



UNIVERSITÀ
DEGLI STUDI
FIRENZE

FLORE

Repository istituzionale dell'Università degli Studi di Firenze

Effect of diets containing *Hermetia illucens* on rainbow trout microbiota: DGGE and NGS approaches

Questa è la Versione finale referata (Post print/Accepted manuscript) della seguente pubblicazione:

Original Citation:

Effect of diets containing *Hermetia illucens* on rainbow trout microbiota: DGGE and NGS approaches / Leonardo Bruni, Vesna Milanovic, Lucia Aquilanti, Giuliana Parisi. - In: ITALIAN JOURNAL OF ANIMAL SCIENCE. - ISSN 1828-051X. - ELETTRONICO. - (2021), pp. 0-0. (ASPA 24th Congress Padova (Italy) 21-24 September 2021) [10.1080/1828051X.2021.1968170].

Availability:

The webpage <https://hdl.handle.net/2158/1244280> of the repository was last updated on 2021-09-28T10:58:57Z

Publisher:

Taylor and Francis

Published version:

DOI: 10.1080/1828051X.2021.1968170

Terms of use:

Open Access

La pubblicazione è resa disponibile sotto le norme e i termini della licenza di deposito, secondo quanto stabilito dalla Policy per l'accesso aperto dell'Università degli Studi di Firenze (<https://www.sba.unifi.it/upload/policy-oa-2016-1.pdf>)

Publisher copyright claim:

Conformità alle politiche dell'editore / Compliance to publisher's policies

Questa versione della pubblicazione è conforme a quanto richiesto dalle politiche dell'editore in materia di copyright.

This version of the publication conforms to the publisher's copyright policies.

La data sopra indicata si riferisce all'ultimo aggiornamento della scheda del Repository FloRe - The above-mentioned date refers to the last update of the record in the Institutional Repository FloRe

(Article begins on next page)



Official Journal of
the Animal Science
and Production
Association (ASPA)

Italian Journal of
Animal Science



italian
journal
of
animal
science

ASPA 24th CONGRESS
Padova, September 21-24, 2021
Book of Abstracts

Italian Journal of Animal Science



ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/tjas20>

ASPA 24th Congress Book of Abstract

Roberto Mantovani & Alessio Cecchinato

To cite this article: Roberto Mantovani & Alessio Cecchinato (2021) ASPA 24th Congress Book of Abstract, Italian Journal of Animal Science, 20:sup1, 1-236, DOI: [10.1080/1828051X.2021.1968170](https://doi.org/10.1080/1828051X.2021.1968170)

To link to this article: <https://doi.org/10.1080/1828051X.2021.1968170>



© 2021 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 21 Sep 2021.



Submit your article to this journal [↗](#)



View related articles [↗](#)



View Crossmark data [↗](#)

Italian Journal of Animal Science

Official Journal of the Animal Science
and Production Association

Online ISSN: 1828-051X

Editor-in-Chief

Marcello Mele, University of Pisa (Italy)
Email: marcello.mele@unipi.it

Associate Editors

Umberto Bernabucci, University of Tuscia, Viterbo (Italy)
Email: bernab@unitus.it
Subject area: Production physiology and biology

Alessio Cecchinato, University of Padova (Italy)
Email: alessio.cecchinato@unipd.it
Subject area: Animal genetics and breeding

Federica Cheli, University of Milano (Italy)
Email: federica.cheli@unimi.it
Subject area: Ruminants nutrition and feeding

Jean-François Hocquette, INRA (France)
Email: jean-francois.hocquette@inra.fr
Subject area: Animal food quality and safety

Antonino Nizza, University of Napoli (Italy)
Email: nizza@unina.it
Subject area: Non-ruminants nutrition and feeding

Paolo Trevisi, University of Bologna (Italy)
Email: paolo.trevisi@unibo.it
Subject area: Non-ruminants nutrition and feeding

Eleni Tsiplakou, Agricultural University of Athens (Greece)
Email: eltsiplakou@aua.gr
Subject area: Livestock systems, management and environment

Giuliana Parisi, University of Firenze (Italy)
Email: giuliana.parisi@unifi.it
Subject area: Aquaculture, poultry, companion and wildlife

Section Editors

Alessandro Agazzi, University of Milano (Italy)
Email: alessandro.agazzi@unimi.it

