https://doi.org/10.17221/61/2025-CJFS

Evaluation of differences in the quality of pork meat from Czech pig breeds based on nutritional value, energy value and amino acid score

Pavel Nevrkla[1], *Eva Weisbauerová*[2], *Svitlana Karvan*[2]*, *Jan Sečkář*[1], *Zdeněk Hadaš*[1], *Miroslav Rozkot*[2], *Drahomíra Čtvrtlíková Knitlová*[1]

[1]*Department of Animal Breeding, Faculty of AgriSciences, Mendel University in Brno, Brno, Czech Republic*

[2]*Department of Pig Breeding, Institute of Animal Science, Prague, Czech Republic*

**Corresponding author: karvan.svitlana@vuzv.cz*

Citation: Nevrkla P., Weisbauerová E., Karvan S., Sečkář J., Hadaš Z., Rozkot M., Čtvrtlíková Knitlová D. (2025): Evaluation of differences in the quality of pork meat from Czech pig breeds based on nutritional value, energy value and amino acid score. Czech J. Food Sci., 43: 411–418.

Abstract: The nutritional quality of meat from pigs of the indigenous Prestice Black-Pied pig (PB) and the three-breed commercial hybrid of Large White × Landrace × Large White$_{\text{sireline}}$ (CH) was compared using these indicators: content of intramuscular fat, protein, saturated fatty acids (SFA) and essential amino acids (EAAs). The protein content and energy value of PB and CH meat were 20.12% and 22.56%, and 426.77 kJ·(100 g)$^{-1}$ and 443.01 kJ·(100 g)$^{-1}$, respectively. The lowest fat content (1.33%) and SFA content (0.33%) were found in the meat of commercial hybrid pigs. Leucine and lysine were the most predominant EAAs detected. Valine and leucine are the limiting AAs in studied meat as a protein source for children at 0.5–2 years of age. The compositions of AAs in PB and CH pork fully meet the protein needs of children over 2 years of age and adults. The calculated amount of pork meat provides the required daily intake of AAs and ensures 5–8% energy for children and 8–11% energy for adults at moderate physical activity. In general, the meat of Prestice Black-Pied pig and of the commercial hybrid showed the high nutritional value and quality and it can be recommended for consumption in the diet by children and adults.

Keywords: meat nutrients; protein quality; amino acids; pork consumption

Traditionally, people have always consumed natural products of animal (meat, milk) and plant origin (fruits, vegetables, cereal crops, legumes etc.), poultry products, fish, seafood. Despite the recent use of additional synthetic sources of nutrients, meat remains the primary source of complete, digestible protein in the human diet. Due to the closeness of the chemical composition of meat, its structure and properties to the proteins of the human body, meat occupies a special and essential place in the system of rational human nutrition as a source of protein (Drewnowski 2024; Zduńczyk et al. 2024).

Proteins are very important dietary macronutrients required for life with various metabolic and physiologic functions, including the regulation of appetite, food intake, body weight, and body composition. Their role in the regulation of blood pressure, glucose and lipid metabolism, bone metabolism, and the immune system has long been known and widely described (Górska-Warsewicz et al. 2018; Wolfe et al 2018; Penkert et al. 2021). Animal proteins contain so-called ‚indispensable' (IAA) or ‚essential' (EAAs) amino acids (AAs), which play a specific supporting

Supported by the Ministry of Agriculture of the Czech Republic (Grant No. RO0723).

https://doi.org/10.17221/61/2025-CJFS

role in stimulating the body growth, physiological functions of the human body, mental abilities, positively affect the absorption and digestibility of other food components and enable vitamins and minerals to fulfil all their physiological functions (Datlow et al. 2023; Leroy et al. 2023). EAAs cannot be synthesised by the human body and therefore they must be supplied by diet including meat.

There are many publications that analyse the quality of pork meat based on technological quality attributes (Rosenvold and Andersen 2003), genetic background of quality characteristic based on molecular markers (Kowalczyk et al. 2022), a multitude of factors, including genetic characteristics, rearing systems, feed composition, gender differences, pre-slaughter handling, and meat aging processes (Pandey et al. 2024), muscle fibre staining techniques (Lebedová et al. 2020), the breed composition for purebred and crossbred pigs (Lin et al. 2024), as well as comparison among pig breeds (Li et al. 2013; Tu et al. 2025).

