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Lower stocking density in pigs: welfare, growth rate, and meat quality

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Objective

How does stocking density in the fattening phase affect growth performance, carcass characteristics, intrinsic meat quality, as well as immunophysiological parameters and welfare assessment in crossbreed pigs?

Data

- **1.0 vs 1.5 vs 2.0m²/pig**
- **2 crossbreeds**
- **2 seasons**
- **2 commercial farms**

- **102x** DanBred pigs
- **80x** [(Polish Large White x Polish Landrace) x (Duroc x Pietrain)]

- **2x 42** loins
- **2x 42** blood, intestinal, and liver samples

Methods

- **Growth** in 2 and 3 phases
- **Meat intrinsic quality:** pH, shear force, fatty acid (FA) profiles, crude protein and fat, colour
- **Immunophysiological parameters:** IgG, IgA, IgM, and antioxidant enzymes
- **Welfare assessment** based on adjusted WelfareQuality®
- **Statistics** two-way ANOVA group and sex of pig and PCA for FA

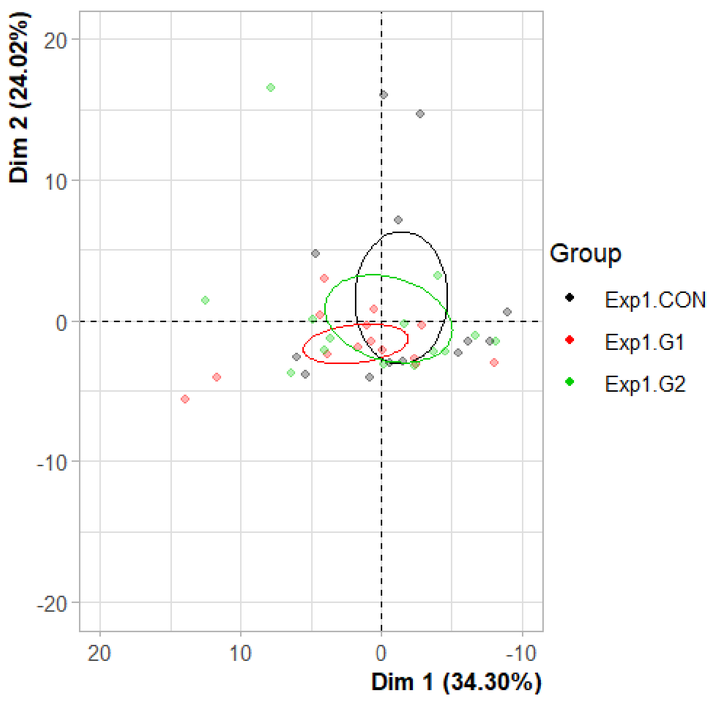
Results

Pigs in groups with more space grow faster, and have better immuno-physiological levels,
BUT it might not financially compensate the farmer for lower stocking density.

Space allowance does not affect the intrinsic meat quality.