Susana Alves, Universidade Técnica de Lisboa (Portugal)
Email: susanaalves@fmv.ulisboa.pt

Gianni Battaccone, University of Sassari (Italy)
Email: battacon@uniss.it

Luca M. Battaglini, University of Torino (Italy)
Email: luca.battaglini@unito.it

Ali-Reza Bayat, Natural Resources Institute (Finland)
Email: alireza.bayat@luke.fi

Francesca Bertolini, Technical University of Denmark (Denmark)
Email: franb@aqu.dtu.dk



Taylor & Francis
Taylor & Francis Group



Massimo Bionaz, Oregon State University (USA)

Email: massimo.bionaz@oregonstate.edu

Alessio Bonaldo, University of Bologna (Italy)

Email: alessio.bonaldo@unibo.it

Adriana Bonanno, University of Palermo (Italy)

Email: adriana.bonanno@unipa.it

Fulvia Bovera, University of Napoli (Italy)

Email: bovera@unina.it

Salvator Calvet Sanz, Polytechnic University of Valencia (Spain)

Email: salcalsa@upvnet.upv.es

Alessio Cecchinato, University of Padova (Italy)

Email: alessio.cecchinato@unipd.it

Beniamino T. Cenci Goga, University of Perugia (Italy)

Email: beniamino.cencigoga@unipg.it

Alberto Cesarani, University of Sassari (Italy)

Email: acesarani@uniss.it

Stefania Chessa, University of Torino (Italy)

Email: stefania.chessa@unito.it

Alessandro Dal Bosco, University of Perugia (Italy)

Email: alessandro.dalbosco@unipg.it

Juan Vicente Delgado Bermejo, University of Córdoba (Spain)

Email: juanviagr218@gmail.com

Marion Girard, Agroscope (Switzerland)

Email: marion.girard@agroscope.admin.ch

Flaviana Gottardo, University of Padova (Italy)

Email: flaviana.gottardo@unipd.it

Andrea Minuti, "Sacro Cuore" Catholic University, Piacenza (Italy)

Email: andrea.minuti@unicatt.it

Gianluca Neglia, University of Napoli (Italy)

Email: neglia@unina.it

Anna Nudda, University of Sassari (Italy)

Email: anudda@uniss.it

Johan Osorio, South Dakota State University (USA)

Email: johan.osorio@sdstate.edu

Manuela Renna, University of Torino (Italy)

Email: manuela.renna@unito.it

Evangelia Sossidou, Veterinary Research Institute, NAGREF Campus, Thessaloniki (Greece)

Email: sossidou.arig@nagref.gr

Giuseppe Stradaoli, University of Udine (Italy)

Email: giuseppe.stradaoli@uniud.it

Hai-Jun Zhang Feed Research Institute, Chinese Academy of Agricultural Sciences Beijing (China)

Email: fowlfeed@163.com

Italian Journal of Animal Science

The *Italian Journal of Animal Science* is an international peer-reviewed open access journal publishing original scientific papers, reviews and short communications.

The journal serves as essential reading for animal scientists, technicians and all those who research animal production.

The journal encourages submissions of international relevance on the following subjects:

- Animal derived food quality and safety
- Animal genetics and breeding
- Aquaculture, poultry, companion and wild game animals
- Livestock systems, management and environment
- Non-ruminant or ruminant nutrition and feeding
- Production physiology and functional biology of farmed, companions and wild game animals.
- Animal behavior
- Animal welfare
- In vitro studies that have an application to farmed livestock

Manuscripts must address topics based on research at molecular, cellular, organ, whole animal and production system levels. Manuscripts discussing milk or meat analysis and compositions must show a direct link to either livestock production system, product quality, animal feeding/nutrition, animal genetics or breeding. Manuscripts describing laboratory animal models will be considered where the study highlights a potential benefit to farmed livestock.

Submissions discussing epidemiology, parasitology, infective diseases, food-borne diseases do not fit with the aims and scope of the journal.

Meeting reviews, book reviews and conference supplements are also published, as well as news and guidelines from the Animal Science and Production Association (ASPA). We welcome submissions from ASPA members and non-members alike.

Article publishing charge

The standard article publishing charge (APC) for this journal is US\$900 / €795 / £690. Depending on your location, these charges may be subject to local taxes.

For members of the Animal Science and Production Association, the publication fee is US\$450 / €400 / £345. Depending on your location, these charges may be subject to local taxes. There are no submission charges for this journal.

