

Nutrient content in pork – dry aged loin and dried ham



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Næringsstofindhold i gris - krogmodnet kam og tørret skinke

Report

2024

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Preface

The present work was initiated by Danish Agriculture & Food Council by a grant from The Danish Pork Levi Fund (Svineafgiftsfonden). By agreement the samples included are marketed dried ham, Serrano and Schwartzwalder, and dry age pork loin. Analysis data is included in the update of the Food Data Bank and will be published in Frida (www.frida.fooddata.dk).

The project was organized and carried out by Sarah Jegsmark, Marija Langwagen, Anders Poulsen and Jette Jakobsen. The analyses were carried out at Eurofins Steins Laboratory, Vejen, Denmark. The report has emerged as a result of a collaboration between Marija Langwagen, Anders Poulsen and Jette Jakobsen.

Kongens Lyngby, April 2024

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Summary

The aim of the project was to obtain knowledge on the nutrient content in dried ham products and dry aged loin from the Danish market. The sampling was performed in 2023. The data will be published in the Danish food composition database (www.frida.fooddata.dk).

The project included two dried ham products, Serrano and Schwartzwalder, and dry aged pork. The dried ham products was analysed as composite samples, while dry aged pork loin was analysed in eight individual samples. The ten samples were analysed for macronutrients, and six samples for micronutrients. The macronutrients included nitrogen, amino acids, fat, fatty acids, ash and dry matter. The micronutrients were the vitamins retinol incl. β -carotene, α -tocopherol, phylloquinone and the menaquinone 4 to 10, thiamine, riboflavin, niacin, pyridoxine, pantothenic acid, biotin, folate, cobalamin and ascorbic acid, and the minerals sodium, potassium, calcium, magnesium, phosphorus, iron, copper, zinc, iodine, manganese, chromium, selenium, and molybdenum.

Resumé

Formålet med projektet var at opnå viden om næringsstofindholdet i tørrede skinkeprodukter og krogmodnet kam markedsført i Danmark. Prøveudtagningen er foretaget i 2023. Dataene vil blive offentliggjort i den danske fødevarerdatabase (www.frida.fooddata.dk).

Projektet omfattede to tørrede skinkeprodukter, Serrano og Schwartzwalder, samt krogmodnet kam. De tørrede skinkeprodukter blev analyseret som pool-prøver, mens krogmodnet kam blev analyseret i otte individuelle prøver. De ti prøver blev analyseret for makronæringsstoffer og seks prøver for mikronæringsstoffer. Makronæringsstofferne omfattede nitrogen, aminosyrer, fedt, fedtsyrer, aske og tørstof. Mikronæringsstofferne var vitaminerne retinol inkl. β -caroten, α -tocopherol, phylloquinon og menaquinon 4 til 10, thiamin, riboflavin, niacin, pyridoxin, pantotensyre, biotin, folat, cobalamin og ascorbinsyre og mineralerne natrium, kalium, calcium, magnesium, jern, fosfor, kobber, zink, jod, mangan, krom, selen og molybdæn.

1. Introduction

In the Danish Food Composition Database (www.fooddata.dk) information on nutrients in dry aged pork and dried ham are not available.

The most selling dried ham in Denmark was found to be Serrano Ham (Spanish: Jámón Serrano) and Black Forest Ham (German: Schwartzwälder Schinken). Both types of ham product have since 1997 carried the EU seal “PGI” (Protected Geographical Indication). This provides protection for traditional production of the product in Spain and in the Black Forrest, respectively. The Black Forest is geographically well-defined, it stretches from Pforzheim in the north to Lörrach near the Swiss border (Serrano, 2024; Schwartzwald, 2024).

The manufacturing process of the two types of ham is as follows. Serrano ham is based on a fresh ham, which is trimmed and cleaned, then stacked and covered with salt for about two weeks to draw off excess moisture and preserve the meat from spoiling. The salt is then washed off, and the hams are hung to dry for about six months. Finally, the hams are hung in a cool, dry place for six to 18 months (Bernstein & Friedman, 2008).

Black Forest ham is a cut, raw ham, salted, seasoning, brining, curing, cold smoking maturing for 12 weeks (Schwartzwald, 2024; Rainer Wagner, Schwarzwälder Schinken Verband, personal communication, 19-04-2024).

Dry aged pork is produced locally in Denmark and the maturing time differs between producers.

This project aimed to establish the nutrient content in dry aged pork and two dried ham products. For the dry aged pork it was additional essential to estimate the variation of the nutrient contents.

2. Sample material

2.1. Market analysis

The availability of the dried ham products, was investigated in nine supermarkets and discount chains (Bilka, Rema 1000, Nemlig.com, Føtex, Netto, SuperBrugsen, Meny, Coop 365 and Lidl in April 2023).

The market for dry aged loin was also investigated. Retailers and producers able to deliver the necessary samples of dry aged loin were limited to Danish Crown, Bilka, and a few butchers.

