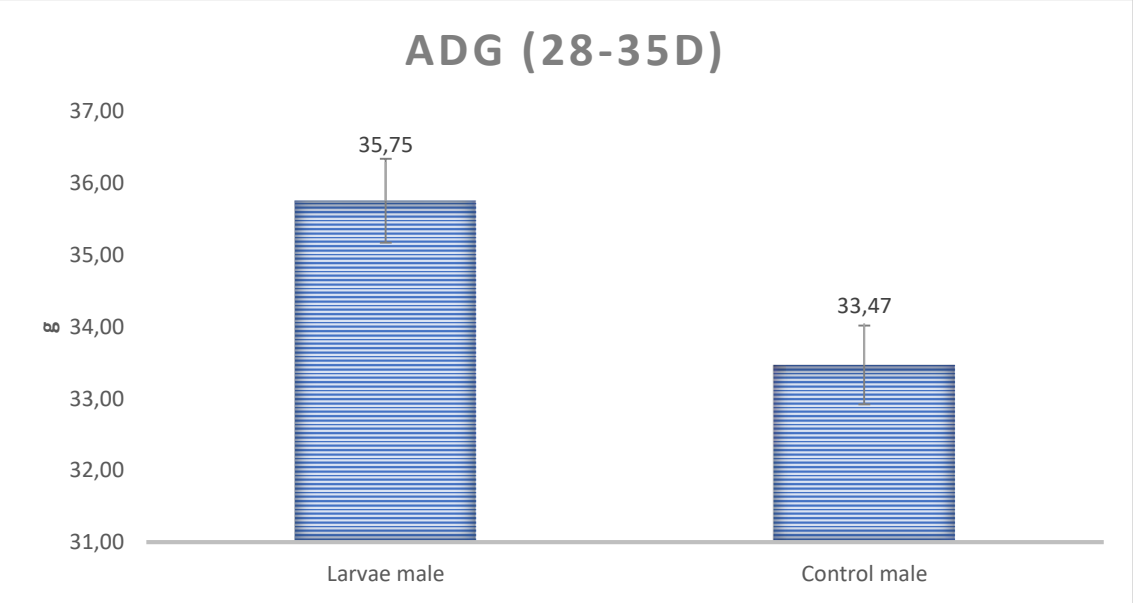


Figure 6. FCR of treated and control male groups during the first period (28-35d) (n = 6 pen; 10 birds/pen). ***P=0.001

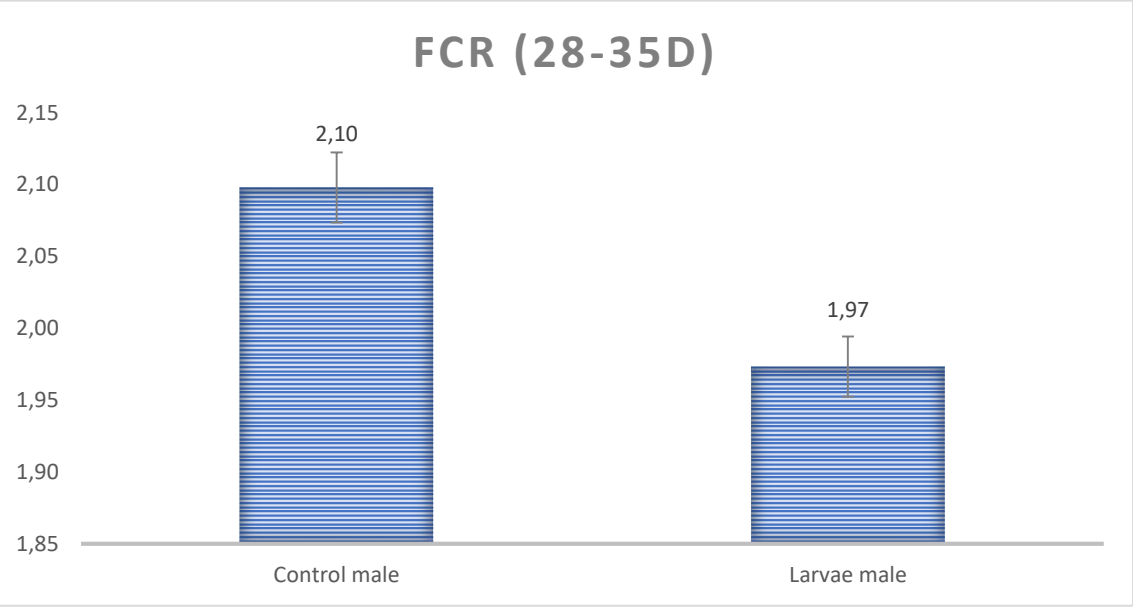


Figure 7. FCR of treated and control female groups during the second period (35-82d) (n = 6 pen; 10 birds/pen). *P<0.05