The present research is focused on the evaluation of differences in the quality of pork meat from Czech pig breeds based on its nutritional and energy value, as well as amino acid score which indicates compliance with amino acid requirements. These breeds include Prestice Black-Pied pig (PB), which is currently kept in a closed population in the Czech Republic according to the National Programme for Farm Animal Resources, which belongs to European Regional Focal Point for Animal Genetic Resources. The breed is characterised by average fertility, good longevity, strong constitution and adaptability, it shows worse values of feed conversion, lower growth intensity, worse carcase value traits, but better meat quality parameters, such as pH and drip loss value in comparison with a commercial hybrid (Matoušek et al. 2016; Nevrkla et al. 2023). The objective of this study is to analyse and compare the nutritional and energy value of two pig populations: Prestice Black-Pied pig and a commercial hybrid of Large White × Landrace × Large White$_{\text{sireline}}$ (CH), based on their meat composition, particularly fat and amino acid content in the *longissimus lumborum et thoracis* (MLLT) muscle which were reported in the study by Nevrkla et al. (2023).

MATERIAL AND METHODS

The study was carried out on a total of 39 pigs [19 barrows (B) and 20 gilts (G)] of the indigenous PB and 37 pigs (17 B and 20 G) of the three-breed commercial hybrid of CH. A detailed description of the experimental methodology (animals, housing, feeding etc.) is given in Nevrkla et al. (2023). The animals were kept in operational conditions of a production farm in the Czech Republic in accordance with Council Directive 2008/120/EC.

After termination of fattening, the pigs were transferred from the experimental facility to a slaughterhouse located within 40 km. The animals were left to rest for about 2 h before slaughter. Then, they were slaughtered by electrical stunning (350 V, 4 A) and exsanguination. The carcasses were processed and cooled to 4 °C. After 24 h, samples (150 g) of MLLT were collected between the second and the third last rib and transported in a portable fridge to the laboratory for further analysis (Nevrkla et al. 2023).

The moisture content of samples was determined according to ISO 1442:2023, while the dry matter content in the samples was determined according to ISO 936:1998. The intramuscular fat (IMF) content in dry matter was analysed after extraction with petroleum ether on the Soxhlet 1043 device (FOSS Tecator AB, Hoganas, Sweden) as described in ISO 1444:1996. Nitrogenous compounds were determined using the Kjeltec Auto 1030 Analyser (FOSS Tecator AB, Hoganas, Sweden), the values obtained were then converted to meat protein content by a factor of 6.25 according to ISO 1871:2009. The automated AA analyser AAA 400 (INGOS Ltd., Prague, Czech Republic) equipped with an ion-exchange column was used to determine the AA content in meat after acid hydrolysis of protein molecules with 6 M hydrochloric acid. Chromatographic software ChromuLan (INGOS Ltd, Prague, Czech Republic) was used to estimate AA content.

The data were analysed in SAS version 9.1 software (SAS Institute Inc., USA) and MS Excel using standard statistical functions (SD, *t*-test).

The energy value of meat, expressed in kJ per 100 g, was calculated using these energy equivalents: 17 kJ for protein and 37 kJ for fat according to the recommendations of Regulation (EU) No 1169/2011.

A special programme was written to calculate the amino acid score, energy value and the amount of consumed meat, taking into account the following parameters: amino acid composition, amino acid requirement, identification of limiting amino acids, age of consumer, their gender, weight and physical activity level.

RESULTS AND DISCUSSION

There are many different types of dietary quality indices based on current nutritional knowledge and experience that are used to assess overall dietary intake,

https://doi.org/10.17221/61/2025-CJFS

evaluate dietary patterns and categorise individuals according to their eating behaviour (Schwingshackl et al. 2018; Verger et al. 2021; Harrison et al. 2022). However, different approaches are mainly driven by arbitrary choices due to the lack of knowledge of healthy diets and unresolved methodological problems (Gil et al. 2015).

To assess the nutritional, biological and energy values of pork meat, the indicators based on the chemical composition of meat were selected: fat, protein, SFA and EAAs content. These four indicators are sufficient for an initial and simple assessment of the overall nutritional quality of meat based on its composition and for calculating and comparing the energy value of different food products. Because pork meat can contain varying amounts of fat, a part of pork meat, the MLLT, is used as the reference standard to compare meat quality.