2.2. Sampling plan and collection of samples

The sampling plan included four individual samples of each of the dried ham i.e. Serrano and Black Forest was based on the market investigation in April 2023.

The dry aged loin was ordered from Danish Crown by a branch of the Meny supermarket. In order to make sure that all samples were from different pigs, each sample of pork loin was collected in eight different weeks. Dry aged product is solely a product from FRILANDSGRIS®.

All sampled was collected from June until October.

2.3. Sample preparation and homogenization.

After collection, the refrigerated samples were stored at max. 5 °C. The sub-samples for each composite sample were packed in individual plastic bags at DTU Food including information on the weight of the sub-samples to be used for each of the two composite sample. All subsamples contributed equally to the composite sample. For the dry aged loin, the rind was cut-off, with as little fat as possible. Weight of the rind is provided in appendix A.

The samples were transported at 5 °C to Eurofins Steins Laboratorium A/S, Vejen, Denmark. Within 72 h each subsamples and composite sample were blended for 30 s, in a blender suitable for the amount (Robot Coupe Blixer 5 plus, Blixer 3 (Robot Coupe, Vincennes France) or OBH Mini chopper (OBH Nordica, Denmark). Heating during the blending process was evaded by the use of dry ice. The homogenised material was stored in plastic containers (approx. 100 g) at max. -18 °C.

3. Analysis methods

The analysis methods used to determine the nutrient content of the pork are provide in Appendix B. The samples of dried ham were made into composite samples and analysed by double determination, while dry aged loin were analysed as individual samples by a single determination. All analyses are carried out by accredited testing under ISO17025 at Eurofins Steins A/S (DANAK 222).

4. Results

The analysis results are shown in appendix C-G. The macronutrients appear in appendix C, vitamins in appendix D, minerals in appendix E, amino acids in appendix F, and fatty acids in appendix G.

In Table 1 is provided comparison to results obtained in a previous project which aimed to establish data for the nutrient content in traditional Danish pork (Jakobsen et al., 2017).

Table 1. Macronutrient in pork loin, raw and dry aged.

		Pork, loin, rind cut off		
Dry aged/raw		Dry aged	Raw	<i>p-value</i>
Sampling year		2023 ¹	2015 ²	
No of samples		8	12	
Protein ³ , g/100 g	average (sd)	19.9 (1.2)	17.4 (1.2)	0.0002
Fat, g/100 g	average (sd)	17.5 (4.0)	23.6 (3.5)	0.002
Dry matter, g/100 g	average (sd)	40.0 (5.0)	42.1 (2.5)	<i>ns</i>
Ash, g/100 g	average (sd)	0.951 (0.045)	0.884 (0.044)	0.004

¹ Present study in Frilandsgris®; ² Based on data from Jakobsen et al. 2017 on pork from traditional Danish pigs. Individual data, see Appendix H; ³Nitrogen x 6.25.

The rind cut-off of the dry aged loin contributed on average 8.2% of the loin, with a range between 6.1% to 9.7%. In the former study of raw loin the rind cut-off of the raw loin contributed on average 6.2% of the loin, with a range between 3.3% to 8.1%.

5. Discussion

The strength of the project is that the collection of samples has been performed to be representative for the two types of dried ham on the Danish market.

5.1. Dried ham

For two different types of dried ham, Serrano and Black Forest, the content of dry matter is 53 g/100 g and 46 g/100 g, respectively (Appendix C). From the list of ingredient for Serrano ham it is stated that 145 g to 152 g of raw ham is used to make 100 g Serrano, while 129 g to 134 g raw ham is used to make 100 g of Black Forest Ham, which is presumably the reason for the difference in dry matter. The results for the content of micronutrient except sodium and potassium, which is added as part of the production process, the content seems higher in Serrano ham than in Black Forest Ham (Appendix D-G).

5.2. Dry aged loin

As mentioned dry aged ham included in the project is branded FRILANDSGRIS®. Pigs of this brand are born in a hut in the field. All sows are free range – and the pigs have plenty of opportunity to frolic in the field. The piglets are weaned from the sow after 5 weeks, after which they are moved to barns with lots of straw. Pigs always has access to outdoor areas in the form of running yards. Furthermore, the pigs are born, bred and slaughtered in Denmark (Friland, 2024). The samples analysed for the dry aged pork loin are a product of Danish Crown marketed as matured (dry aged) between 14-21 days, which was the information given in the store. It was not possible to include samples of the loin taken before the maturing process. Such data would have been the optimal to document changes of the macronutrients due to the dry aging process. An alternative strategy was to compare the new data of macronutrients in dry aged loin with our data for traditional Danish pork (Jakobsen et al., 2017). This comparison show no difference in dry matter, but a significantly higher content of protein and lower content in fat, see Table 1.