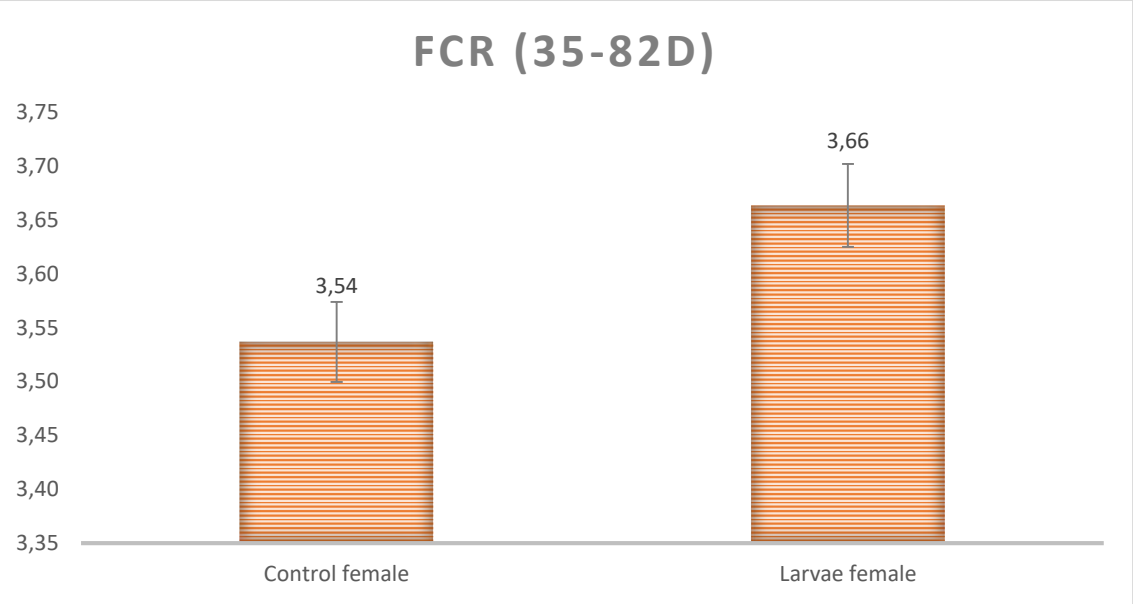


Figure 8. FCR of treated and control female groups during the whole period (28-82d) (n = 6 pen; 10 birds/pen). *P<0.05

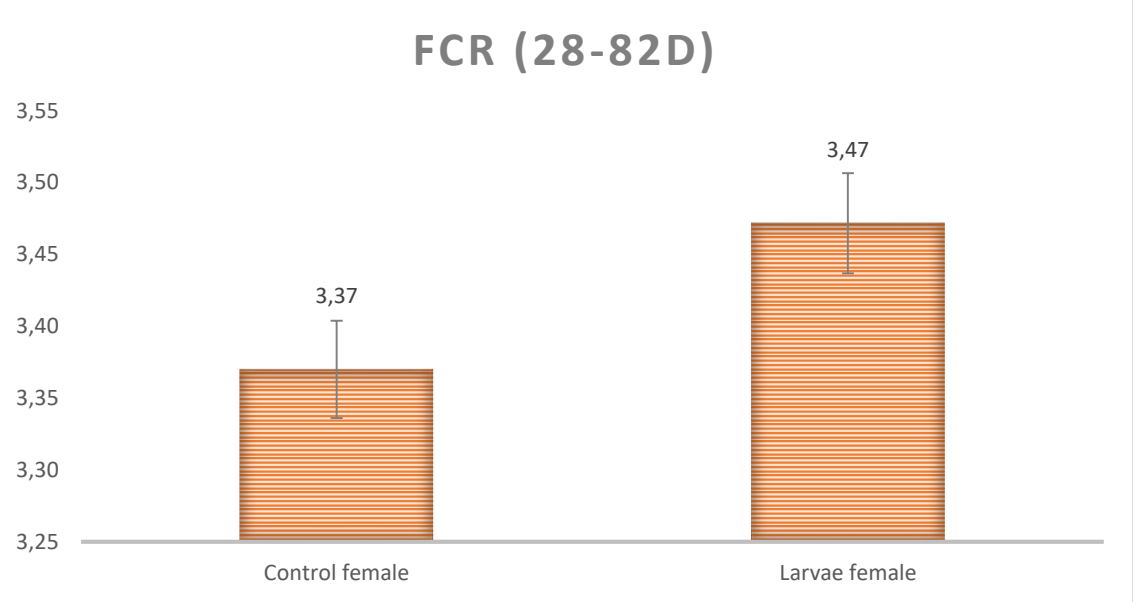
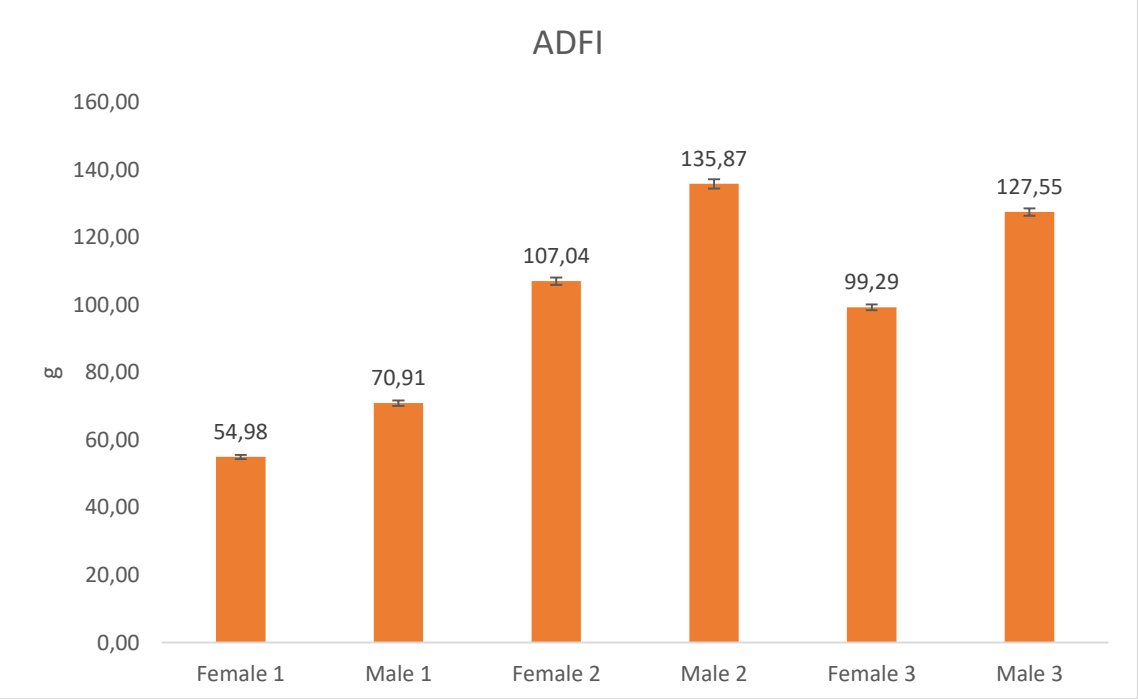


