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Effect of genotype on chemical composition and fatty acid profile of guinea pig carcass (*Cavia porcellus* L.)

Efecto del genotipo sobre la composición química y perfil de ácidos grasos de la carcasa de cuy (*Cavia porcellus* L.)

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Abstract

The aim of this study was to evaluate the effect of the genotype on the deposition curve of the chemical components and fatty acid profile of carcass of guinea pigs of Peru and Cieneguilla genotypes. Forty-eight male guinea pigs (24 per genotype), randomly distributed in pens with three animals each per genotype were used. Management and feeding protocols, up to 32 wk of age, were similar for both genotypes. The deposition curve of the chemical components was determined using the Gompertz equation. Data of the fatty acid profile were submitted to analysis of varianza under a Randomized Complete Block Design using the SAS Studio Environment software, with a significance level of $\alpha = 0.05$. The results showed that the asymptote of the moisture and protein content in the carcass of the Peru genotype was higher ($P < 0.05$) than that of Cieneguilla genotype, but not in the fat content, which was similar ($P > 0.05$) in both genotypes. Likewise, the function of the relationship between the maximum deposition rate of the three chemical components and the content at adulthood (k) was similar ($P > 0.05$) in the two genotypes. The age of maximum moisture deposition rate and total protein at the inflection point (ti) are lower than the maximum fat deposition rate in both genotypes. Regarding the fatty acid profile of the carcass, the content of total and individual saturated fatty acids was similar ($p > 0.05$) in the two genotypes was observed. However, the content of total monounsaturated fatty acids and oleic acid (C18:1C) were higher ($p < 0.05$) in the Cieneguilla genotype, while the content of total polyunsaturated fatty acids, linoleic and linolenic acids were higher ($P < 0.05$) in the carcass of guinea pigs of the Peru genotype. In conclusion, the asymptote of moisture content and crude protein in adulthood was higher ($p < 0.05$) in the Peru genotype. In saturated fatty acid content, there were no statistical differences between both genotypes, but the Cieneguilla genotype contains a higher ($p < 0.05$) percentage of monounsaturated fatty acids and the Peru genotype has a higher ($p < 0.05$) percentage of polyunsaturated fatty acids.

Keywords: *guinea pig, genotype, deposition of chemical compounds, profile of fatty acids and polyunsaturated fatty acids.*

Resumen

El objetivo del presente estudio fue evaluar el efecto del genotipo sobre la curva de deposición de los componentes químicos y perfil de ácidos grasos de la carcasa del cuy de los genotipos Perú y Cieneguilla. Se utilizaron 48 cuyes machos (24 por genotipo), distribuidos al azar en siete pozas con tres animales cada uno por genotipo. El manejo y la alimentación con rastrojo de brócoli y alimento balanceado fue similar para ambos

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genotipos hasta las 32 semanas de edad. Las curvas de deposición de los componentes químicos fueron determinadas mediante el modelo de la ecuación de Gompertz y para el perfil de ácidos grasos se utilizó el Diseño Bloques Completamente al Azar usando el programa SAS Studio Environment, con un nivel de significación de $\alpha=0.05$. Los resultados mostraron que la asíntota del contenido de humedad y proteína en la carcasa del genotipo Perú fue superior ($p<0.05$) al de Cieneguilla, mientras que el contenido de grasa que fue similar ($p>0.05$) en ambos genotipos. Igualmente, la función de la relación de la máxima tasa de deposición de los tres componentes químicos y el contenido a la edad adulta (k) fue similar ($p>0.05$) en los dos genotipos. La edad de la máxima tasa de deposición de humedad y proteína total en el punto de inflexión (ti) son inferiores a la máxima tasa de deposición de grasa en ambos genotipos. Respecto al perfil de ácidos grasos de la carcasa, se observó que el contenido de ácidos grasos saturados totales e individuales fue similar ($p>0.05$) en los dos genotipos. Sin embargo, el contenido de ácidos grasos monoinsaturados totales y ácido oleico (C18:1C) fueron superiores ($p<0.05$) en el genotipo Cieneguilla, mientras que el contenido de ácidos grasos poliinsaturados totales, ácido linoleico y linolénico fueron superiores ($p<0.05$) en la carcasa de los cuyes del genotipo Perú. En conclusión, la asíntota del contenido de humedad y de la proteína cruda en la edad adulta fue mayor ($p<0.05$) en el genotipo Perú. En el contenido de ácidos grasos saturados no hubo diferencias estadísticas entre ambos genotipos, pero el genotipo Cieneguilla, contiene mayor ($p<0.05$) porcentaje de ácidos grasos monoinsaturados y el genotipo Perú mayor ($p<0.05$) porcentaje de ácidos grasos poliinsaturados.