These data are based on the loin without rind, as it is not possible to obtain satisfactory, homogeneous samples including the rind for the chemical analyses. The weight of the rind cut-off in the present study is on average 8.2% of the weight of the loin (with rind), compared to 6.2% for the raw loin (with rind). It should be mentioned, that the procedure for cutting off the rind in both studies was not performed by a butcher.

As the fat content is lower in the dry aged product compared to the raw, it may be either that FRILANDSGRIS® is either less fatty than traditional Danish slaughter pigs or that the pork cuts for dry aging are selected for a lower fat content.

7. Perspectives

To properly understand the effect of dry aging on the nutrient contents, it would be necessary to analyse samples of the same batch of pork taken before, during and after dry aging, and preferably by continuing the aging process for longer time than 14-21 days.

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Appendix A – Information about the samples collected

DTU Code	Individual sample	Brand name	Sample name	Manufacturer	Pack- age, g	Number of packages	Store	City	Date of collection	Best before
2303-POOL-13	2303-13-01; -02; -03; -04		Serrano ham							
	2303-13-01	Salling	Jamon Serrano	NOEL Alimentaria	90	6	Bilka	Copenhagen	27-06-2023	22-08-2023
	2303-13-02	Deli Drengene	Serrano skinke	N/A	90	6	Nemlig.com	Online	28-06-2023	28-11-2023
	2303-13-03	Premieur	Jamon Serrano 'Gran Reserva'	N/A	100	6	Netto	Kastrup	27-06-2023	21-08-2023
	2303-13-04	Dulano Selection	Original Jamon Serrano	Bell Deutschland GmbH & Co. KG	100	6	Lidl	Kastrup	27-06-2023	13-09-2023
2303-POOL-14	2303-14-01; -02; -03; -04		Schwarzwälder ham							
	2303-14-01	Tannenhof	Schwarzwaldskinke	Fleischwaren GmbH	100	5	365Discount	Copenhagen	27-06-2023	28-07-2023
	2303-14-02	Salling	Schwarzwälder Schinken (BGB)	Hermann Wein GmbH & Co. KG	100	5	Bilka	Copenhagen	27-06-2023	27-07-2023
	2303-14-03	Rema1000	Schwarzwälder skinke	Fleischwaren GmbH	100	5	Rema1000	Kastrup	27-06-2023	18-08-2023
	2303-14-04	La Campagna	Schwarzwälder Schinken	Hermann Wein GmbH & Co. KG	100	5	Netto	Kastrup	27-06-2023	19-07-2023

Appendix A – Information about the samples collected - continued

DTU Code	Sample name	Brand name	Manufacturer	Weight, g	Rind, g	Store	City	Date of collection	Best before
2303-15-01	DRY AGED PORK; KAM U/BEN DRY AGED	Friland/Meny	Danish Crown	2060*	no info	Meny	Søborg	03-07-2023	07-07-2023
2303-16-01	DRY AGED PORK; KAM U/BEN DRY AGED	Friland/Meny	Danish Crown	1305	105,3	Meny	Søborg	23-08-2023	29-08-2023
2303-17-01	DRY AGED PORK; KAM U/BEN DRY AGED	Friland/Meny	Danish Crown	2324*	174,5	Meny	Søborg	02-09-2023	05-09-2023
2303-18-01	DRY AGED PORK; KAM U/BEN DRY AGED	Friland/Meny	Danish Crown	1257	116,7	Meny	Søborg	10-09-2023	18-09-2023
2303-19-01	KAM U/BEN DRY AGED	Meny	Danish Crown	2329*	186,1	Meny	Søborg	15-09-2023	19-09-2023
2303-20-01	DRY AGED PORK; KAM U/BEN DRY AGED	Friland/Meny	Danish Crown	1351	82,1	Meny	Søborg	23-09-2023	29-09-2023
2303-21-01	DRY AGED PORK; KAM U/BEN DRY AGED	Friland/Meny	Danish Crown	1976*	191,4	Meny	Søborg	29-09-2023	02-10-2023
2303-22-01	DRY AGED PORK; KAM U/BEN DRY AGED	Friland/Meny	Danish Crown	1215	107,9	Meny	Søborg	06-10-2023	08-10-2023

