AgroStat

Marseille, 14-16 March 2018

Due to the increasing quantity of data in agrosciences, there is a need for specific tools which place statistics and data science at the heart of challenges of the contemporary world. The AGROSTAT conference gives statisticians, engineers and users of statistical methods a unique opportunity to exchange around topics, such as sensometrics, chemometrics, experimental designs, risk analysis, process control or big data.

This event brings together internationally recognized academic and industrial organizations representatives, to take stock of advances in statistics, express their needs and to anticipate future challenges.

This conference, which is held every two years, is organized this year by **Aix-Marseille University,** the "Mediterranean Institute of Biodiversity and Marine and Continental Ecology", UMR CNRS 7263 / IRD 237, team Toxicology & Environmental Health (TSE), under the auspices of the Agro-Industry Group of the French Statistical Society (SFdS). The SFdS is a non-profit organization bringing together researchers, engineers, teachers and statistics users.

SCIENTIFIC COMMITTEE:

- El Mostafa QANNARI (Oniris, France – President)
- Michelle SERGENT (Aix-Marseille University, France - Co-presidente)
- Stéphanie BOUGEARD (Anses Ploufragan, France)
- Damien BREMAUD (L'Oréal, France)
- Per BROCKHOFF (Technical University of Denmark, Denmark)
- Philippe COURCOUX (Oniris, France)
- Bernadette GOVAERTS (UC Louvain, Belgium)
- El Mestafa HADRAMI (FST, Fes, Morocco)
- Sébastien LE (AgroCampus Ouest, France)
- Sébastien MARQUE (Capionis, France)
- Hal MCFIE (Hal MacFie Sensory Training Ltd, Great Britain)
- Nicolas PINEAU (Nestlé, Switzerland)
- Michael MEYNERS (P&G, Germany)
- Pascal SCHLICH (INRA Dijon, France)
- Douglas RUTLEDGE (AgroParisTech, France)

ORGANIZING COMMITTEE :

- Michelle SERGENT (Aix-Marseille University, IMBE, France)
- Magalie CLAEYS-BRUNO (Aix-Marseille University, IMBE, France)
- Valérie DEYRIS (Aix-Marseille University, ISM2, France)
- Franck TORRE (Aix-Marseille University, IMBE, France)
- Marine BERRO (Aix-Marseille University, IMBE, France)

Wednesday 14 March

9h00			**Welcome speech - M. SERGENT, M. QANNARI**
		Inaugural conference	
9h15	**PL1**	**B. K. Ersbøll**	**Big Data from Farm to Fork, advantages and challenges**
		Session 1: BIG DATA/MACHINE LEARNING/DEEP LEARNING - Chair: S. Marque	
10h20	**O01**	P. Rebenaque	Automated analysis of tasting comments in sensory analysis
10h40	**O02**	M.-B Blanquart	Impact of the questionnaire structure on overall results in preference mapping: a meta-analysis on 285 consumer studies
11h00	**O03**	S. Bougeard	Current multiblock methods: competition or complementarity? A comparative study in a unified framework
11h20			***Coffee break***
		Session 2: DEVELOPMENT TOOLS - Chair: D. Brémaud	
11h50	**O04**	N. Pineau	Use of R-Shiny apps to communicate sensory and consumer modeling tools outputs
12h10	**O05**	I. Rebhi	An interactive shiny tool for sensory and consumer data mapping : sensmapui
12h30			***Lunch***
		Session 3: CHEMOMETRICS - Chairs: D. Rutledge/ E. Vigneau	
14h00	**PL2**	**P. Bastien**	**Use of sparse methods in cosmetics**
15h00	**O06**	B. Jaillais	Random forests for the prediction of water content by near-infrared hyperspectral imaging spectroscopy in biscuits
15h20	**OO7**	C. Peltier	What is the better test to detect multivariate differences in large dimensional data?
15h40	**O08**	D.N. Rutledge	Comparison of Principal Components Analysis, Independent Components Analysis and Common Components Analysis
16h00			***Coffee break***
16h30	**O09**	E. Vigneau	Analyse des relations entre plusieurs blocs de données par l'approche Path-Comdim: une application pour évaluer la qualité environnementale sur le littoral atlantique français
16h50			**Poster presentations**
17h15			POSTER SESSION
18h00			***Welcome Reception: Les Halles de la Major***

Thurs day 15 March

Session 4: SENSOMETRICS - Chairs : Ph. Courcoux / P. Schlich

8h45	**PL3**	**J. Castura**	**Consumer diversity in sensory evaluation data**
9h30	**O10**	M. Brard	A latent class regression model for the clustering of multivariate binary ratings
9h50	**O11**	E. Qannari	One thousand and one ways to analyze free sorting data
10h10	**O12**	N. Pineau	CATA as an alternative method to free sorting
10h30			***Coffee break***
11h00	**O13**	F. Llobell	Clustatis: a cluster analysis of multiblock datasets. application to sensometrics
11h20	**O14**	G. Lecuelle	Modeling temporal dominance of sensations data with stochastic processes
11h40	**PL4**	**B. Boulanger**	**Round table: The world beyond p-values: how to make research in the 21st?**
12h30			***Lunch & posters***
14h30			***SOCIAL EVENT***
19h30			***Gala diner : Reverso - Les Terrasses du port***