Palabras claves: *cuy, genotipo, deposición de compuestos químicos, perfil de ácidos grasos y ácidos grasos poliinsaturados.*

Introduction

In any animal production system, the body growth rate is a very important measure of the productive process, which follows a biological process specific to each animal species that occurs throughout the life cycle. But, with the advancement of knowledge in nutrition and public health, nowadays the market is looking for foods of animal origin that provide high-quality protein and fat for human consumption. Among them could be guinea pig meat, which is a domestic species little studied as a productive animal that meets these qualities. In this regard, the first researchers to study the anatomy and growth of the different organs of the guinea pig as a laboratory animal were Gericke et al. (2005) whose results can be used as a starting point for new research.

In recent decades, thanks to the knowledge of the benefits of guinea pig meat that is healthy and delicious (Rosenfeld, 2008), it is an economical source of high-quality animal protein for humans, which has motivated the breeding of this species. mainly in developing countries (Lammers et al., 2009); however, in livestock production systems, there are many factors that influence production parameters. The most important factors are the feed composition and the animal genotype (Do & Mair, 2020). In this regard, in Peru, improved guinea pigs are products of crosses between genotypes developed in different research centers, such as: Peru, Andina, Inti and lately the Kuri, released by INIA (Chauca, 2022) that gave it the name of “Razas”. Other ones are Yauris genotype (National University of the Center of Huancayo), Cieneguilla genotype, UNALM (Cantaro et al., 2020), each with its own productive and reproductive characteristics.

Regarding meat quality, the chemical composition is essential for the most efficient production systems (Fernandes et al., 2010). Furthermore, the initial body composition is important in predicting the energy requirement for growth, but its assessment has its limitations in live animals (Tedeschi et al., 2004; Baker et al., 2006). On the other hand, the moisture, protein, and ash contents of the body tissue of fat-free animals are remarkably constant. In this regard, Clawson et al. (1991) in a meta-analysis study with approximately 200 research papers with different types of animals and ages, observed that moisture, protein, and ash of fat-free body tissue are in a ratio of about 19:5:1 (74-76 percent moisture, 20-22 percent protein, and 3-5 percent ash) in cattle, goats, mice, rats, sheep, pigs, chickens, quail, turkeys, and fish (Clawson et al., 1991).

Growth and development can be measured in relation to changes in body tissues due to age and deposition of chemical compounds in the body mass of animals and that this basic information is used to estimate nutrient needs (Michell, 1962; cited by Ayala, 2018), because at the beginning of an animal's life, weight gains are made up mainly of water, protein, and minerals, which are necessary for the growth of muscle and bone tissue, later weight gains contain increasing amounts of fat (Mitchell , 1962 cited by Ayala, 2018). Research studies reported that fat is deposited at an increasing rate with the age of the animal, while protein and ash are deposited at decreasing rates. As was reported in the lipid content in capybara (Hidroahoerus hydrochaeris) meat that increases from 0.40 to 1.48 percent from juvenile to adult age (Anwar & Kegan, 2020).

To study the dynamics of the deposition curve of chemical components in animal body tissue, the Gompertz mathematical model was used. In this regard, the growth rate and chemical composition of the pig carcass, showed that the protein retention potential increases with genetic selection and other factors associated with age that could be influencing the measurement values (Casas et al., 2010). Besides, the processes of assessment of the dynamics of the carcass macromolecules show that the maturation rate parameter is different for the lipid and protein fractions (Andersen & Pedersen, 1996; Knap, 2000). In another study with several strains of guinea pigs, significant differences in fat content in the carcass of guinea pigs from the Mantaro, Saño and Type 1 strains at 13 weeks of age were reported; variations that could be due to the high variability of the animal (Kaijak, 2003 cited by Chauca et al., 2008). In another experiment with rabbits, they showed that muscle fat deposition is significantly affected by the genotype of the species, this would be due to the activity of lipogenic enzymes (glucose 6, phosphate dehydrogenase and fatty acid synthase) and oxidative enzymes (β-hydroxyacyl– CoA dehydrogenase and citrate synthase) during lipid metabolism of muscle tissue (Zomeño et al., 2010). Another factor that varies the composition of the carcass is the type of feed consumed by the animals, as reported in guinea pigs of the Cieneguilla genotype (Huamaní et al., 2016; Guevara et al., 2016).