*two samples

Appendix A – Information about the samples collected - continued

DTU Code	Individual sample	Ingredients
2303-POOL-13	2303-13-01; -02; -03; -04	
	2303-13-01	Ham, salt.
	2303-13-02	Pork (145 g pork used per 100 g serrano ham), salt, antioxidant (E-301), preservatives (E-250, E-252).
	2303-13-03	Ham (to 100 g product is used 145 g ham), salt, antioxidant (E301), preservatives (E250, E252).
	2303-13-04	Pork (to 100 g product is used 152 g pork), salt, sugar, preservatives (sodium nitrite, potassium nitrate, antioxidant (sodiumascorbate), vegetable oils (canola, sunflower).
2303-POOL-14	2303-14-01; -02; -03: -04	
	2303-14-01	Ham (130 g pork is used for 100 g product), salt, spices, sugar, dextrose, antioxidant: E301, preservatives: E 250, E252, smoked.
	2303-14-02	Ham (129 g ham is used for 100 g product), salt, spices (black pepper, coriander, juniper), dextrose, preservatives (E250, E252).
	2303-14-03	Ham (130 g ham is used for 100 g product), salt, spices (garlic, coriander, pepper, juniper, cloves, cinnamon, laurel), dextrose, antioxidant (E 301), spice extracts (garlic, coriander, pepper, juniper), preservatives (E 250, E 252)
	2303-14-04	Ham (134 g of ham is used for 100 g of product), salt, spices (black pepper, coriander, juniper), dextrose, preservatives (E250, E252).
2303-15-01 to 2303-22-01		Dry aged loin, without rind and bone**

**See appendix A for the weight of rind for each sample.

Appendix B - Analytical methods – short description

Nitrogen: NMKL 6:2003. The total amount of organic nitrogen is measured according to the Kjeldahl principle. Expanded uncertainty: 5%.

Amino acids: ISO 13903:2005; EU 152/2009. Tryptophan: Alkaline hydrolysis, quantification by HPLC. Methionine and cysteine: Oxidized with hydrogen peroxide and formic acid at cold temperature, followed by acid hydrolysis using aqueous hydrochloric acid. Amino acids are separated in an amino acid analyzer and the detection is carried out using post column derivatisation with ninhydrin reagent at 440 and 570 nm. All other amino acids: Hydrolyzed in aqueous hydrochloric acid and separated in an amino acid analyzer. The spectrophotometric detection is carried out using post column derivatisation with ninhydrin reagent at 440 nm and 570 nm. Expanded uncertainty: 14%, but 10% for tryptophan.

Fat: ISO 11085:2015. The sample is boiled in hydrochloric acid. The washed and dried residue is extracted with petroleum ether. The solvent is evaporated and the residue is dried and weighed. Expanded uncertainty: 6%.

Fatty acids: AOCS 1f-96 (2009). The sample is boiled in hydrochloric acid and the fat is extracted using a mixture of diethyl- and petroleum ether. Treated with sodium hydroxide and boron trifluoride in methanol to form fatty acid methyl esters (FAMES), measured by GC-FID. C17:0 internal standard. Expanded uncertainty: 10%.

Cholesterol: After saponification, the cholesterol is extracted with butyl-methyl-ether followed by silylation for determination by GC-FID. Expanded uncertainty: 15%.

Dry matter: NMKL 23:1991. The total dry matter content is determined by evaporating all water from the sample by means of heating at a constant temperature. Expanded uncertainty: 5%.

Ash: NMKL 173:2005. The sample is ashed at 525-550°C, and the ash weighed. Expanded uncertainty: 4%.

Retinol (Vitamin A): EN 12823-1:2000. Alkaline hydrolysis using ethanolic potassium hydroxide solution. Extracted with hexane:ethylacetate. Separated and quantified by NP-HPLC-UV (325 nm). External standard. Limit of quantification: 21 µg/100 g.

β-carotene (Vitamin A): Adaption of method based on EN 12823-2:2000. All-trans-β-carotene is extracted and separated by RP-HPLC, and quantified by UV/DAD detection (450 nm). External standard. Limit of quantification: 5 µg/100 g.

Vitamin D (Vitamin D3, 25-hydroxy vitamin D3, vitamin D2, 25-hydroxy vitamin D2): Alkaline hydrolysis, liquid-liquid extraction, clean-up by solid-phase-extraction. RP-LC-ESI-MS/MS.13C- labelled internal standard.

α-tocopherol (vitamin E): EN 12822:2014. Alkaline hydrolysis, NP-HPLC with fluorescence detection (Ex/Em 290 nm/327 nm). External standard. Expanded uncertainty: 16%.

Vitamin K (phylloquinone and menaquinone 4 to 10). The internal standards *d7*-phylloquinone, *d7*-menaquinone-4, *d7*-menaquinone-7, and *d7*-menaquinone-9 are added to the samples. Extraction performed by boiling 2-propanol. Following evaporation to dryness, the fat is degraded enzymatically by use of two lipases. The extract is evaporated to dryness, and clean-up by liquid-liquid extraction followed by silica SPE. Evaporation to dryness, dissolved in ethanol followed by separation, detection and quantification of phylloquinone, MK-4 to MK-10 using LC-APCI-MS/MS.

Thiamin incl. hydroxyl-2-ethylthiamin: EN 14122-2014. Acid hydrolysis, separation by RP-HPLC and quantified by fluorescence detection (Ex/Em: 368 nm/440 nm) after post-column oxidation to thiochrome. External standard. Expanded uncertainty: 16%.