Daily reference intakes (DRI) for energy and selected nutrients for adults are presented in Table 1 and they are generally established in accordance with the recommendations of Regulation (EU) No 1169/2011, Joint FAO/WHO/UNU Expert Consultation (2007), guidelines by WHO (2023a, 2023b), and FAO (2003). Table 1 summarises the main components and nutrients of pig meat based on the average values of PB and CH pork meat properties that were presented by Nevrkla et al. (2023). These properties are related to ensuring nutritional, biological and energy values of the product, which allows us to assess its quality based on the average values of PB and CH pork meat properties. As can be seen from Table 1, there is a difference in the content of proteins between PB (20.12%) and CH (22.56%) meat, fat between PB (2.29%) and CH (1.61%) meat, as well as correspondingly low content of SFA (0.3–0.5%). These results are expected since a certain proportion of CH pigs are bred to reduce the fat content of pork meat, taking into account the desires and preferences of those consumers who increasingly prefer to eat leaner meat. On the other hand, some consumers consider that the intramuscular fat content of pork meat should be between 2.5% and 3.0% (Siemiński et al. 2023) for the optimum taste and flavour of food, and PB meat fulfils their preferences. According to consumer and industry criteria, CH pigs increase their productivity due to favourable high feed conversion efficiency, rapid growth rates, meat quality, and economic advantages (Sarmiento-García and Vieira-Aller 2023).

Comparison of the pork meat composition with daily reference intake for nutrients shows that 100 g of pork meat has an energy value of 426 kJ (PB) and 443 kJ (CH), provides 3% of the daily total fat intake, including 2% of SFA, and provides 50% of protein intake, including 50% of EAAs. Taking into account the conversion factor for calculating the energy, 100 g of meat provides 5–5.5% of the reference energy intake (which is 8 400 kJ per day), including 4–4.5% due to proteins and 0.8–1.0% due to fat. The energy value of the studied meat is provided by 20% of fat and 80% of proteins in PB meat and 14% of fat and 86% of proteins in CH meat, which corresponds to the WHO recommendation (2023) limiting the total fat intake to 30% of total energy. Energy intake coming from SFA is less than 10% and it also corresponds to the strict WHO recommendation (2023).

Table 1. Composition (mean ± SD) and energy value of PB and CH pork meat

Properties	Mean ± SD		*P*-value	DRI for adults (18–60 y)
	genotype PB	genotype CH		
Moisture (%)	76.49 ± 0.01*	74.64 ± 0.80	0.041	
Fat (%)	2.29 ± 0.13**	1.61 ± 0.04**	0.009	70 g
SFA (%)	0.47 ± 0.10	0.33 ± 0.01	0.093	20 g
Proteins (%)	20.12 ± 0.11*	22.56 ± 0.84*	0.84	50 g
EAAs (%)	6.89 ± 0.02	7.54 ± 0.01	0.056	14 g
Ash (%)	1.10 ± 0.03	1.20 ± 0.04	0.055	–
E [kJ·(100 g)$^{-1}$]	426.77 ± 2.79	443.01 ± 12.74	0.11	8 400 kJ
Ef (%)	19.85 ± 0.97**	13.45 ± 0.74**	0.009	–
Esfa (%)	4.07 ± 0.83	2.76 ± 0.20	0.081	–
Epr (%)	80.15 ± 0.97**	86.55 ± 0.74**	0.009	–

* and **significance at 0.05 and 0.01 levels, respectively

PB – Prestice Black-Pied pig; CH – commercial hybrid; DRI – daily reference intake; SFA –saturated fatty acids; EAA – essential amino acid; *E* – energy value of meat; *Ef* – energy intake of fat (% to total E); *Esfa* – energy intake of SFA; *Epr* – energy intake of proteins

https://doi.org/10.17221/61/2025-CJFS

The content of EAAs in pork meat is shown in Table 2. The general requirements for AA for adults 18 to 60 years of age are used in accordance with the FAO/IAEA (2024), Joint FAO/WHO/UNU Expert Consultation (2007). Eight major EAAs including THR, MET, VAL, ILE, LEU, HIS, PHE and LYS were detected in the meat samples. LEU and LYS were the most predominant EAAs detected, GLU and ASP were the most predominant nonEAAs, present in the highest amounts in the meat of PB. Similar results were obtained by other researchers (Okrouhlá et al. 2006 and 2008; Dostálová et al. 2012).

The specific amounts of AAs to meet all human physiological needs have not been definitively and precisely established. There are many studies that identified reference intakes of EAA reflecting minimum requirements, unconditional adequate amounts and minimum daily requirements, which were reviewed in Boye et al. (2012). FAO/WHO recommendations were used to assess the protein quality of meat by comparing meat composition with standards (OECD/FAO 2024). Therefore, amino acid scores (*AAS*) for EAAs were calculated using the EAA requirements (Sr1, Sr2) for adults, which are shown in Table 2.