Based on PCA the breed has more effect on FA profile than m2/pig

	Parameter	DanBreed pigs				[(Polish Large White x Polish Landrace) x (Duroc x Pietrain)] pigs			
	Experiment 1	Exp1.G1	Exp1.G2	Exp1.CON	p-value	Exp2.G1	Exp2.G2	Exp2.CON	p-value
Blood	IgG, mg/mL	21.74^{A}	18.92^{B}	19.33^{B}	<0.001	16.95^{C}	18.17^{B}	22.35^{A}	<0.001
	IgM, mg/ml	7.47^{A}	6.17^{B}	6.65^{B}	<0.001	5.2	5.5	5.32	ns
	IgA, mg/mL	2.53	2.5	2.5	ns	3.62^{B}	2.27^{C}	4.97^{A}	<0.001
	IL-2, pg/mL	55.87^{A}	52.68^{B}	55.99^{A}	0.003	34.11^{B}	34.00^{B}	38.83^{A}	<0.001
	IL-6, pg/mL	7.11^{A}	11.63^{B}	7.81^{A}	<0.001	4.10^{A}	3.84^{A}	4.44^{B}	<0.001
	IL8, ng/ml	10.76^{B}	14.53^{A}	15.40^{A}	<0.001	18.52^{B}	17.17^{C}	27.65^{A}	<0.001
	IL-10, pg/mL	43.27	38.97	45.03	ns	30.88^{A}	28.53^{B}	31.25^{A}	<0.001
	Lactic acid, mmol/L	11	11.42	11.05	ns	1.12^{B}	1.28^{A}	1.04^{C}	<0.001
	LZM, mg/ml	1.26^{A}	1.13^{B}	1.05^{B}	<0.001	0.78^{B}	0.76^{B}	0.87^{A}	<0.001
	CLDN1, pg/ml	1.49^{A}	1.90^{B}	1.60^{A}	<0.001	1.31	1.39	1.41	ns
	CLDN3, pg/ml	1.25^{A}	1.41^{A}	1.04^{B}	<0.001	2.18	2.19	2.4	ns
	NO, nmol/mL	10.3	9.11	11.05	ns	43.73^{B}	47.81^{A}	32.25^{C}	<0.001
	MDA, µmol/L	1.97^{C}	2.22^{B}	2.55^{A}	<0.001	3.84^{B}	4.24^{A}	2.97^{C}	<0.001
	SOD, U/ml	7.75^{B}	9.8^{A}	7.82^{B}	<0.001	0.66^{A}	0.64^{A}	0.49^{B}	<0.001
	CAT, U/ml	2.90^{B}	3.32^{A}	2.35^{C}	<0.001	8.99^{B}	9.94^{A}	6.74^{C}	<0.001
	GSH, µmol/L	0.54^{B}	0.61^{A}	0.58^{AB}	0.008	7.36^{A}	5.73^{B}	7.02^{A}	<0.001
	FRAP, µmol/L	8.75^{B}	8.56^{B}	5.72^{A}	<0.001	169.91^{A}	162.49^{B}	157.75^{B}	<0.001
Liver	MDA, µmol/g	2.49^{B}	2.71^{B}	3.12^{A}	<0.001	178.55^{A}	152.26^{B}	120.44^{C}	<0.001
	SOD, U/g	151.05^{A}	128.99^{C}	141.89^{B}	<0.001	11.44^{B}	13.16^{A}	11.03^{B}	<0.001
	CAT, U/g	131.01^{A}	102.9^{B}	125.22^{A}	<0.001	3.06^{B}	3.06^{B}	3.79^{A}	<0.001
	GSH, µmol/g	17.34^{B}	20.37^{A}	19.81^{B}	<0.001	19.19^{A}	19.67^{A}	18.27^{B}	0.045
Intestine	MDA, µmol/g	1.68^{B}	1.65^{B}	2.04^{A}	<0.001	67.99^{A}	61.87^{B}	53.85^{C}	<0.001
	SOD, U/g	210.53^{A}	172.91^{B}	162.43^{B}	<0.001	1.65^{A}	1.72^{A}	0.75^{B}	<0.001
	CAT, U/g	175.31^{B}	199.95^{A}	127.63^{C}	<0.001	16.95^{C}	18.17^{B}	22.35^{A}	<0.001
	GSH, µmol/g	5.11^{B}	6.45^{A}	5.81^{AB}	0.001	5.2O	5.5O	5.32	ns



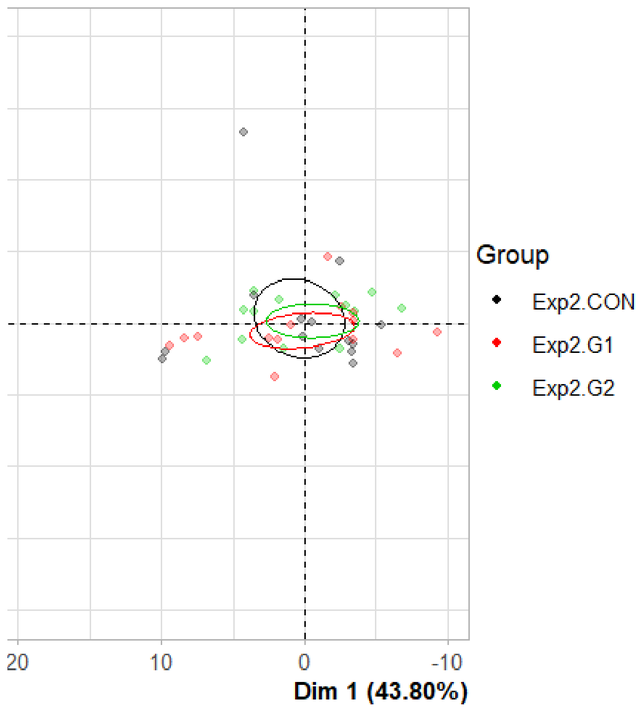


Figure – Principal Component Analysis of fatty acids profile in DanBred (Exp1) and [(Polish Large White x Polish Landrace) x (Duroc x Pietrain)] (Exp2), where CON – control 1.0m²/pig, G1 – 1.5m²/pig, G2 – 2.0 m²/pig.

Conclusions

- Pigs in group with 1.5 m2/pig grew faster than those in control and 2.0 m2/pig
- There were very few significant differences in carcass and meat quality parameters
- Space allowance does not affect fatty acid profile in two husbandry systems and two breeds
- Moderate space (1.5 m²) seems to create optimal immunophysiological conditions