Riboflavin: EN 14152:2003. Acid hydrolysis, enzymatic treatment, separation by RP-HPLC, quantified by fluorescence detection (Ex/Em: 468 nm/520 nm). External standard. Adapted to quantify riboflavin-5-phosphate and riboflavin separately. Expanded uncertainty: 16%.

Pyridoxine: EN 14164. Acid extraction, followed by treatment with phosphatase. By reaction with glyoxylic acid in the presence of Fe²⁺ as catalyst, pyridoxamine is transformed into pyridoxal, which is then reduced to pyridoxine by the action of sodium borohydride in alkaline medium. Pyridoxine is finally quantified by RP-HPLC with fluorescence detection (Ex/EM: 290 nm/395 nm). External standard. Expanded uncertainty: 14%.

Niacin: EN 15652:2009. Nicotinic acid and nicotinamide are extracted from samples in a weak hydrochloride acid solution at 100 °C, separated by RP-HPLC, detected and quantified by fluorescence detection (Ex/Em: 322 nm/380 nm) after a post column reaction with hydrogen peroxide catalyzed by Cu(II) ions under UV-radiation (365 nm). External standard. Niacin is calculated as the sum of nicotinic acid and nicotinamide. Expanded uncertainty: 14%.

Biotin: LST AB 266.1,1995. Biotin is extracted from the sample in an autoclave using acid hydrolysis. After dilution with basal medium containing all required growth nutrients except biotin the growth response of *Lactobacillus plantarum* (ATCC 8014) to extracted biotin is measured turbidimetrically and is compared to calibration solutions with known concentrations. Expanded uncertainty: 24%.

Pantothenic acid: AOAC 2012.16. LC/MS/MS with isotope dilution. Expanded uncertainty: 20%.

Folates: NMKL 111:1985. Folate is extracted from the sample in an autoclave using a buffer solution, followed by an enzymatic digestion with human plasma and pancreas V. After dilution with basal medium containing all required growth nutrients except folic acid the growth response of *Lactobacillus rhamnosus* (ATCC 7469) to extracted folate is measured turbidimetrically and is compared to calibration solutions with known concentrations. Limit of quantification: 5 µg/100 g.

Cobalamin (vitamin B₁₂): Extraction in sodium cyanide at 100°C. Immunoaffinity clean-up. LC-UV (361 nm).

Vitamin C (ascorbic acid and dehydroascorbic acid): The sample is extracted in an aqueous solution containing trichloroacetic acid and the antioxidant tris(2-carboxyethyl)phosphine (TCEP). TCEP reduces dehydroascorbic acid to ascorbic acid. The final extract is analysed by HPLC with UV detection at 265 nm.

Sodium, potassium, calcium, magnesium, phosphorous, iron, copper, zinc: EN 13805:2014/EN ISO 11885. Pressure digestion. Analysis of liquid samples by inductively coupled plasma optical emission spectroscopy (ICP-OES).

Selenium, chromium, manganese: EN 13805:2014/EN ISO 17294:2016. Pressure digestion. Analysis of liquid samples by inductively coupled plasma mass spectroscopy ICP-MS.

Molybdenum: EN 13805:2014/EN 15763:2010. ICP-MS/MS Pressure digestion. Analysis of liquid samples by inductively coupled plasma mass spectrometry ICP-MS.

Iodine: DS EN ISO 15111:2007. Determination of iodine by ICP-MS.

Appendix C – Macronutrients

DTU code	Sample information	Nitrogen		Fat		Ash		Dry matter	
2303-POOL-13	Ham, dried, Serrano	4,98	g/100 g	15,05	g/100 g	5,68	g/100 g	53,19	g/100 g
2303-POOL-14	Ham, dried, Schwarzwald	4,08	g/100 g	14,60	g/100 g	4,60	g/100 g	45,73	g/100 g
2303-15-01	Pork, loin, dry aged	3,33	g/100 g	15,50	g/100 g	0,95	g/100 g	36,89	g/100 g
2303-16-01	Pork, loin, dry aged	3,11	g/100 g	17,60	g/100 g	0,97	g/100 g	39,05	g/100 g
2303-17-01	Pork, loin, dry aged	3,26	g/100 g	18,40	g/100 g	0,97	g/100 g	39,20	g/100 g
2303-18-01	Pork, loin, dry aged	3,27	g/100 g	13,30	g/100 g	0,96	g/100 g	36,12	g/100 g
2303-19-01	Pork, loin, dry aged	3,11	g/100 g	21,50	g/100 g	0,95	g/100 g	45,45	g/100 g
2303-20-01	Pork, loin, dry aged	2,82	g/100 g	22,00	g/100 g	0,86	g/100 g	41,06	g/100 g
2303-21-01	Pork, loin, dry aged	3,11	g/100 g	20,80	g/100 g	0,93	g/100 g	48,68	g/100 g
2303-22-01	Pork, loin, dry aged	3,47	g/100 g	11,00	g/100 g	1,02	g/100 g	33,29	g/100 g
<i>Average</i>	<i>Pork, loin, dry aged</i>	<i>3,19</i>	<i>g/100 g</i>	<i>17,51</i>	<i>g/100 g</i>	<i>0,95</i>	<i>g/100 g</i>	<i>39,97</i>	<i>g/100 g</i>
<i>Std.dev</i>	<i>Pork, loin, dry aged</i>	<i>6,1</i>	<i>%</i>	<i>22,8</i>	<i>%</i>	<i>4,7</i>	<i>%</i>	<i>12,6</i>	<i>%</i>