Since *AAS* > 1 for all AAs in the studied pork meat of PB and CH, there is no limiting AA for adults. This means that the AA composition of pork meat meets the requirements for protein quality in adults. The minimum mean of *AAS* is 1.06 for VAL and LEU in PB meat, and *AAS* is 1.02 for VAL in CH meat. The maximum mean of *AAS* is for HIS: 2.32 for PB meat and 2.24 for CH meat; and *AAS* is for THR: 1.78 for PB meat and 1.65 for CH meat.

Similar calculations were performed to assess the pork AA compliance for children (Table 3). The age and average weight of children were taken into account. It was found that there are limiting AAs for children 0.5–2 years old; *AAS* (VAL, LEU) for children 0.5 years old is 0.65 for PB and 0.60 (VAL) for CH, the maximum mean of *AAS* for HIS is 1.22 for PB and 1.13 for CH, respectively. And the limiting AAs for children 1–2 years old are VAL (*AAS* = 0.89) and LEU (*AAS* = 0.89) for PB and VAL (*AAS* = 0.82) for CH. Since *AAS* > 1 for all AAs, the composition of the AAs of the studied PB and CH pork fully satisfies the protein needs of children over 2 years of age.

Tables 2 and 3 show the values calculated at a protein intake of 0.66 g·kg^{-1} per day. This is the minimum

Table 2. Essential amino acids (EAAs) content in MLLT (mean ± SD) by genotype and amino acids compliance for adults (18–60 years)

Amino acid (AA)	Content of AAs (S, mean ± SD)			AA requirement		AAS (mean ± SD)		
	PB	CH	*P*-value	Sr1	Sr2	PB	CH	*P*-value
THR	47.98 ± 3.69	42.69 ± 1.60	0.102	15	23	2.09 ± 0.16	1.86 ± 0.07	0.102
VAL	48.33 ± 3.52	44.71 ± 1.61	0.159	26	39	1.24 ± 0.09	1.15 ± 0.04	0.159
MET	26.99 ± 0.17	26.60 ± 0.39	0.161	10	16	1.69 ± 0.01	1.66 ± 0.02	0.161
ILE	45.52 ± 1.69*	41.00 ± 1.11*	0.044	20	30	1.52 ± 0.06*	1.37 ± 0.04*	0.044
LEU	72.89 ± 11.44	73.56 ± 2.65	0.471	39	59	1.24 ± 0.19	1.25 ± 0.04	0.471
PHE	37.22 ± 0.31	36.00 ± 2.12	0.252	–	–	–	–	–
LYS	80.63 ± 1.16*	73.73 ± 1.30*	0.015	30	45	1.79 ± 0.03*	1.64 ± 0.03*	0.015
HIS	40.67 ± 1.74	37.79 ± 1.01	0.090	10	15	2.71 ± 0.12	2.52 ± 0.07	0.09
TRP	–	–	–	4	6	–	–	–
CYS	–	–	–	4	6	–	–	–
SAAs (MET + CYS)	–	–	–	15	22	–	–	–
ArAAs (PHE + TYR)	71.17 ± 2.92	67.27 ± 3.25	0.167	25	38	1.8 ± 0.08	1.77 ± 0.09	0.167
Total EAAs	400.22 ± 23.73	376.07 ± 11.81	0.163	184	277	1.44 ± 0.09	1.36 ± 0.04	0.163

*significance level at 0.05 level

PB – Prestice Black-Pied pig; CH – commercial hybrid; MLLT – *longissimus lumborum et thoracis* muscle; SAAs – sulphur-containing amino acids; ArAAs – aromatic amino acids; S – average content of AA [mg·(1 g)$^{-1}$ of proteins in meat]; EAAs – essential amino acids; Sr1 – EAAs requirement, mg·kg^{-1} body weight per day; Sr2 – EAAs requirement, mg·g^{-1} of proteins·kg^{-1} body weight per day, mean nitrogen requirement of 105 mg N·kg^{-1} per day (0.66 g proteins·kg^{-1} per day), Sr2 = Sr1/0.66; AAS – amino acid score at total protein requirement of 0.66 g·kg^{-1} per day, *AAS* = S/Sr2.

