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Growth performance and carcass traits of heavy pigs fed diets with a partial to total replacement of soybean meal with spirulina powder

L. Gallo, G. Don, D. Giannuzzi, A. Toscano,
S. Schiavon
DAFNAE, University of Padova, Italy

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UNIVERSITÀ DEGLI STUDI DI PADOVA
DAFNAE
Department of Agronomy Food Natural
resources Animals and Environment



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Background

- increasing sustainability: primary goal of global pig sector
- feedstuffs production: associated with impact categories
- soybean (**SBM**) main protein source, but concerns for land occupation, land degradation and deforestation
- need for investigating alternative/novel protein sources
- interest for *Arthrospira platensis* (Spirulina, **SP**), due to:
 - its high protein content and valuable AA profile
 - decreased land use and competition with human food
- feasibility of replacing SBM with SP and replacement level?

- study performed within the frame of Agritech National Research Center, funded by the European Union Next-Generation EU
- task 5.3.4 focused on Alternative protein sources for animal nutrition
- ***aimed to evaluate the effects of a partial to full replacement of SBM with SP on growth and carcass traits of growing pigs***

Animals, husbandry and experimental design

- 88 crossbred pigs (gilts and barrows)
- 8 pens with fully slatted floor
- Each pen equipped with electronic feeder



Composition (g/kg DM)	SP	SBM
Dry matter (DM)	923	888
Crude Protein	711	490
Lysine	39.5	31.3
Meth + cys	21.6	14.8
Ether extract	85	17
NDF	nd	98
Starch	nd	62
Ash	76	71

Animals, husbandry and experimental design

- SP nucleus composed by SP (64%), sugar beet pulp and wheat meal
- after 15 d acclimation, pigs allotted to **4 dietary treatments** (2 pens/treatment):
 - a control diet (**SP00**) based on SBM + cereals
 - three experimental diets formulated replacing 33% (**SP33**), 66% (**SP66**) and 100% (**SP100**) SBM with SP nucleus

Diets characteristics (g/kg as fed)

50-90 kg BW	SBM	SP Nucleus	CP	Lys
SP00	185	0	155	7.4
SP33	124	63	156	7.4
SP66	63	124	158	7.4
SP100	0	185	160	7.6
90-140 kg BW	SBM	SP Nucleus	CP	Lys
SP00	155	0	149	8.0
SP33	104	52	145	8.2
SP66	53	104	146	8.1
SP100	0	157	147	8.1
140-175 kg BW	SBM	SP Nucleus	CP	Lys
SP00	120	0	136	6.6
SP33	80	41	134	6.5
SP66	40	81	139	6.7
SP100	0	122	141	6.9

Husbandry and experimental details

- restricted feed allowance: 1.9 to 3.2 kg/d 1st to last wk
- individual collection of:
 - BW and ultrasound P2 BCKF thickness every 2 weeks
 - daily feed intake
- ADG and G/F computed
- pigs were slaughtered after 138 d on feed, when they reached the target BW of 175 kg

Slaughtering details

- carcasses processed according to conventional practices
- individual collection of:
 - hot carcass weight (without head)
 - BCK thickness using a Hennessy grading probe
 - weight of loins with ribs
 - weight of lards
 - weight of left trimmed ham after 24-h chilling

Statistical analysis

- growth and slaughter traits analyzed with a linear mixed model:

$$y_{ijkl} = \mu + diet_i + sex_j + (diet \times sex)_{ij} + pen(diet)_{k:i} + e_{ijkl}$$

- y_{ijkl} : each observed trait;
- μ : the overall intercept of the model;
- $diet_i$: fixed effect of the i^{th} diet ($i = 1, \dots, 4$);
- sex_j : fixed effect of the j^{th} sex ($j: 1 = \text{gilts}, 2 = \text{barrows}$);
- $(diet \times sex)_{ij}$: interaction effect between diet and sex;
- pen_k : random effect of the l^{th} pen ($l = 1, \dots, 8$) within diet _{i} (error line for diet)
- e_{ijkl} : random residual



Results

Growth traits

	SP00	SP33	SP66	SP100	P Diet	RMSE
Pigs, no	22	21	21	21		
BW In, Kg	51.1	53.0	53.0	52.7	0.8	3.98
BW Fin, kg	174.8	171.6	173.0	174.7	0.5	6.48
ADG, g/d	913	881	881	904	0.4	36
P2 BCKF In, mm	7.6	8.1	7.8	8.0	0.9	0.90
P2 BCKF Fin, mm	16.7	16.3	17.2	17.0	0.9	1.76
FI, g/d	2610	2598	2642	2625	0.7	47
G/F, kg/kg	0.350	0.339	0.334	0.344	0.4	0.013

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Carcass traits

	SP00	SP33	SP66	SP100	P Diet	RMSE
Carcass weight (CW), kg	141	138	139	140	0.4	5.66
Hennessy BCKF, mm	24.9	26.6	26.3	24.5	0.7	3.13
Weight of, kg:						
- loins	26.7	25.6	26.1	26.1	0.4	1.75
- lards	8.4	8.4	8.5	8.3	0.9	1.00
- left trimmed ham	13.8	13.6	13.6	13.8	0.6	0.7
Incidence on CW of, %:						
- loins	18.9	18.6	18.8	18.6	0.7	0.79
- lards	6.0	6.1	6.1	6.0	0.9	0.68
- left trimmed ham	9.8	9.9	9.8	9.9	0.9	0.33

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Conclusions

- palatability of feeds not depressed by the inclusion of SP, also at the greatest level
- comparable growth rate and feed efficiency for pigs of different groups
- carcass traits not affected by the inclusion of SP, also at the greatest level
- results obtained at herd and slaughter level suggest that is feasible to replace also totally SBM with SP
- further studies needed to investigate the effects of such a replacement on meat quality traits and metabolic response of animals

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Thank you