Regarding the of fatty acids profile in the carcass of guinea pigs and other animal species, recent studies have been carried out in order to evaluate the quality of meat fat through its composition of saturated and unsaturated fatty acids as well as its biological functions and its importance in the life and health of animals and human beings as the final consumer of products of animal origin (Givens, 2005). In this regard, in a study with muscle tissue from the loin of cattle, pigs and lambs, they observed that the most notable difference in these animals is that the pig deposits a greater amount of linoleic, arachidonic and docosahexaenoic acid (DHA) compared to ruminants, due to the bio-hydrogenation process of polyunsaturated acids by rumen microorganisms, converting them into monounsaturated fatty acids such as oleic and saturated fatty acids such as stearic acid, which are absorbed and incorporated into ruminant tissues (Enser et al., 1996).

Studies carried out with guinea pigs fed diets enriched with sacha inchi and fish oil, observed an increase in the percentage of polyunsaturated fatty acids such as linoleic and linolenic acid and a reduction in monounsaturated and saturated fatty acids (Guevara et al., 2016); a similar trend was reported by Huamaní et al. (2016) with guinea pigs fed with forage and concentrated feed. The high variation in terms of fatty acid content in guinea pig meat and other species of rodents could be due to the existence of a different fatty acid metabolism between species influenced by the type of feeding and associated with variations in digestive systems that could lead to different metabolic pathways (Betancourt & Díaz, 2014).

Research on body composition and fatty acid profile of guinea pig meat is important for the most efficient production systems, as well as for obtaining a good quality animal product for human consumption. With the results of these studies, the direct beneficiaries would be the producers of this animal species due to the added value of good quality meat. But it is necessary to continue with the search for more information through research works with this species as a productive animal and not a laboratory animal for food production. The scarce information on the benefits and quality of guinea pig meat has motivated the development of this research work with main objective to evaluate the effect of the genotype on the deposition curve of the chemical components (protein, fat and moisture) and the fatty acid profile of the carcass of two guinea pig genotypes (Peru and Cieneguilla).

Materials and methods

Place and facilities

This research work was carried out at the facilities of the Meat Research and Social Projection Program and the proximal chemical analyzes for the determination of the chemical components of the carcass were carried out at the Food Nutritional Evaluation Laboratory of the Academic Department of Nutrition, Animal Husbandry Faculty , Universidad Nacional Agraria La Molina, and the determination of the fatty acids profile of the carcass was carried out in the Biochemistry Laboratory of the National University of Santa, Chimbote, Peru. Forty-eight male guinea pigs (24 of each genotype) from the first to 32 weeks of age were used The animals were randomly housed in pens with three guinea pigs each and by genotype. An 81 m^2 noble material shed with a cement floor was used. The pens were disinfected and flamed, ground corncob as an absorbent floor was used.

Genotypes of guinea pigs evaluated

The following genotypes were evaluated:

1: Peru genotype (INIA)

2: Cieneguilla genotype (UNALM)

Feeding regimen

Broccoli stubble (*Brassica olereacca* L. Var Itálica Plenck) from the Pachacamac and Cieneguilla area was supplied as forage. 15 % of the average live weight of the guinea pigs from each pool was offered daily (8:20 am). Likewise, the animals received a balanced feed daily (Table 1) and the nutritional content of the feed is presented in Table 2.

