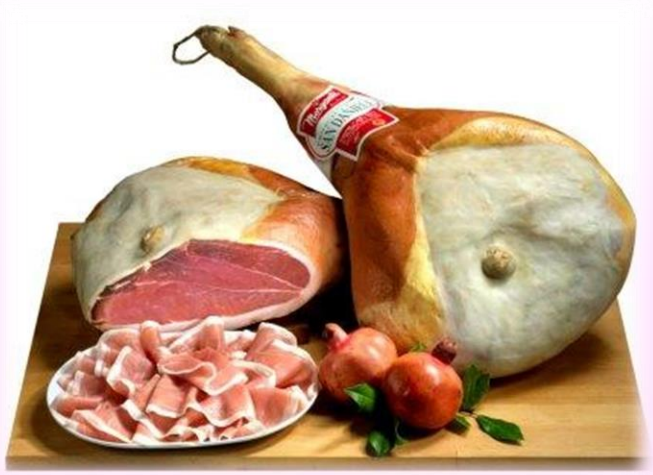

Quality attributes of PDO dry-cured hams as affected by low-protein diets and genetic line of pigs

Giuseppe Carcò, Mirco Dalla Bona, Luca Carraro, Luigi Gallo, Stefano Schiavon

Background

- Dry-cured ham is a traditional product in many Mediterranean countries
- More than 30 dry-cured hams are classified as Protected Denomination of Origin (PDO) and Protected Geographical Indication (PGI)
- Dry-cured ham quality might be influenced by diet and genetic group (GG)
- Low-protein diets might improve the fat content of the raw hams
- Leaner genetic groups might negatively affect the quality of raw hams
- Few studies have investigated the influence of low-protein diets and GG on the dry-cured ham characteristics

Objectives

To investigate the influence of low-protein diets on the characteristics of San Daniele like dry-cured hams obtained from genetic groups of pigs with different lean growth potential.

Methods

- 96 pigs
- 2 sexes (barrows and gilts)
- 2 dietary protein levels
  - **CONV (146 – 130 g/kg CP)**
  - **LP (114 – 101 g/kg CP)**
- 4 genetic groups sired by:
  - **Italian Duroc (ANAS)**
  - **Goland C21 (Gorzagri)**
  - **Topigs tempo (Topigs)**
  - **Danish Duroc (DANBRED)**

Methods

96 left raw hams

PDO San Daniele Curing

- Salting (15 days)
- Pressing (48 hours)
- Resting (90 days)
- Rinsing
- Drying (1 week)
- Greasing
- Seasoning (15 months)

Methods

40 dry-cured hams

- 2 sexes (barrows and gilts)
- 2 dietary protein levels (CONV and LP)
- 2 genetic types *(Schiavon et al, 2015)*
  - **ANAS** (Fat retention= 284 g/d; Protein retention= 8.9 g/d)
  - **DANBRED** (Fat retention= 258 g/d; Protein retention= 10.1 g/d)

Methods

Laboratory analyses

- Weight losses
- Physical and texture analyses
- Chemical composition
- Fatty acids composition

Methods

Stastical analysis

$$y_{ijklm} = \mu + GG + diet + sex + GG \times diet + ham(GG \times diet \times sex) + e$$

Results

Trimmed hams traits (n=40)

	Diet (D)				Genetic group (GG)			
	CONV	LP	SEM	*P*	ANAS	DANBRED	SEM	*P*
Fat thickness, mm	19.8	21.9	1.21	ns	23.7	18.1	1.20	**
Hams weight, kg:								
raw (trimmed)	14.7	14.8	0.21	ns	14.4	15.2	0.21	**
after salting	14.4	14.4	0.18	ns	14.0	14.8	0.18	**
after seasoning	10.1	10.1	0.15	ns	9.92	10.3	0.15	†
after deboning	7.59	7.65	0.13	ns	7.52	7.72	0.13	ns
Weight losses, %								
after salting	2.45	3.03	0.26	ns	2.70	2.78	0.26	ns
after seasoning	31.6	31.7	0.42	ns	30.9	32.2	0.42	*
after deboning	48.4	48.4	0.49	ns	47.6	49.2	0.49	*

Results

Ham weight losses (n=40)