Appendix D – Vitamins

DTU Code	Sample information	Vitamin D3	25-hydroxy vitamin D3	α - tocopherol	PK	MK-4	MK-7	MK-10	Ascorbic acid
		$\mu\text{g}/100\text{ g}$	$\mu\text{g}/100\text{ g}$	$\text{mg}/100\text{ g}$	$\mu\text{g}/100\text{ g}$	$\mu\text{g}/100\text{ g}$	$\mu\text{g}/100\text{g}$	$\mu\text{g}/100\text{ g}$	$\text{mg}/100\text{ g}$
2303-POOL-13	Ham, dried, Serrano	0,28	0,111	0,442	0,175	2,3	0,275	0,11	<0,5
2303-POOL-14	Ham, dried, Schwarzwald	0,16	0,160	0,678	0,108	2,3	0,28	0,14	<0,5
2303-15-01	Pork, loin, dry aged	0,86	0,300	0,395	<0,1	3,9	0,15	<0,1	1,2
2303-17-01	Pork, loin, dry aged	1,75	0,260	0,639	<0,1	7,5	0,22	<0,1	0,51
2303-19-01	Pork, loin, dry aged	1,13	0,290	0,612	<0,1	8,7	0,121	<0,1	0,60
2303-21-01	Pork, loin, dry aged	1,06	0,191	0,606	<0,1	9,8	0,129	<0,1	1,12
<i>Average</i>	<i>Pork, loin, dry aged</i>	<i>1,2</i>	<i>0,26</i>	<i>0,56</i>	<i><0,1</i>	<i>7,48</i>	<i>0,16</i>	<i><0,1</i>	<i>0,86</i>
<i>Std.dev</i>	<i>Pork, loin, dry aged</i>	<i>32</i>	<i>19</i>	<i>20</i>		<i>34</i>	<i>29</i>		<i>41</i>

For all samples: Retinol <21 $\mu\text{g}/100\text{ g}$; β -carotene <5 $\mu\text{g}/100\text{ g}$; vitamin D2 <0.05 $\mu\text{g}/100\text{ g}$; 25-hydroxyvitamin D2 <0.05 $\mu\text{g}/100\text{ g}$; MK-5, MK-6, MK-8, MK-9 < 0.1 $\mu\text{g}/100\text{ g}$.

Appendix D – Vitamins - continued

DTU Code	Sample information	Thiamine	Riboflavin	Niacin	Pyridoxine	Pantothenic acid	Biotin	Cobalamin
		mg/100g	mg/100g	mg/100g	mg/100g	mg/100g	µg/100g	µg/100g
2303-POOL-13	Ham, dried, Serrano	0,519	0,287	8,03	0,461	0,969	5,2	0,63
2303-POOL-14	Ham, dried, Schwarzwald	0,762	0,220	6,86	0,406	0,728	5,4	0,48
2303-15-01	Pork, loin, dry aged	0,930	0,117	6,77	0,397	0,328	3,3	0,29
2303-17-01	Pork, loin, dry aged	0,879	0,155	7,82	0,349	0,472	5,4	0,49
2303-19-01	Pork, loin, dry aged	0,777	0,115	7,7	0,346	0,326	6,1	0,19
2303-21-01	Pork, loin, dry aged	0,857	0,108	7,3	0,298	0,538	7,0	0,34
<i>Average</i>	<i>Pork, loin, dry aged</i>	<i>0,86</i>	<i>0,12</i>	<i>7,40</i>	<i>0,35</i>	<i>0,42</i>	<i>5,44</i>	<i>0,33</i>
<i>Std.dev</i>	<i>Pork, loin, dry aged</i>	<i>7</i>	<i>17</i>	<i>6</i>	<i>12</i>	<i>26</i>	<i>29</i>	<i>38</i>