Table 1: Percentage composition of the concentrated

Ingredient	Percentage
Wheat bran	49.35
Hominy feed	22.28
Corn gluten	10.04
Soybean cake	12.30
Alfalfa hay	3.18
Calcium carbonate	1.48
Iodized salt	0.25
Dicalcium phosphate	0.50
DL-methionine	0.07
Vitamin-mineral supplement	0.20
Rovimix Stay – C 35	0.20
Antifungal	0.15
Total	100.00

Source. Food Plant of the Food Research and Social Projection Program, Animal Husbandry Faculty, UNALM

Table 2: Nutritional content of concentrated feed (as fed and dry basis)

Nutrients	As fed (percentage)	Dry basis (percentage)
Dry material	88.74	100
Crude protein	18.10	20.40
Digestible Energy (Mcal/kg)	2.856	3.218
Crude fiber	8.50	9.58
Calcium	0.90	1.01
Available phosphorus	0.41	0.46
Lysine	0.78	0.88
Methionine – Cysteine	0.80	0.90
Methionine	0.40	0.45
Arginine	1.15	1.30
Phenylalanine	0.84	0.95
Ascorbic acid, mg/Kg	750.00	845.17
Sodium	0.20	0.22

Source: Food Plant of the Food Research and Social Projection Program, Animal Husbandry Faculty of Zootechnics, UNALM

The feed was administered daily (8:45 am) *ad libitum*, using circular porcelain-coated clay feeders with a capacity of 300 g; additionally, circular porcelain-coated clay wells were used as drinkers, with 250 ml capacity. Clean water was supplied daily.

Chemical composition of the carcass

Three young guinea pigs were sacrificed from the first week of age and the rest of the animals were sacrificed up to 32 weeks of age. The carcasses of guinea pigs of 1, 2, 4, 8, 12, 16, 22 and 32 weeks of age, without head, legs and noble organs (heart, kidneys and lungs) were coded and bagged and frozen at -4°C. For the homogenization process, the samples were subjected to heat treatment using an AII American Sterilizer autoclave, model No. 025X at 120°C for 40 minutes, then they were homogenized in a high-speed blender with distilled water in a 2:1 ratio (weight: weight), according to the modified method of Hartsook & Hershberger (1963). For the determination of moisture, crude protein and crude fat, twenty grams of homogenized sample were separated in duplicate from each animal and sent to the Food Nutritional Evaluation Laboratory of the Academic Department of Nutrition. Content of the carcass was determined using the Method 950.46, the crude fat content according to the Method 2003.50 and total nitrogen (crude protein: N x 6.25) using the Method. 984.13 (Association of Official Analysis Chemists [AOAC], 1990).

Determination of the deposition curve of total protein, crude fat and moisture of the carcass

With the data of chemical compounds of the two genotypes, the deposition curve of these compounds was determined using the Gompertz equation, the same as that described by Tjorve & Tjorve (2017):

$$y= a*\exp(-\exp(-k*(t-ti)))$$

Where:

y = Is the weight (g) of the animal or body component in the time you

a = It is the estimated weight (g) of the animal or component body to maturity

k = It is the maturity index or rate of the animal (g/ day or week) or estimate of the earliness of maturity. It also indicates growth rate

t i = It is the time (age in days or weeks) when the animals reach the maximum growth rate.

Determination of carcass fatty acids

The carcasses were heat treated in an autoclave and liquefied with distilled water in a 2:1 (W/W) ratio according to the modified method of Hartsook & Hershberger (1963), for lipid extraction. 20 g of the liquefied carcass extract were used per animal and in duplicate, it was homogenized with 350 ml of a mixture of chloroform: methanol 2:1 (v/v) of reagent grade for five minutes, later it was washed with a solution of NaCl at 0.9 % and centrifuged to separate the supernatant containing chloroform and lipids. The chloroform was removed by evaporation with a stream (2-3 ml) of liquid nitrogen according to the method described by Folch et al. (1957). The extracted fat was stored in small hermetically sealed test tubes, identified and frozen. For the determination of fatty acids, a GC-2010 SHIMADZU gas chromatograph, Column RT, 2560 – FAMES was used, according to the Method 996.06 (Association of Official Analysis Chemists [AOAC], 2000) belonging to the Laboratory for Research and Development of Agroindustrial Products of the Faculty of Agroindustrial Engineering of the National University of Santa, Chimbote, Peru.