Friday 16 March

Session 5: EXPERIMENTAL DESIGNS - Chairs: M. Claeys/M. Sergent			
9h00	**PL5**	**J-P Gauchi**	**Metamodeling and global sensitivity analysis for computer models with correlated input**
9h45	**O15**	S. Marque	Plan d'expériences et simulations sur le contrôle qualité des contaminants microbiologiques de produits finaux
10h05	**O16**	Q. Carboué	Experimental design and solid state fermentation: a holistic approach to improve cultural medium for the production of fungal metabolites
10h25			***Coffee break***
10h55	**O17**	V. Rodrigues	Food source attribution of human campylobacteriosis by meta-analysis of case-control studies
11h15	**O18**	U. Gonzales-Barron	An extended bigelow-type meta-regression model describing the heat resistance of neosartorya spores
11h35	**O19**	V. Cadavez	Dynamic determination of optimum growth rate of listeria monocytogenes in minas soft cheese during cold shelf-life
11h55		P. Schlich	Statistical analysis of chocolate tasting data obtained from participants
12h15			***Closing of the conference, Awards*** ***Lunch***

DUODENAL MORPHOMETRY OF CHICKENS FED WITH *Schizochytrium* spp. ALGAE EXTRACT SUPPLEMENT

Andiara Gonçalves-Tenório[1], Patricia F. de Freitas[2], Sabrina E. Takahashi[2], Patricia Rossi[2], Ursula Gonzales-Barron[1] and Vasco Cadavez[1]

[1]CIMO Mountain Research Centre, School of Agriculture (ESA), Polytechnic Institute of Bragança, Portugal
[2]Federal Technological University of Paraná, Brazil (UTFPR)
E-mail: andiaragoncalves@gmail.com

Abstract

Currently, there is a search for feed supplements aimed at improving efficiency in the production of meat broilers. One supplement option that has shown satisfactory results in other species is algae. For such, this work had as objective to evaluate the effect of the addition of microalgae extract in feed on poultry duodenum. The development of duodenum villi and crypts was assessed at 7 and 35 days of age of broiler chickens fed with *Schizochytrium* spp. (EMS) supplement. Using a mixed-effects models, it was found that after 7 days, EMS supplementation did not alter the morphological characteristics of the duodenum; however, a slight increase ($P>0.05$) at the height of the villi (HV) and the size of the crypt region (CR) was observed in the diet with 0.3% EMS. At 35 days of age, birds supplemented with 0.3% EMS presented higher ($P<0.05$) villus height, higher ($P<0.05$) crypt region, and consequently higher ($P<0.05$) HV:CR ratio. Comparing birds fed without special diet (control) and those with ESM treatments, it was demonstrated that the supplementation had a positive effect ($P<0.05$) on the morphometric measurements of the duodenum.

Keywords: Broiler, algae, feed, intestine, villi, crypt

INTRODUCTION

Additives used to feed broilers are intended to improve the health of the gastrointestinal tract, increase growth rate and feed efficiency. Among them, the algae extract has been used as feed supplement in several species of meat-producing animals, with satisfactory results in quails, swine and fish. Algae are sources of proteins, carbohydrates, fibers, minerals and vitamins, however the bioavailability of nutrients depends on their chemical composition and the animal species. The potential of algae as a feed supplement can be assessed by their effects on the animal's digestive system. In this way, the study of intestinal morphometry is essential since the digestive system is responsible for the digestion of food, the absorption of nutrients and the elimination of undigested residues. The absorption of nutrients occurs mainly in the small intestine, which is also responsible for digestion. Thus, the size of the villi depends on the number of cells that compose them: the greater the number of cells, the larger the villus size, which in turn corresponds to a greater area for nutrient absorption. Hence, the objective of this work was to evaluate the effect of the addition of microalgae extract *Schizochytrium* spp. (EMS) in feed on the development of broilers' duodenum villi at 7 and 35 days of age.

METHODOLOGY

Animals and diet

After approval the Ethics Committee on Animal Use (CEUA) of UTFPR (Dois Vizinhos Campus, Protocol no. 2013-003), the research was conducted in the UTFPR experimental aviary, located at latitude 25° 44'01" S and longitude 53° 03'26" W, at an average altitude of 509 m. A total of 760 one-day old female chicks of the Cobb lineage with an average weight of 49±10 g were used. The chicks were housed in the experimental aviary, with bed of wood shavings, divided into boxes of 1.2 m^2. At the beginning of the trial, the chicks were randomly distributed in eight blocks, and the five treatments (0.00 (control), 0.30, 0.60 0.90 and 1.2% of EMS/kg dry matter feed) were allocated within each block, while villi and crypt measurements were taken at day 7 and 35 of age. Food and water were supplied *ad libitum*, using tubular feeders and *nipple* type drinking fountains. During the first week of life, the ambient temperature was adjusted to 35° C and, afterwards kept to 25° C until the end of the trial. Light programming was performed according to the Cobb lineage manual specifications.