	Diet (D)				Genetic group (GG)			
	CONV	LP	SEM	*P*	**ANAS**	**DANBRED**	**SEM**	***P***
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after deboning	7.59	7.65	0.13	ns	7.52	7.72	0.13	ns
Weight losses, %								
after salting	2.45	3.03	0.26	ns	2.70	2.78	0.26	ns
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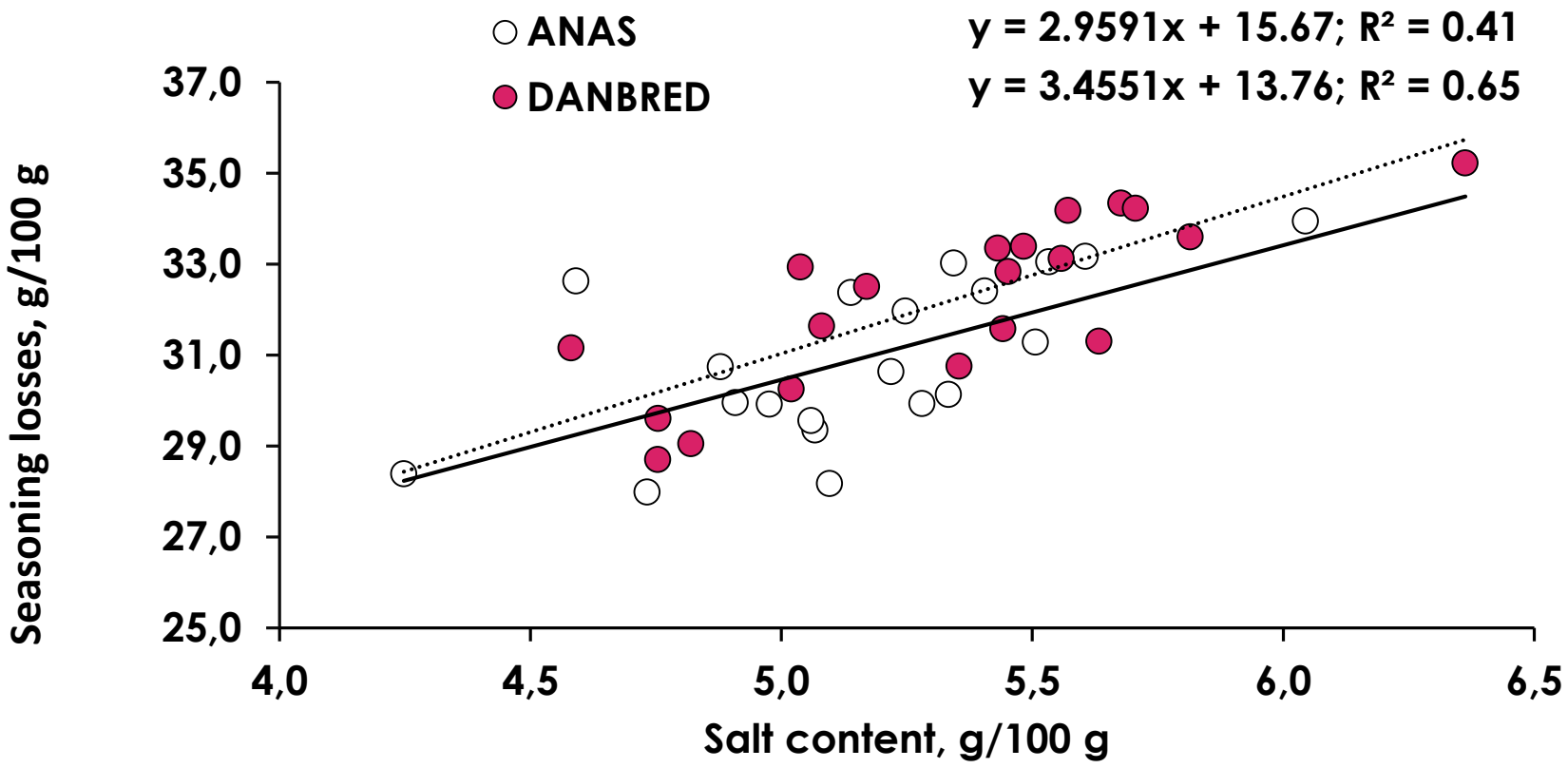
after deboning	48.4	48.4	0.49	ns	**47.6**	**49.2**	**0.49**	*

Results

Ham weight losses (n=40)



Results

Chemical composition of the slice (n=40)

	Diet (D)				Genetic group (GG)			
	CONV	LP	SEM	*P*	ANAS	DANBRED	SEM	*P*
Water	507	505	3.3	Ns	508	504	3.3	ns
Protein	289	280	2.1	**	281	288	2.1	*
Ash	70.6	69.3	1.2	ns	68.6	71.3	1.2	ns
Lipid	133	146	4.5	*	142	137	4.5	ns
Protein:Lipid	2.37	2.12	0.06	**	2.25	2.25	0.06	ns
Soluble protein	81.5	78.9	1.0	†	80.3	80.2	1.0	ns
Salt	53.1	51.9	0.9	ns	51.6	53.4	0.9	ns
Proteolysis index	0.277	0.275	0.004	ns	0.276	0.276	0.004	ns