Statistical analysis

The dynamics of the deposition curve of the chemical compounds of the carcass of the two genotypes of guinea pigs were evaluated using the equation of Gompertz (1825) and using the Proc NLIN, REG and AUTOREG in SAS (2005) to adjust the regression functions, linear and nonlinear. Factors affecting the chemical composition curve were evaluated using the general linear model (PROC GLM) procedure from SAS (2005). Results were given as least square means (LSM) of weekly chemical composition with standard error. When non-linear functions were fitted, the Gauss-Newton method was used as the iteration method. The data from the determination of fatty acids from the carcass were subjected to ANOVA under a Randomized Complete Block Design, with two genotypes and three repetitions each, considering the age (week) as blocks. For the analysis of variance and the comparison of means, Duncan's significance test was performed ($p<0.05$) under the following Linear Additive Model: $Y_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij}$.

Results and discussion

Moisture, total protein and crude fat content of carcass

Knowing the age of highest growth rate is of great economic importance, but there is also special interest in knowing the deposition of nutrients in body tissues, because these determine the nutritional needs of the animal (Sakomura et al., 2005). Table 3 shows the chemical composition values of the guinea pig carcass of different ages and genotypes, observing an increase in crude fat deposition with increasing age, while the protein content increased up to 12 weeks of age, decreasing later, probably due to the increase in body fat that occurs as the animals age; as Ayala (2018) mentions, during growth there is always some fat deposition, which increases as the maturity of the animal approaches. Coinciding with the statements of Noblet (2004) and Mitchell (1966) cited by Ayala (2018), who mention that at the beginning of life, weight gains are mainly made up of moisture, crude protein and minerals, which are necessary for the growth of muscle and bone tissue, later weight gains contain increasing amounts of fat and consequently its energy content increases. Similar results were reported in other species of animals, as the live weight increases (without digestive system), the weights of the chemical components of the meat also increase, although at different rates (Mitchell, 1966 cited by Ayala, 2018).

The curve estimated by the Gompertz model for the content of chemical components in guinea pig meat at different ages and genotypes is presented in Figure 1. It is observed that all the components of the guinea pig carcass follow a sigmoid curve, but very pronounced in the case of body water in both genotypes. Similarly, body fat is deposited at an increasing rate with advancing age while protein is deposited at a decreasing rate, as was also reported by Sakomura et al. (2005) in broiler chickens. In this regard, in the present study it was recorded that there are differences in terms of percentage of crude fat in favor of the Cieneguilla genotype and crude protein in favor of the Peru genotype, this variation could be due to the genetic origin of the ancestors of both groups of animals (Reynaga et al. 2020; Anwar & Kegan, 2020).

The values found in this study are similar to the information reported by Clawson et al. (1991) who carried out a meta-analysis study using 200 research papers with different animal species, observed that moisture, crude protein and fat-free body weight are in a 19:5.1 ratio (74 - 76, 20 – 20 and 3 – 5 percent, respectively).

Table 3. Percentage chemical composition of guinea pig carcasses of different ages

Age(weeks)	Genotype	Moisture	Crude fat	Total protein
1	Peru	75.26 ± 0.88[1]	1.75 ± 0.26[1]	17.70 ± 0.79[1]
	Cieneguilla	74.94 ± 0.50	1.87 ± 0.29	17.68 ± 0.85
2	Peru	74.21 ± 0.96	2.24 ± 0.33	18.44 ± 0.72
	Cieneguilla	73.85 ± 0.43	2.64 ± 0.39	18.34 ± 0.49
4	Peru	72.28 ± 0.53	3.13 ± 0.34	19.55 ± 0.68
	Cieneguilla	71.47 ± 1.14	3.79 ± 0.64	19.71 ± 0.59
8	Peru	68.02 ± 1.09	6.98 ± 0.43	20.12 ± 0.52
	Cieneguilla	67.12 ± 0.85	7.48 ± 0.58	20.10 ± 0.67
12	Peru	61.88 ± 0.58	12.08 ± 0.48	21.03 ± 0.86
	Cieneguilla	61.63 ± 0.98	12.91 ± 0.56	20.85 ± 0.62
16	Peru	59.18 ± 0.81	15.10 ± 0.56	20.95 ± 0.66
	Cieneguilla	60.19 ± 1.13	15.37 ± 0.78	19.90 ± 0.50
22	Peru	58.49 ± 0.68	17.07 ± 0.56	18.98 ± 0.73
	Cieneguilla	59.52 ± 1.42	17.98 ± 0.46	18.29 ± 0.72
32	Peru	56.87 ± 0.61	20.11 ± 6.06	17.76 ± 042
	Cieneguilla	56.60 ± 1.00	21.75 ± 0.77	17.40 ± 0.63