https://doi.org/10.17221/61/2025-CJFS

Table 3. Amino acids compliance of pork meat for children

Amino acid	Children 0.5 years					Children 1–2 years					Children 3–10 years				
	AAR		AAS (mean ± SD)			AAR		AAS (mean ± SD)			AAR		AAS (mean ± SD)		
	Sr1	Sr2	PB	CH	*P*-value	Sr1	Sr2	PB	CH	*P*-value	Sr1	Sr2	PB	CH	*P*-value
THR	34	52	0.93 ± 0.07	0.83 ± 0.03	0.102	23	35	1.38 ± 0.11	1.22 ± 0.06	0.101	18	27	1.76 ± 0.14	1.57 ± 0.06	0.102
VAL	49	74	0.65 ± 0.04	0.60 ± 0.02	0.159	36	55	0.89 ± 0.06	0.82 ± 0.03	0.159	29	44	1.10 ± 0.08	1.02 ± 0.04	0.159
ILE	36	55	0.83 ± 0.03*	60.75 ± 0.02*	0.043	27	41	1.11 ± 0.04*	1.00 ± 0.03*	0.044	23	35	1.31 ± 0.05*	1.18 ± 0.03*	0.044
LEU	73	111	0.66 ± 0.10	0.67 ± 0.02	0.471	54	82	0.89 ± 0.14	0.90 ± 0.03	0.471	44	67	1.09 ± 0.17	1.10 ± 0.04	0.471
LYS	64	97	0.83 ± 0.01*	0.76 ± 0.01*	0.015	45	68	1.18 ± 0.02*	1.08 ± 0.02*	0.015	35	53	1.52 ± 0.02*	1.39 ± 0.02*	0.015
HIS	22	33	1.22 ± 0.05	1.13 ± 0.03	0.090	15	23	1.79 ± 0.08	1.66 ± 0.04	0.09	12	18	2.24 ± 0.10	2.08 ± 0.06	0.090
TRP	9.5	14	–	–	–	6.4	10	–	–	–	4.8	7	–	–	–
SAAs	31	47	–	–	–	22	33	–	–	–	18	27	–	–	–
ArAAs	59	89	0.80 ± 0.03	0.75 ± 0.04	0.167	40	61	1.17 ± 0.05	1.11 ± 0.05	0.167	30	45	1.57 ± 0.06	1.48 ± 0.07	0.167
Total EAAs	378	573	0.60 ± 0.04	0.58 ± 0.02	0.163	268	406	0.84 ± 0.06	0.82 ± 0.03	0.163	214	324	1.06 ± 0.07	1.03 ± 0.04	0.163

Table 3. Amino acids compliance of pork meat for children (continued)

Amino acid	Children 11–14 years					Children 15–18 years				
	AAR		AAS (mean ± SD)			AAR		AAS (mean ± SD)		
	Sr1	Sr2	PB	CH	*P*-Value	Sr1	Sr2	PB	CH	*P*-value
THR	18	27	1.76 ± 0.14	1.57 ± 0.06	0.102	17	26	1.86 ± 0.14	1.66 ± 0.06	0.102
VAL	29	44	1.10 ± 0.08	1.02 ± 0.04	0.159	28	42	1.14 ± 0.08	1.05 ± 0.04	0.159
ILE	22	33	1.37 ± 0.05*	1.23 ± 0.03*	0.044	21	32	1.43 ± 0.05*	1.29 ± 0.03*	0.044
LEU	44	67	1.09 ± 0.17	1.10 ± 0.04	0.471	42	64	1.15 ± 0.18	1.16 ± 0.04	0.471
LYS	35	53	1.52 ± 0.02*	1.39 ± 0.02*	0.015	33	50	1.61 ± 0.02*	1.47 ± 0.03*	0.015
HIS	12	18	2.24 ± 0.10	2.08 ± 0.06	0.090	11	17	2.44 ± 0.10	2.27 ± 0.06	0.090
TRP	4.8	7	–	–	–	4.5	7	–	–	–
SAAs	17	26	–	–	–	16	24	–	–	–
ArAAs	30	45	1.57 ± 0.06	1.48 ± 0.07	0.167	28	42	1.68 ± 0.07	1.59 ± 0.08	0.167
Total EAAs	212	321	1.07 ± 0.07	1.04 ± 0.04	0.163	201	305	1.12 ± 0.08	1.10 ± 0.04	0.163

*significance level at 0.05 level

PB – Prestice Black-Pied pig; CH – commercial hybrid; SAAs – sulphur-containing *amino acids;* ArAAs – aromatic amino acids; AAR – amino acid requirement; EAAs – essential amino acids; Sr1 – EAAs requirement, $mg \cdot kg^{-1}$ body weight per day; Sr2 – EAAs requirement, $mg \cdot g^{-1}$ of proteins$\cdot kg^{-1}$ body weight per day, mean nitrogen requirement of 105 mg $N \cdot kg^{-1}$ per day (0.66 g proteins$\cdot kg^{-1}$ per day), Sr2 = Sr1/0.66; AAS – amino acid score at total protein requirement of 0.66 $g \cdot kg^{-1}$ per day, *AAS* = S/Sr2

https://doi.org/10.17221/61/2025-CJFS

protein requirement (MPR), which is defined as: the lowest level of dietary protein intake that compensates the loss of nitrogen from the body, and thus it maintains the body protein mass in people in energy balance with a moderate level of physical activity, plus, in children or in pregnant or lactating women, the needs associated with tissue deposition or milk secretion at a rate consistent with good health. But based on an assessment of true interindividual variation, a safe individual intake was determined to be 0.83 $g \cdot kg^{-1}$ per day. This intake meets the needs of 97.5% of individuals in the population (i.e. the risk of deficiency for any individual at this intake is ≤ 2.5%) (Millward 2012).