For all samples: folates <5 µg/100 g

Appendix E – Minerals

Content per 100 g

DTU Code	Sample information	Sodium mg	Potassium mg	Calcium mg	Magnesium mg	Phosphorous mg	Iron mg	Copper mg	Zinc mg	Manganese mg	Selenium µg	Molybdenum µg
2303-POOL-13	Ham, dried, Serrano	1850	580	16	33	295	0,96	0,08	2,3	0,013	22	1,5
2303-POOL-14	Ham, dried, Schwarzwald	1450	490	5,4	29	250	0,79	0,07	2,2	0,012	17	<1
2303-15-01	Pork, loin, dry aged	50	370	3,8	21	190	0,34	0,03	1,3	<0,005	16	<1
2303-17-01	Pork, loin, dry aged	53	380	4,6	22	210	0,40	0,04	1,3	0,008	14	1,1
2303-19-01	Pork, loin, dry aged	52	370	3,8	23	200	0,32	0,03	1,0	0,006	10	<1
2303-21-01	Pork, loin, dry aged	58	370	4,0	21	200	0,31	0,03	0,9	0,006	14	<1
<i>Average</i>	<i>Pork, loin, dry aged</i>	<i>53</i>	<i>373</i>	<i>4,1</i>	<i>22</i>	<i>200</i>	<i>0,34</i>	<i>0,03</i>	<i>1,1</i>	<i>0,006</i>	<i>14</i>	<i><1</i>
<i>Std.dev</i>	<i>Pork, loin, dry aged</i>	<i>6%</i>	<i>1%</i>	<i>9%</i>	<i>4%</i>	<i>4%</i>	<i>12%</i>	<i>10%</i>	<i>17%</i>	<i>20%</i>	<i>19%</i>	

For all samples: iodine <5 µg/100 g, chromium <2 µg/100 g

Appendix F – Amino acids

DTU Code	Sample information	Isoleucine	Leucine	Lysine	Methionine	Cysteine	Phenylalanine	Tyrosine	Threonine	Tryptophan
		g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g
2303-POOL-13	Ham, dried, Serrano	1,315	2,295	2,595	0,522	0,282	1,245	0,935	1,365	0,366
2303-POOL-14	Ham, dried, Schwarzwald	1,100	1,925	2,225	0,440	0,248	1,080	0,837	1,145	0,312
2303-15-01	Pork, loin, dry aged	0,893	1,550	1,810	0,435	0,207	0,905	0,695	0,964	0,248
2303-17-01	Pork, loin, dry aged	0,877	1,550	1,810	0,352	0,158	0,836	0,645	0,912	0,230
2303-19-01	Pork, loin, dry aged	0,872	1,500	1,810	0,407	0,164	0,893	0,641	0,897	0,216
2303-21-01	Pork, loin, dry aged	0,879	1,530	1,790	0,477	0,197	0,868	0,641	0,905	0,248
<i>Average</i>	<i>Pork, loin, dry aged</i>	<i>0,880</i>	<i>1,533</i>	<i>1,805</i>	<i>0,418</i>	<i>0,182</i>	<i>0,876</i>	<i>0,656</i>	<i>0,920</i>	<i>0,236</i>
<i>Std.dev</i>	<i>Pork, loin, dry aged</i>	<i>1,0%</i>	<i>1,5%</i>	<i>0,6%</i>	<i>12,6%</i>	<i>13,3%</i>	<i>3,5%</i>	<i>4,0%</i>	<i>3,3%</i>	<i>6,6%</i>

DTU Code	Sample information	Valine	Arginine	Histidine	Alanine	Aspartic acid	Glutamic acid	Glycine	Proline	Serine
		g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g
2303-POOL-13	Ham, dried, Serrano	1,460	1,795	1,095	1,695	2,665	4,340	1,410	1,230	1,135
2303-POOL-14	Ham, dried, Schwarzwald	1,220	1,505	0,938	1,400	2,295	3,700	1,195	0,989	0,956
2303-15-01	Pork, loin, dry aged	0,960	1,240	0,840	1,120	1,890	2,980	0,874	0,801	0,793
2303-17-01	Pork, loin, dry aged	0,981	1,270	0,803	1,180	1,840	2,950	1,070	0,847	0,773
2303-19-01	Pork, loin, dry aged	0,960	1,340	0,780	1,190	1,830	2,910	1,220	0,882	0,778
2303-21-01	Pork, loin, dry aged	0,947	1,260	0,733	1,110	1,800	2,800	0,981	0,739	0,754
<i>Average</i>	<i>Pork, loin, dry aged</i>	<i>0,962</i>	<i>1,278</i>	<i>0,789</i>	<i>1,150</i>	<i>1,840</i>	<i>2,910</i>	<i>1,036</i>	<i>0,817</i>	<i>0,775</i>
<i>Std.dev</i>	<i>Pork, loin, dry aged</i>	<i>1,5%</i>	<i>3,4%</i>	<i>5,7%</i>	<i>3,5%</i>	<i>2,0%</i>	<i>2,7%</i>	<i>14,1%</i>	<i>7,6%</i>	<i>2,1%</i>