[1]: Standard deviation
Source. Food Nutritional Evaluation Laboratory, UNALM

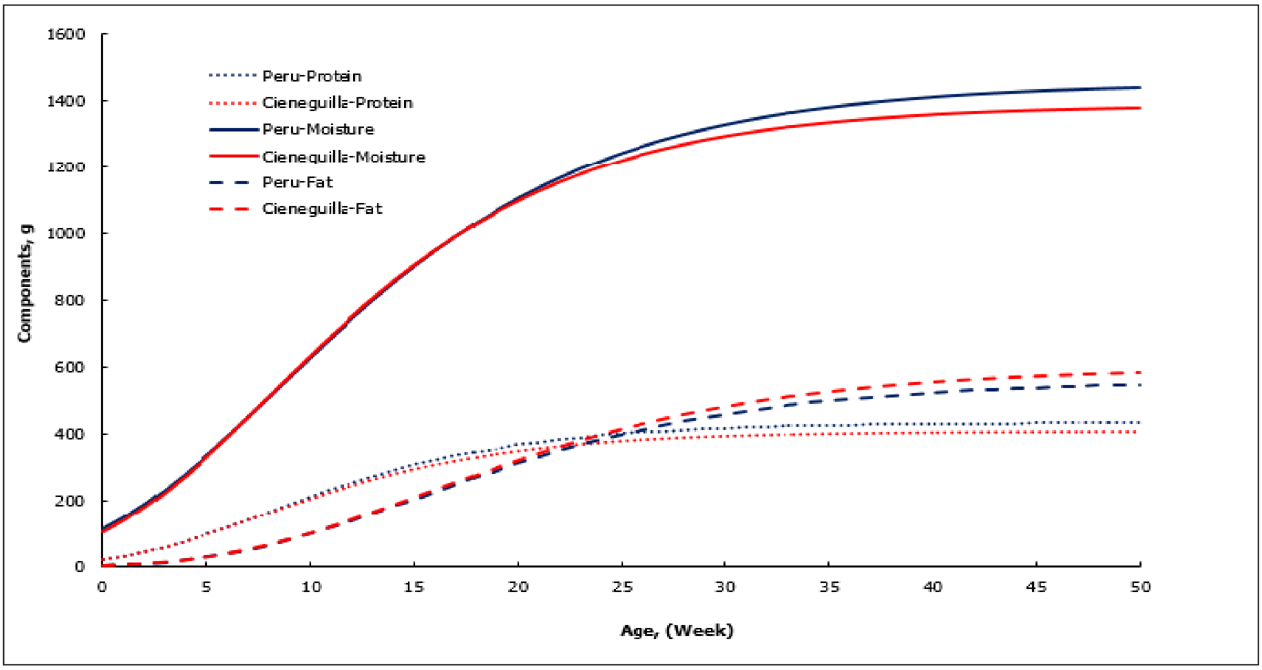

Figure 1. Curves estimated by Gompertz of the moisture, protein and fat content at different ages of the guinea pig of the Peru and Cieneguilla genotypes

Estimates of the chemical components of the guinea pig carcass according to the Gompertz equation

The estimates of the content of the chemical components of the carcasses of guinea pigs of both genotypes are presented in Table 4. It is observed that the moisture content asymptote at adult age (a) is higher ($p < 0.05$) in the Peru genotype than in the Cieneguilla genotype. On the other hand, the maximum moisture deposition rate at the inflection point was at the age of 8.372 and 7.964 weeks (ti), for the Peru and Cieneguilla genotypes, respectively. In this regard, Mitchell (1966) cited by Ayala (2018) observed that at the beginning of life weight gains are mainly made up of water, protein and minerals that are necessary for bone and muscle growth, but at an older age the fat deposition increases.