Considering the safe level of protein requirement for different groups of people (adults and children), their age, (average) body weight, moderate level of habitual physical activity PAL = 1.75 and the limiting AA for children (Table 3), the energy value of raw pork meat and its amount to provide AA intake were theoretically

Table 4. Theoretically calculated amount of raw pork meat for consumption by children (from 0.5 to 18 years) and adults (from 18 to 60 years)

Age group	Average body weight, *Wb* (kg)	Mass of raw meat to provide AAs, *m* ($g \cdot day^{-1}$)		Energy for body, *E* ($kJ \cdot day^{-1}$)		Energy requirement, *Er*	Energy for body, *Erb*	% of daily energy from meat (*E*/*Er* × 100%)	
		PB	CH	PB	CH			PB	CH
Children 0.5 y	6	43.06	41.52	183.78	183.94	338.00	2.03	9.06	9.07
Children 2 y	11	58.00	55.93	247.54	247.76	337.00	3.71	6.68	6.68
Children 3 y	13	55.22	53.24	235.66	235.87	335.00	4.36	5.41	5.42
Children 6 y	21	86.36	83.26	368.54	368.86	307.00	6.45	5.72	5.72
Children 10 y	32	131.59	126.88	561.58	562.08	260.00	8.32	6.75	6.76
Children 13 y	42	167.02	161.04	712.78	713.41	220.00	9.24	7.71	7.72
Children 14 y	50	198.83	191.71	848.54	849.29	218.00	10.90	7.78	7.79
Children 15 y	54	205.02	197.68	874.96	875.73	211.00	11.41	7.73	7.74
Children 17 y	59	229.85	221.62	980.91	981.77	200.00	12.17	8.14	8.15
Youth 18 y	62	235.56	227.13	1 005.30	1 006.20	198.00	12.27	8.23	8.24
Adult	50	206.26	183.99	880.27	815.11	195.00	9.75	9.03	8.36
Adult	60	247.51	220.79	1 056.32	978.13	180.00	10.80	9.78	9.06
Adult	75	309.39	275.99	1 320.40	1 222.66	160.00	12.00	11.00	10.19
Adult	85	350.65	312.79	1 496.45	1 385.68	150.00	12.75	11.74	10.87

Safe level of protein requirement ($g \cdot kg^{-1}$ per day): 0.83 for adults; 0.88 for boys (18 y); 0.86 for girls (18 y); 0.87 average for youth 18 y; 0.91 for children 6–10 years; 0.94 for children 1–5 years

PB – Prestice Black-Pied pig; CH – commercial hybrid; *E* – energy intake of the mass of meat ($g \cdot day^{-1}$) to ensure AAs for person at average body weight; *Er* – energy requirement, $kJ \cdot kg^{-1}$ body weight per day for population at moderate level of habitual physical activity (PAL = 1.75); *Erb* – energy requirement for body at average weight, $kJ \cdot day^{-1}$ for population with PAL = 1.75, *Erb* = *Er* × *Wb*; *E*/*Er* × 100% – index indicating % of required daily energy, which is provided by meat

https://doi.org/10.17221/61/2025-CJFS

calculated based on the average means of raw meat mass using our developed programme (Table 4). As we can see, the calculated amount of raw meat ensures 5–8% of energy for children and 8–11% of energy for adults. Despite the significant differences between the fat and protein content of the studied meat (Table 1, $P > 0.05$), the difference between the weight of raw pork samples and the energy obtained is not significant. In general, the theoretically calculated amount of raw pork meat is 200–280 g per day for adults, depending on their weight and age but the servings also depend on the cooking technique. According to the Food-Based Dietary Guidelines the average single portion is 100–150 g and weekly consumption is 300–600 g of processed meat in different European countries (European Commission 2025). The specific individual amount of meat required for the normal functioning of the human body is calculated on the basis of *food*-based *dietary* guidelines (Montagnese et al. 2015), which include all nutrient groups.