Figure 9. ADFI of males and females during the 3 growing periods considered (n = 12 pen; 10 birds/pen). ***P<0.001



References

References:

1. Castellini C., Berri C., Le Bihan-Duval E. and Martino G. (2008). Qualitative attributes and consumer perception of organic and free-range poultry meat, World's Poultry Science Journal. 64, 500-512.

2. Devatkal S. K., Naveena B. M. and Kotaiah T. (2019). Quality, composition, and consumer evaluation of meat from slow-growing broilers relative to commercial broilers. Poultry Science. 98, 6177-6186.

3. Pinto Da Rosa P., Pio Ávila B., Damé Veber Angelo I., Garavaglia Chesini R., Albandes Fernandes T., Da Silva Camacho J., Bugoni M., Roll V.F.B. and Gularte M.A. (2021). Impact of different chicken
meat production systems on consumers' purchase perception. British Poultry Science. Online early view, doi: 10.1080/00071668.2020.1857335.

4. Jia F., Peng S., Green J., Koh L. and Chen X. (2020). Soybean supply chain management and sustainability: A systematic literature review. Journal of Cleaner Production. 255, Online early view, doi: 10.1016/j.jclepro.2020.120254.

5. Soglia D., Sartore S., Maione S., Schiavone A., Dabbou S., Nery J., Zaniboni L., Marelli S., Sacchi P. and Rasero R. (2020). Growth performance analysis of two Iitalian slow-growing chicken breeds: Bianca di Saluzzo and Bionda Piemontese. Animals. 10, article n. 969.

6. Van Huis A. (2013). Potential of Insects as Food and Feed in Assuring Food Security. Annual Review of Entomology. 58, 563-83.

7. Józefiak D., Józefiak A., Kierończyk B. and Rawski M. (2016). Insects - a natural nutrient source for poultry – a review. Annals of Animal Science. 16, 297-313.

8. Allegretti G., Talamini E., Schmidt V., Bogorni P.C., Ortega E. (2017). Insect as feed: An emergy assessment of insect meal as a sustainable protein source for the Brazilian poultry industry. Journal of Cleaner Production. 171, 403-412.

9. Barragan-Fonseca K.B., Dicke M. and van Loon J.J.A. (2017). Nutritional value of the black soldier fly (Hermetia illucens) and its suitability as animal feed – a review. Journal of Insects as Food and Feed. 3(2), 105-120.

10. Bellezza Oddon S., Biasato I., Imarisio A., Pipan M., Dekleva D., Colombino E., Capucchio M.T., Meneguz M., Bergagna S., Barbero R., Gariglio M., Dabbou S., Fiorilla E., Gasco L. and Schiavone A. (2021). Black soldier fly and yellow mealworm live larvae for broiler chickens: Effects on bird performance and health status. J Anim Physiol Anim Nutr. 105: 10-18.

POULTRYNSECT

This project has received funding from transnational funding bodies, partners of the H2020 ERA-NETs SUSFOOD2 and CORE Organic Cofund, under the Joint SUSFOOD2/CORE Organic Call 2019. This document reflects only the author's view and the transnational funding bodies are not responsible for any use that may be made of the information it contains.