Results

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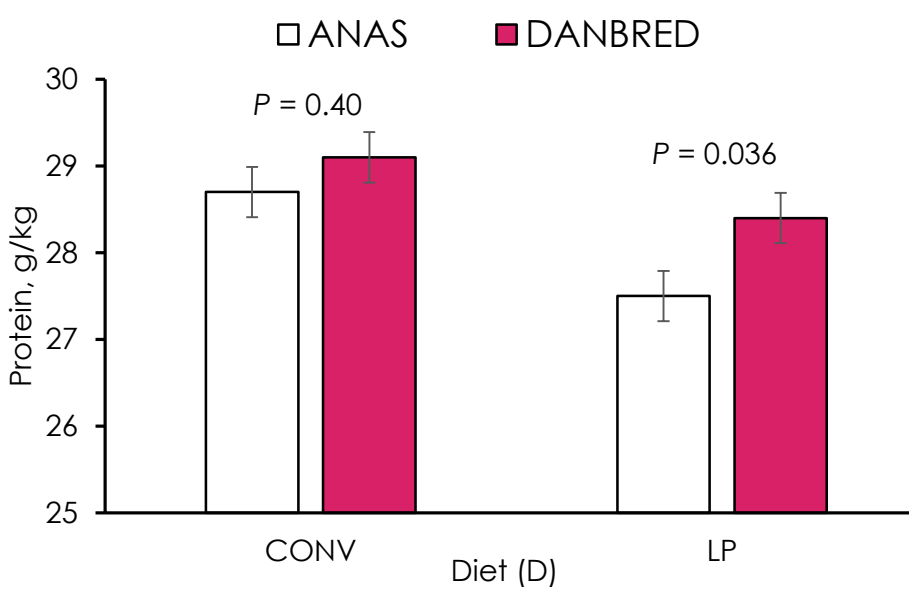
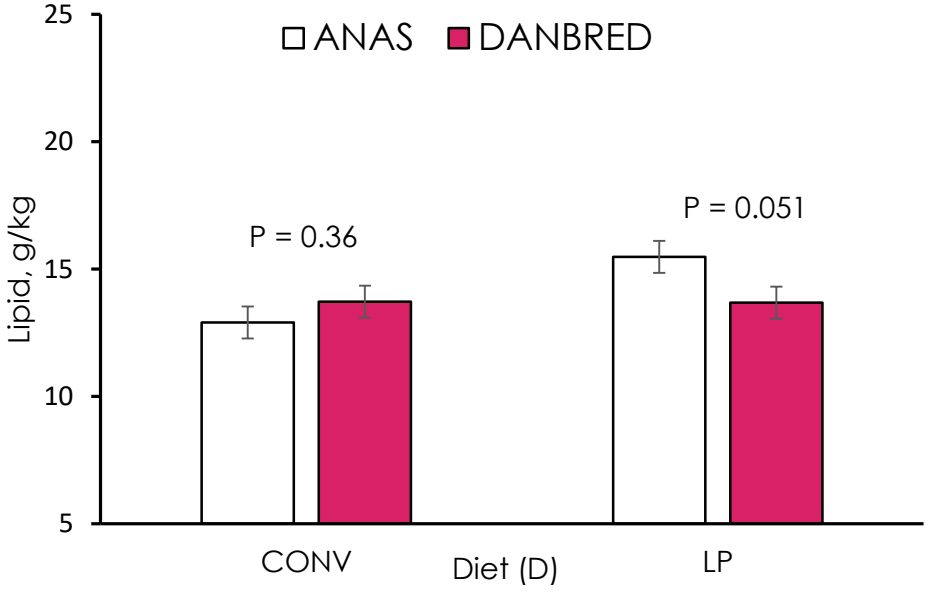
Results

GG x D interaction on chemical composition





Results

Physical traits of the slice (n=40)

	Diet				Genetic group			
	CONV	LP	SEM	*P*	ANAS	DANBRED	SEM	*P*
pH	5.49	5.52	0.01	†	5.51	5.50	0.01	ns
Water activity	0.90	0.90	0.002	ns	0.90	0.89	0.002	ns
Colour:								ns
Lightness (L*)	37.5	37.3	0.29	ns	37.7	37.2	0.29	ns
Green-red (a*)	7.00	6.92	0.18	ns	7.05	6.87	0.18	ns
Blue-yellow (b*)	8.24	8.30	0.12	ns	8.26	8.28	0.12	ns
Texture:								
Shear force, N	32.8	33.6	1.10	ns	33.0	33.4	1.10	ns
Hardness, N	20.7	19.3	1.09	ns	19.1	21.0	1.09	ns
Adhesiveness, N×s	-1.73	-1.73	0.08	ns	-1.81	-1.66	0.08	ns
Cohesiveness	0.54	0.55	0.01	ns	0.55	0.54	0.01	ns
Springiness	0.73	0.73	0.01	ns	0.73	0.73	0.01	ns
Chewiness, N	8.42	7.92	0.52	ns	7.76	8.58	0.52	ns