Peer Review Statement

The publication of manuscripts is subject to the approval of referees and in agreement with the Editorial Advisory Board's opinions. All peer review is single blind and submission should be online via ScholarOne Manuscripts. Referees will be selected from among qualified scientists in the international scientific community.

Submitting your paper

This journal uses ScholarOne Manuscripts (previously Manuscript Central) to peer review manuscript submissions. Please read the guide for ScholarOne authors before making a submission. Please submit your paper in the author centre at <https://mc.manuscriptcentral.com/tjas>

Italian Journal of Animal Science

volume 20, supplement 1, 2021

ASPA 24th Congress

Padova, September 21-24, 2021

Guest Editors

Roberto Mantovani (Coordinator), Alessio Cecchinato, Giovanni Bittante, Maurizio Ramanzin, Lucia Bailoni, Mauro Penasa, Flaviana Gottardo, Sara Pegolo, Giorgio Marchesini, Rebecca Ricci, Cristina Sartori, Marco Cullere, Marco Birolo, Severino Segato, Valentina Bonfatti, Marta Brscic, Luigi Gallo, Stefano Schiavon, Franco Tagliapietra

Table of Contents

<hr/> MAIN LECTURES		<hr/> POSTERS	103
Management strategies to improve animal health, welfare and resilience	1	<hr/> INDEX OF AUTHORS	196
Nutritional profile of food	1		
<hr/> ORAL COMMUNICATIONS			
Alternative feeds and waste recycling	16		
Nutritional profile of food	18		

ASPA 24th Congress

Padova, September 21-24, 2021

ORGANIZING COMMITTEE

Lucia Bailoni (President)
Luigi Gallo (Secretary)
Roberto Mantovani (Secretary)
Igino Andrighetto
Paolo Berzaghi
Paolo Carnier
Martino Cassandro
Giulio Cozzi
Antonella Dalle Zotte
Massimo De Marchi
Chiara Rizzi
Angela Trocino
Rina Verdiglione
Gerolamo Xiccato

SCIENTIFIC COMMITTEE

Giovanni Bittante (President)
Marco Cullere (Secretary)
Marco Birolo
Valentina Bonfatti
Marta Brscic
Cecchinato Alessio
Flaviana Gottardo
Giorgio Marchesini
Sara Pegolo
Mauro Penasa
Maurizio Ramanzin
Rebecca Ricci
Cristina Sartori
Severino Segato
Stefano Schiavon
Enrico Sturaro
Franco Tagliapietra

sealant and oral administration of 200 mL of homogenate *A. arborescens*. *Aloe arborescens* was administered in the morning during the distribution of the total mixed ration for 14 days (7 days before up to 7 days after drying). For 16S rRNA-gene sequencing and volatilome analyses, rumen liquor and fecal matter were collected fourteen days before (T0) dry-off, at drying-off (T1) and seven days after dry-off (T2, only fecal samples). The V3-V4 hypervariable regions of the bacterial 16S gene was sequenced in two MiSeq (Illumina) runs with 2 × 250-base paired-end reads. No significant differences were observed for alpha- and beta-diversity between treatments along the three timepoints in the rumen microbiome. Conversely, according to all indices except evenness (equitability, simpson_e) the alpha diversity of the hindgut microbiome increased significantly (p-values in the range 0.002 – 0.011) in the ASIG group at T2. Regarding beta-diversity, the hindgut microbiome showed a statistically significant (p-value = 0.0479) separation between treatments. Independently from sampling time and treatments, the bacterial community of the hindgut was dominated by Bacteroidetes (~40%) and Firmicutes (~48%); rumen showed prevalence of Bacteroidetes (~45%), Firmicutes (~25%) and Proteobacteria (~12%). In rumen, due to the high variability for all the metabolites no significant differences were observed between T0 and T1. In conclusion, the dietary supplementation with *Aloe arborescens* seems to have a sizable effect on the composition of the dairy cow gut microbiome, but not at the rumen level.

Acknowledgements

RABoLa, co-funded by the Region Lombardia D.d.s.21.12.2018 n. 19442.