CONCLUSION

The performed study showed a significant effect of the genetic group of the pigs on the fat, SFA, protein and some AAs contents. The greatest influence was observed on the amount of EAAs: LEU, LYS and THR and on the amount of nonEAAs: GLU and ASP. Comparison of the AA profile of pork meat with AA requirements indicates that the limiting AAs are VAL and LEU only for children 0.5–2 years old. For older children and adults, the studied PB and CH pig meat meets all modern and healthy requirements of dietary guidelines and can provide the required amount of proteins and energy. The approach used in this study allows an adequate assessment of the nutritional value of pork meat as an essential food and dietary component as well as it can be applied to evaluation and comparison of other protein products.

REFERENCES

Boye J., Wijesinha-Bettoni R., Burlingame B. (2012): Protein quality evaluation twenty years after the introduction of the protein digestibility corrected amino acid score method. The British Journal of Nutrition, 108: *S*183–S211.

Datlow L.Y., Leventhal M., King J., Wallace T.C. (2023): Consumption patterns and the nutritional contribution of total, processed, fresh, and fresh-lean pork to the U.S. diet. Nutrients, *15*: 2595.

Dostálová A., Koucký M., Vališ L., Šimečková M. (2012): Evaluation of fattening performance, carcass traits and meat characteristics of Prestice Black-Pied pigs in the organic free- range and conventional system. Research in Pig Breeding, 6: 15–19.

Drewnowski A. (2024): Perspective: The place of pork meat in sustainable healthy diets. Advances in Nutrition, 15: 100213.

European Commission (2025): Food-Based Dietary Guidelines Recommendations for Meat. Available at https://knowledge4policy.ec.europa.eu/health-promotion-knowledge-gateway/food-based-dietary-guidelines-europe-table-8_en (accessed March 20, 2025).

Gil Á., Martinez de Victoria E., Olza J. (2015): Indicators for the evaluation of diet quality. Nutrición Hospitalaria, 31: 128–144.

Górska-Warsewicz H., Laskowski W., Kulykovets O., Kudlińska-Chylak A., Czeczotko M., Rejman K. (2018): Food products as sources of protein and amino acids – The case of Poland. Nutrients, 10: 1977.

Harrison M.R., Palma G., Buendia T., Bueno-Tarodo M., Quell D., Hachem F. (2022): A scoping review of indicators for sustainable healthy diets. Frontiers in Sustainable Food Systems, 5: 822263.

Kowalczyk M., Kaliniak-Dziura A., Prasow M., Domaradzki P., Litwińczuk A. (2022): Meat quality – Genetic background and methods of its analysis. Czech Journal of Food Science, 40: 15–25.

Lebedová N., Needham T., Čítek J., Okrouhlá M., Zadinová K., Pokorná K., Stupka R. (2020): Comparison of two muscle fibre staining techniques and their relation to pork quality traits. Czech Journal of Animal Science, 65: 193–204.

Leroy F., Smith N.W., Adesogan A.T., Beal T., Iannotti L., Moughan P.J., Mann N. (2023): The role of meat in the human diet: Evolutionary aspects and nutritional value. Animal Frontiers, 13: 11–18.

Lin Q., Diao S., Chen X., Du J., Wu J., Zhang X., Liu X., Li J., Zhang Z. (2024): Evaluation of the breed composition of pork via population structure analysis in pigs. Animals, 14: 3489.

Li Y.X., Cabling M.M., Kang H.S., Kim T.S., Yeom S.C., Sohn Y.G., Kim S.H., Nam K.C., Seo K.S. (2013): Comparison and correlation analysis of different swine breeds meat quality. Asian-Australasian Journal of Animal Sciences, 26: 905–910.

Matoušek V., Kernerová N., Hyšplerová K., Jirotková D., Brzaková M. (2016): Carcass traits and meat quality of Prestice Black-Pied pig breed. Asian-Australasian Journal of Animal Sciences, 29: 1181–1187.

Millward D.J. (2012): Identifying recommended dietary allowances for protein and amino acids: A critique of the 2007 WHO/FAO/UNU report. British Journal of Nutrition, 108: S3–S21.

Montagnese C., Santarpia L., Buonifacio M., Nardelli A., Caldara A.R., Silvestri E., Contaldo F., Pasanisi F. (2015): European food-based dietary guidelines: A comparison and update. Nutrition, 31: 908–915.

https://doi.org/10.17221/61/2025-CJFS

Nevrkla P., Weisbauerová E., Horký P., Hadaš Z., Rozkot M., Čtvrtlíková Knitlová D. (2023): Fatty acid and amino acid profiles in muscle *longissimus lumborum et thoracis* of the indigenous Prestice Black-Pied pig breed in comparison with a commercial pig hybrid. Italian Journal of Animal Science, 22: 472–481.