Appendix G – Fatty acids

DTU Code	Sample information	C14:0	C16:0	C18:0	C16:1,n-7	C18:1,n-9	C18:1,n-7	C20:1,n-9	C18:2,n-6	C18:3,n-3	Cholesterol
		g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	g/100 g	mg/100 g
2303-POOL-13	Ham, dried, Serrano	0,15	2,68	1,27	0,31	4,80	0,38	<0.1	1,48	<0.1	97,0
2303-POOL-14	Ham, dried, Schwarzwald	0,14	2,50	1,27	0,28	4,33	0,35	<0.1	0,87	<0.1	77,6
2303-15-01	Pork, loin, dry aged	0,16	3,04	1,73	0,27	4,17	0,32	0,1	1,07	<0.1	59,2
2303-17-01	Pork, loin, dry aged	0,23	3,97	2,01	0,43	5,43	0,45	0,11	1,52	0,11	58,5
2303-19-01	Pork, loin, dry aged	0,26	5,18	2,91	0,41	7,11	0,49	0,17	1,55	0,12	59,8
2303-21-01	Pork, loin, dry aged	0,19	4,11	2,30	0,37	6,24	0,43	0,12	1,5	0,12	60,5
<i>Average</i>	<i>Pork, loin, dry aged</i>	<i>0,21</i>	<i>4,08</i>	<i>2,24</i>	<i>0,37</i>	<i>5,74</i>	<i>0,42</i>	<i>0,13</i>	<i>1,4</i>	<i>0,12</i>	<i>59,5</i>
<i>Std.dev</i>	<i>Pork, loin, dry aged</i>	<i>21%</i>	<i>22%</i>	<i>23%</i>	<i>19%</i>	<i>22%</i>	<i>17%</i>	<i>25%</i>	<i>16%</i>	<i>4,9%</i>	<i>1,4%</i>

All samples <0.1 g/100 g of: C4:0, C6:0, C8:0, C10:0, C12:0, C13:0, C15:0, C17:0, C20:0, C21:0, C22:0, C23:0, C24:0, C12:1,n-1, C14:1,n-5, C15:1,n-5, C17:1,n-7, C18:1,n-12, C20:1,n-11, C22:1,n-11, C22:1,n-9, C24:1,n-9, C18:3,n-6, C18:4,n-3, C20:2,n-6, C20:3,n-6, C20:3,n-3, C20:4,n-6, C20:5,n-3, C22:2,n-6, C22:3,n-3, C22:4,n-6, C22:5,n-6, C22:5,n-3, C22:6,n-3, C14:1,trans, C16:1,trans, C18:1,trans, C20:1,trans, C22:1,trans, C18:2,trans, C18:3,trans.

Appendix H – Macro nutrients in fresh loin, rind cut-off

All information about the samples can be found in Jakobsen et al., 2017

Code	Pork cut*	Weight g	Rind g	Nitrogen g/100g	Protein g/100g	Fat g/100g	Dry matter g/100g	Ash g/100g
15085730	Pork, loin, middle part, raw, rind cut off	3718	320	3,08	19,2	20,1	39,0	0,92
15085755	Pork, loin, middle part, raw, rind cut off	3667	310	2,76	17,3	24,9	43,0	0,88
15091687	Pork, loin, middle part, raw, rind cut off	3262	225	3,10	19,4	17,3	36,6	0,98
15093539	Pork, loin, middle part, raw, rind cut off	3486	267	2,75	17,2	23,7	41,7	0,91
15085732	Pork, loin, part versus ham, raw, rind cut off	541	39	2,61	16,3	27,3	44,5	0,83
15091663	Pork, loin, part versus ham, raw, rind cut off	536	47	2,82	17,6	25,4	44,0	0,85
15091689	Pork, loin, part versus ham, raw, rind cut off	604	45	2,92	18,2	19,6	40,6	0,90
15093541	Pork, loin, part versus ham, raw, rind cut off	595	39	2,85	17,8	22,4	43,4	0,88
15085731	Pork, loin, part versus neck, raw, rind cut off	522	30	2,56	16,0	27,3	43,5	0,82
15091662	Pork, loin, part versus neck, raw, rind cut off	520	29	2,56	16,0	29,5	45,7	0,87
15091688	Pork, loin, part versus neck, raw, rind cut off	608	22	2,54	15,9	22,3	42,5	0,86
15093540	Pork, loin, part versus neck, raw, rind cut off	672	23	2,83	17,7	23,0	40,7	0,91
	<i>Pork, loin, rind cut off</i>			2,78	17,38	23,57	42,10	0,88
	<i>Pork, loin, rind cut off</i>			0,19	1,19	3,55	2,54	0,04
<i>Information of analyses of rind</i>								
15087339	<i>Pork loin, middle part, rind</i>		320	3,76	23,5	23,7	51,2	0,58
15091664	<i>Pork loin, middle part, rind</i>		310	3,94	24,7	16,3	44,9	0,64
15091690	<i>Pork loin, middle part, rind</i>		225	5,00	31,2	14,3	44,5	0,62
15093542	<i>Pork loin, middle part, rind</i>		267	4,46	27,9	20,3	46,6	0,60

* All samples produced by Danish Crown, Danmarksgade 22, 7400 Herning

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