P137

Insights into the faecal microbial phenotyping of pig using a Biolog EcoPlate[®] method

Diana Luise, Alice Checucci, Federico Correa, Paolo Bosi, Paola Mattarelli, Paolo Trevisi

Dipartimento di Scienze agrarie e alimentari (DISTAL), Alma Mater Studiorum-University of Bologna, Bologna, Italy, DISTAL, Bologna, Italy

Contact diana.luise2@unibo.it

Gut microbiota plays a key role in the development and maintenance of health on livestock and contributes to their productive efficiency. Although gut microbiota taxonomy characterization has been increasingly investigated, little is known about its functional characteristics and phenotyping. To fill this gap, Biolog EcoPlates[™] could be applied, however, little is known about its application on pig gut samples. This study aims at evaluating the use of Biolog EcoPlates[™] to characterize the metabolic potential and activity of the microbial community and to investigate the effect of (1) different storage conditions (fresh vs. frozen) (2)

optimal cell concentrations (3) specific length of storage conditions of pig faeces.

Two assays were performed aimed at evaluating differences in the metabolic activities between fresh and snap-frozen faeces at different dilutions (approximately 9 × 10⁵ cells/g, 9 × 10⁴ and 9 × 10³ cells/g) and at different times of storage at –80 °C [15 h (T0) and 15 (T1), 45 (T2) and 150 (T3) days after collection]. Furthermore, the V3-V4 regions of the 16S rRNA gene were analysed to describe the biodiversity of community composition and predicted functionality.

Metabolic capacity of microbial community was detected for 31 lyophilized relevant C substrates, that were grouped by chemical classes (8 carbohydrates, 8 carboxylic acids, 4 polymers, 6 amino acids, 2 amines and 3 miscellaneous substrates). Results highlighted that snap freezing of pig faecal samples preserved the metabolic activity of the microbial community compared with fresh faeces ($p > .1$). Sample storage at –80 °C for 150 days did not affect the metabolism of the microbial community, whose activity remained stable throughout the study period ($p > .1$). The carbon source utilization by pig faecal microbiota was significantly affected by bacterial cell density ($p < .05$). A cell concentration of 10⁴ and 10⁵ cells/g allowed detecting the highest metabolic activity of the microbial community. Overall, after 96 h of incubation, carbohydrates were the most frequently metabolized carbon source, while amines were the least.

In conclusion, results evidenced that the functional metabolic activity of the pig faecal microbial community can be preserved without significant variation until 150 days of storage at –80 °C. The Biolog EcoPlates[™] technology represents a rapid and useful method to explore the metabolic capabilities of the microbial community in animal samples.

P138

Effect of diets containing *Hermetia illucens* on rainbow trout microbiota: DGGE and NGS approaches

Leonardo Bruni, Vesna Milanović^b, Lucia Aquilanti^b, Giuliana Parisi^a

^a*Dipartimento di Scienze e Tecnologie Agrarie, Alimentari, Ambientali e Forestali, University of Florence (UNIFI), Firenze, Italy*

^b*Dipartimento di Scienze Agrarie, Alimentari e Ambientali, Polytechnic University of Marche (UNIVPM), Ancona, Italy*
Contact leonardo.bruni@unifi.it

Hermetia illucens (Diptera: Stratiomyidae; H) larvae are commonly studied as aquafeed ingredient due to their nutritional composition comparable to that of fishmeal. Different dietary formulations are reported to have different effects on fish gut microbiota, which, in turn, modulate fish digestion, immunity, energy balance, social behaviour and more. The previous studies reported contradictory results regarding the effect of insect-based

diets on the microbiota of salmonids. Moreover, to the author's knowledge, the effect of dietary full-fat insects on fish microbiota has not been addressed up to now.

To fill the above-mentioned gap, the aim of this study was to elucidate the effect of a diet containing full-fat H larvae meal (H50, 50% substitution level of fishmeal with full-fat H larvae) on the gut microbiota of rainbow trout (*Oncorhynchus mykiss*) in comparison to a control diet containing fishmeal (H0). Microbial DNA from pyloric caeca mucosa (PC), pyloric intestine content (PIC), mid intestine mucosa (MI) and mid intestine content (MIC) from five fish samples per diet was extracted and subjected to denaturing gradient gel electrophoresis (DGGE) and high-throughput sequencing (MiSeq, Illumina; HTS). Irrespective of the diet, the analysis of selected DGGE bands (excision, sequencing and closest relative search on BLASTN, NCBI) showed that the microbial communities were dominated by *Bacillus* sp. and *Staphylococcus* sp., with sparse *Streptococcus* sp., *Mycoplasma* sp. and *Shigella* sp. Bacterial relative abundances resulting from HTS analysis showed the domination of Proteobacteria in all samples (up to 85% relative abundance), followed by Firmicutes, Actinobacteria and Bacteroidetes. Fusobacteria were almost only found in MIC and PIC extracted from fish fed H0 diet. The differences between dietary groups were not captured by alpha-diversity (observed OTUs, Shannon's entropy, Pielou's evenness, tested with a Kruskal–Wallis test) or beta-diversity indices (unweighted unfrac, Jaccard, robust Aitchison metrics, plotted on PCoA and tested with a PERMANOVA).