OECD/FAO (2024): OECD–FAO Agricultural Outlook 2024–2033. Paris, OECD. Available at https://www.oecd.org/en/publications/oecd-fao-agricultural-outlook-2024-2033_4c5d2cfb-en.html (accessed Aug 1, 2024).

Okrouhlá M., Stupka R., Čítek J., Šprysl M., Kluzáková E, Trnka M., Štolc L. (2006): Amino acid composition of pig meat in relation to live weight and sex. Czech Journal of Animal Science, 51: 529–534.

Okrouhlá M., Stupka R., Čítek J., Šprysl M., Trnka M., Kluzáková E. (2008): Effect of lean meat proportion on the chemical composition of pork. Czech Journal of Food Science, 26: 464–469.

Pandey S., Kim S., Kim E.S., Keum G.B., Doo H., Kwak J., Ryu S., Choi Y., Kang J., Kim H., Chae Y., Seol K.-H., Kang S.M., Kim Y., Seong P.N., Bae I.-S., Cho S.-H., Jung S., Kim H.B. (2024): Exploring the multifaceted factors affecting pork meat quality. Journal of Animal Science and Technology, 66: 863–875.

Penkert L.P., Li R., Huang J., Gurcan A., Chung M.C., Wallace T.C. (2021): Pork consumption and its relationship to human nutrition and health: A scoping review. Meat and Muscle Biology, 5: 43.

FAO & IAEA (2024): Development of a Protein Database and the Way Forward for Reviewing Protein Requirements. Report of a joint FAO/IAEA Technical Meeting in Vienna, Oct 10–13, 2022. Rome, FAO.

Joint FAO/WHO/UNU expert consultation (2007): Protein and Amino Acid Requirements in Human Nutrition. WHO Technical Report Series, 935.

FAO (2003): Food Energy – Methods of Analysis and Conversion Factors. Report of a Technical Workshop in Rome, Dec 3–6, 2002. Rome, FAO.

Rosenvold K., Andersen H.J. (2003): Factors of significance for pork quality – A review. Meat Science, 64: 219–237.

Sarmiento-García A., Vieira-Aller C. (2023): Improving fatty acid profile in native breed pigs using dietary strategies: A review. Animals, 13: 1696.

Schwingshackl L., Bogensberger B., Hoffmann G. (2018): Diet quality as assessed by the healthy eating index, alternate healthy eating index, dietary approaches to stop hypertension score, and health outcomes: An updated systematic review and meta-analysis of cohort studies. Journal of the Academy of Nutrition and Dietetics, 118: 74–100.e11.

Siemiński G., Skałecki P., Florek M., Domaradzki P., Poleszak E., Dmoch M., Ryszkowska-Siwko M., Kędzierska-Matysek M., Teter A., Kowalczyk M., Kaliniak-Dziura A. (2023): Meat nutritional value of Puławska Fattening Pigs, Polish Large White × Puławska crossbreeds and hybrids of DanBred. Animals, 13: 2408.

WHO (2023a): Saturated Fatty Acid and *trans*-fatty Acid Intake for Adults and Children: WHO Guideline. Geneva, World Health Organization.

WHO (2023b): Total Fat Intake for the Prevention of Unhealthy Weight Gain in Adults and Children: WHO Guideline. Geneva, World Health Organization.

Tu W., Wang H., Zhang Y., Jiang W., He C., Huang J., Bai L., Diao Y., Zhou J., Tan Y., Wu X. (2025): Muscle characteristics comparison analysis reveal differences in the meat quality and nutritional components of three Shanghai local pig breeds. Foods, 14: 569.

Verger E., Le Port A., Borderon A., Bourbon G., Moursi M., Savy M., Mariotti F., Martin-Prével Y. (2021): Dietary diversity indicators and their associations with dietary adequacy and health outcomes: A systematic scoping review. Advances in Nutrition, 12: 1659–1672.

Wolfe R.R., Baum J.I., Starck C., Moughan P.J. (2018): Factors contributing to the selection of dietary protein food sources. Clinical Nutrition, 37: 130–138.

Zduńczyk W., Tkacz K., Pietrzak-Fiećko R., Bottari B., Modzelewska-Kapituła M. (2024): Pork as a source of nutrients in a human diet – Comparison of meat obtained from conventional and organic systems offered in the Polish market. NFS Journal, 37: 100199.

Received: April 22, 2025
Accepted: August 8, 2025
Published online: December 18, 2025