Collection, treatment and analysis of intestinal tissue samples

For the collection of tissues, two birds were selected per block at 7 and 35 days of age, which were slaughtered by cervical disarticulation and necropsied to collect approximately 3 cm of tissue from the first

third of the duodenum. The tissue fragments were processed after immersing in paraffin [1], were cut in a microtome with a thickness of 5 µm. Histological sections were stained with Hematoxylin and Eosin [2], and the villus height and villus crypt region were measured in quintuplicate using a light photomicroscope coupled to a computer with an image analysis software (UTHSCSA ImageTool, Version 3.0).

Statistical Analysis

The experimental work was carried out according to a randomized complete block design. The data obtained was analyzed using a mixed model as described,

$$Y_{ijkl} = ESM_i + weight_j + ESM(weight)_{ij} + u_{k(l)} + e_{ijkl}$$

with:

Y_{ijlk}: measure of intestinal villi or crypt; ESM_i: fixed effect of ESM concentration *i*, $weight_j$: fixed effect of bird weight *j*; $ESM(weight)_{ij}$: nested fixed effect of bird weight within the ESM concentration; $u_{k(l)}$: random effects due to bird *l* nested within block *b*; and e_{ijkl}: experimental error.

RESULTS

At 7 days of age, EMS-supplemented feed did not cause any change in the duodenum morphological characteristics (Table 1). However, a slight increase (P>0.05) in villus height (HV) and crypt region (CR) size in the diet supplemented with 0.3% EMS was observed. The inability to detect differences compared to the control treatment may be associated with the high between-bird variability. In fact, the random effects placed on bird explained 71%, 38% and 33% of the variation in HV, CR and HV:CR, respectively. At 35 days of age, birds supplemented with 0.3% EMS had higher (P<0.05) villus height, higher (P<0.05) crypt region size and higher (P<0.05) HV:CR ratio (Table 1). In HV and CR measurements, the difference between the control mean and the pooled ESM treatments' mean showed that, overall, the supplementation had a positive effect (P<0.05) on both morphometric measurements of the duodenum. The increase in villi is associated with increased digestive capacity and absorption of the intestine, as the area of the absorbent surface and nutrient transport systems increases. This relationship is directly linked with increased volume of intestinal epithelial cells. The crypts have three types of cells whose functions are different: enterocytes that have direct involvement in immune regulation, transport, absorption and digestion of nutrients; the goblets that secrete a protective layer of mucus; and the enteroendocrine that are responsible for the release of the digestion hormones. The increase in number and size of the crypts is directly related to the proliferation of enterocytes. The presence of these cells is of great importance, since the epithelium of the small intestine is renewed with the propagation of these cells from the crypt to the villi. Based on these results, we can conclude that the supplementation of broiler feed with EMS leads to an improvement in the development of the intestinal tissue, as evaluated by the size of the villi and the crypt. However, further research is needed to identify the components of EMS that are responsible for such a positive effect on the intestinal development of broilers.

Table 1: Least-squares means and standard error of duodenum morphometric measurements in broilers fed with *Schizochytrium* spp. extract supplement (EMS)

		EMS concentration (g/100 g dry matter feed)			
7 days	Control	0.30	0.60	0.90	1.2
Villous Height	5.80 ± 0.063[a]	5.97 ± 0.063[a]	5.91 ± 0.063[a]	5.88 ± 0.064[a]	5.80 ± 0.064[a]
Crypt Depth	4.56 ± 0.059[a]	4.71 ± 0.060[a]	4.69 ± 0.060[a]	4.63 ± 0.059[a]	4.60 ± 0.061[a]
Villous:Cryp	1.29 ± 0.060[a]	1.26 ± 0.069[a]	1.21 ± 0.059[a]	1.28 ± 0.060[a]	1.21 ± 0.063[a]
35 days					
Villous Height	6.09 ± 0.053[b]	6.30 ± 0.069[a]	6.16 ± 0.059[ab]	6.22 ± 0.054[ab]	6.14 ± 0.064[ab]
Crypt Depth	4.72 ± 0.079[a]	4.73 ± 0.106[a]	4.66 ± 0.088[a]	4.72 ± 0.081[a]	4.56 ± 0.096[a]
Villous:Cryp	1.35 ± 0.093[a]	1.57 ± 0.125[b]	1.49 ± 0.104[ab]	1.51 ± 0.095[ab]	1.58 ± 0.114[b]

[a,b] Within the same row, means with different subscripts are significantly different (P < 0.05)

REFERENCES

[1] Ribeiro CAO, Reis F and SR Grötzner (2012).Técnicas e Métodos para Utilização Prática em Microscopia. Santos Press, Brazil. (In Portuguese).

[2] Beçak W and Paulete J (1976). Técnicas de citologia e histologia. Page 230. Livros 211 Técnicos e Científicos Press, Brazil (In Portuguese).