Further studies with a higher number of replicates might be able to find significant differences between dietary treatments and are needed to postulate a clearer hypothesis on the microbiota structure and diversity in fish fed dietary insects. That knowledge would pave the way to unravelling the functions of the microbiota and to understand the mechanistic laws at the root.

P139

Anthocyanins dietary supplementation in lambs: effects on gut microbiome

Maria Federica Sgarro^a, Pasquale De Palo^a, Aristide Maggiolino^a, Francesca Rita Dinardo^a, Massimo Ferrara^b, Giuseppina Mulè^b

^aMedicina Veterinaria, University of Bari, Valenzano, Italy

^bIstituto di Scienze delle Produzioni Alimentari, National Research Council, Bari, Italy

Contact mariafederica.sgarro@gmail.com

In ruminants, the gastrointestinal tract is colonized by highly concentrated and variable populations of microorganisms, particularly bacteria, archaea, fungi, ciliated protozoa and viruses. Age, diet and management influence bacterial community both for proportions and for diversity. At the first stages after lambing, lambs are functional monogastric animals and low rumen

bacterial activity leads to a greater influence of the diet on the gut microbiome composition. The aim of the present study is to assess the effect of anthocyanins on the fecal bacterial microbiome and microbiota of lambs. A total of 44 Merino male lambs of 25 days were randomly divided in a control group (CG; $n = 22$) and anthocyanins group (AG; $n = 22$). All lambs were fed with alfalfa hay and starter ad libitum and only the AG received a red orange and lemon extract with an 85% anthocyanin concentration (90 mg/kg live weight calculated each two days). Lambs were slaughtered at 40 days and fecal samples were sterile collected from rectum and frozen at -20°C until analysis. Analysis of fecal microbiome was carried out by metabarcoding analysis of 16S rRNA. After reads denoising, sequences were aligned against SILVA rRNA sequence database using MALT, and taxonomic binning was performed with MEGAN. Regardless of the dietary treatment, Proteobacteria and Firmicutes were the predominant bacterial phyla identified. The amount of Firmicutes was 10% and 15% in the AG and CG respectively. Moreover, the amount of Actinobacteria was almost two-fold in the AG than CG. At genus level, Acinetobacter percentage of number of reads recorded double values in the AG than CG, while an increase of Psychrobacter and Streptomyces was observed in AG compared to CG. Dietary supplementation of anthocyanins reduced the relative abundance of Enterobacteriaceae as *Escherichia coli* and *Salmonella* compared to the CG. These results are consistent with some studies carried out on lambs and using other phenolic compounds. Results indicate that the dietary supplementation with anthocyanins in lambs inhibits the growth of some potential pathogenic gram-negative bacteria. These outcomes encourage further studies aiming to deepen knowledge on this topic, as a potential way for reducing the use of antimicrobial substances, as well as improving animals' health and welfare status.

P140

Multi-omics approach to assess the effects of a dual mode synbiotic supplementation on gut health and performance of broiler chickens

Giorgio Brugaletta^a, Luca Laghi^a, Marco Zampiga^a, Basharat Syed^b, Luis Valenzuela^b, Federico Sirri^a

^aDipartimento di Scienze e Tecnologie Agro-Alimentari, Alma Mater Studiorum – University of Bologna, Bologna, Italy

^bBiomin Holding, Biomin Holding, Getzersdorf, Austria
Contact giorgio.brugaletta2@unibo.it

Feeding pre- and pro-biotics to broilers immediately after hatch and during growth has led to positive health and performance outcomes. Such strategy could synergistically affect gut health establishment and preservation. Hence, this hypothesis was tested by