Results

Fatty acids composition of the slice (n=40)

	Diet				Genetic group			
	CONV	LP	SEM	*P*	ANAS	DANBRED	SEM	*P*
SFA, %	30.8	33.1	0.71	ns	32.6	32.1	0.72	ns
MUFA, %	51.0	50.8	0.33	ns	51.4	50.4	0.33	ns
PUFA, %	16.8	16.4	0.22	ns	15.9	17.2	0.22	***
n-3 fatty acids	1.54	1.49	0.03	ns	1.47	1.55	0.03	†
n-6 fatty acids	15.0	14.7	0.16	ns	14.2	15.5	0.20	***
n-6/*n*-3	11.1	11.5	0.14	ns	11.1	11.5	0.25	†

Results

Fatty acids composition of the slice (n=40)

	Diet				Genetic group			
	CONV	LP	SEM	*P*	**ANAS**	**DANBRED**	**SEM**	***P***
SFA, %	30.8	33.1	0.71	ns	32.6	32.1	0.72	ns
MUFA, %	51.0	50.8	0.33	ns	51.4	50.4	0.33	ns
PUFA, %	16.8	16.4	0.22	ns	**15.9**	**17.2**	**0.22**	***
***n*-3 fatty acids**	1.54	1.49	0.03	ns	**1.47**	**1.55**	**0.03**	†
***n*-6 fatty acids**	15.0	14.7	0.16	ns	**14.2**	**15.5**	**0.20**	***
***n*-6/*n*-3**	11.1	11.5	0.14	ns	**11.1**	**11.5**	**0.25**	†

Conclusions

- Low-protein diets had little influence on the chemical and physical characteristics of dry-cured hams
- There is potential to use low protein diets in the production of PDO San Daniele dry-cured hams as they reduce the release of N into the environment
- Genetic groups with different potentials for lean growth present differences in the trimmed ham weight, fat cover and seasoning losses
- Differences in the various chemical, physical and textural traits of the dry-cured hams due to genetic group were less evident
- Further research is required to investigate the effect of diet and genetic group on the sensorial properties of the dry-cured hams

Acknowledgements

- AGER Project;
- University of Padova, DOR1655405/16;
- Azienda Agricola Tre Valli of the Gruppo Veronesi;
- The staff of the Experimental farm *Lucio Toniolo* of the University of Padova;
- Aldo Gini Foundation.


That's all Folks!
Thank you!

	Early finishing (90-120 kg BW)		Late finishing (120-165 kg BW)	
	CONV	LP	CONV	LP
Corn grain	355.7	353.8	384.2	382.3
Barley grain	200.0	200.0	200.0	200.0
Wheat grain	73.3	171.7	106.7	200.9
Soybean meal (44%)	128.3	26.7	91.7	0.0
Wheat bran	120.0	123.3	80.0	80.0
Wheat middlings	60.0	60.0	60.0	60.0
Cane molasses	20.0	20.0	40.0	40.0
Beef tallum	15.0	14.0	14.0	11.0
Calcium carbonate	15.0	15.5	13.5	13.7
Dicalcium phosphate	4.0	4.5	2.0	2.2
Sodium bicarbonate	2.5	2.5	2.5	2.5
Sodium chloride	3.0	3.0	3.0	3.0
Vit. and premix	2.0	2.0	2.0	2.0
Choline HCl	0.4	0.4	0.4	0.4
L-Lysine HCl	0.8	2.1	0.0	1.4
L-Threonine	0.0	0.4	0.0	0.5
L-Tryptophan	0.0	0.1	0.0	0.1

Chemical composition and energy content of the diets

	Early finishing (90-120 kg BW)		Late finishing (120-165 kg BW)	
	CONV	LP	CONV	LP
Dry Matter (g/kg)	884	885	882	883
Cr. Protein(g/kg)	146	114	130	101
Starch (g/kg)	426	478	452	502
NDF (g/kg)	133	129	119	121
Et. Extract (g/kg)	41	39	39	37
Ash (g/kg)	47	44	44	40
NE (MJ/kg)	9.9	10.0	10.0	10.2
SID Lys (g/kg)	6.0	4.8	4.4	3.5
SID Met (g/kg)	2.0	1.7	1.9	1.6
SID Thre (g/kg)	4.1	3.3	3.6	3.0
SID Try (g/kg)	1.2	0.9	1.1	0.8