Regarding the total protein deposition in the guinea pig carcass (Table 4), it was observed that the asymptote of protein deposition at adulthood (a) in the Peru genotype is higher ($p < 0.05$) than the Cieneguilla genotype, which could be due to the genetic variation of these animals. The relationship between the maximum rate of protein deposition (k) was not statistically significant between genotypes. The maximum rate of protein deposition at the inflection point (ti) was observed at the age of 7.748 and 7.459 weeks (ti) for the Peru and Cieneguilla genotypes, respectively,

Table 4. Estimates of parameters and asymptotic standard error of the moisture, protein and fat content of the carcass of guinea pigs of the Peru and Cieneguilla genotypes

PARAMETERS	Moisture		Crude protein		Crude fat	
	Peru	Cieneguilla	Peru	Cieneguilla	Peru	Cieneguilla
	Estimated±SE	Estimated±SE	Estimated±SE	Estimated±SE	Estimated±SE	Estimated±SE
a	1451.6^{a}±21.37	1387.7^{b}±13.87	434.2^{a}±6.13	409.3^{b}±6.30	558.8^{a}±21.01	598.3^{a}±20.92
k	0.1113^{a}±0.00354	0.1203^{a}±0.00275	0.1457^{a}±0.00527	0.1487^{a}±0.00599	0.1095^{a}±0.00741	0.1046^{a}±0.00624
t_i	8.372	7.964	7.748	7.459	15.07	15.427

a,b Different letters in the same row indicate that they differ significantly (P<0.05)
a: Asymptote of protein content at adulthood (g)
k: Function of the relationship between the maximum rate of deposition and the adult content.
ti: It is the time or age in days or weeks in the inflection point
SE: Standard Error

coinciding with the statement of Casas et al. (2010) that according to the parameterization of the Gompertz model, in commercial pigs, the maximum rates of protein deposition occur at a younger age in relation to body weight and carcass weight, a difference that could also be due to the genetic variation of animals mainly. The crude fat deposition asymptote at adulthood (a) was similar in both genotypes (Table 4). Likewise, the relationship between the maximum rate of crude fat deposition (k) was not statistically significant between genotypes, the existence of small differences ($p>0.05$) could be due to the fact that the maximum deposition of fat in the animals is later and that greater variations could be observed in non-improved genetic strains with different feeding systems, environment and health status (Casas et al., 2010).

Fatty acid profile of guinea pig carcass

The values of saturated fatty acids (SSAT) of the two genotypes of guinea pigs at different ages were observed to be similar ($p>0.05$) in both genotypes (Table 5). However, there is a trend towards a higher percentage of these fatty acids in the Peru genotype; which could be due to the content of these saturated fatty acids, giving rise this difference ($p>0.005$). These values coincide with the results reported by Flores-Macheno et al. (2015) who did not find significant differences in total saturated fatty acids in three strains of guinea pigs (improved Peruvian, Andean and Criollo), coinciding with Huamaní et al. (2016) who also did not observe statistical differences in the percentage of saturated fatty acids (SFA) in guinea pigs of the Cieneguilla genotype.

Table 5. Profile of fatty acids of the guinea pig carcass of the genotype Peru and Cieneguilla

Fatty acids	Genotypes		Pr>F
	Perú	Cieneguilla	
Myristic, C14:0	2.13^{a}	2.11^{a}	0.9423
Pentadecanoic, C15:0	0.98^{a}	0.92^{a}	0.1605
Palmitic, C16:0	31.14^{a}	30.77^{a}	0.2880
Palmitoleic, C16:1	1.93^{a}	1.97^{a}	0.5730
Heptadecanoic, C17:0	1.32^{a}	1.23^{a}	0.0975
Stearic, C18:0	13.17^{a}	12.86^{a}	0.1949
Oleic, C18:1c	31.61^{b}	32.07^{a}	0.0436
Elaidic, C18:18t	2.61^{a}	2.86^{a}	0.1272
Linoleic, C18:2	12.48^{a}	11.81^{b}	0.0008
α Linolenic, C18:3	2.68^{a}	2.35^{b}	0.0075
SSAT*	48.23^{a}	47.39^{a}	0.0901
SMON*	35.96^{b}	36.85^{a}	0.0012
SPOL*	14.55^{a}	13.49^{b}	0.0008

ab : Different letters in the same row indicate that they differ significantly ($P<0.05$)
* SSAT = Sum of saturated fatty acids
* SMON = Sum of monounsaturated fatty acids
* SPOL = Sum of polyunsaturated fatty acids

As for monounsaturated fatty acids (SMON), it is observed that there are statistical differences ($p<0.05$) in the content of monounsaturated fatty acids in favor of the Cieneguilla genotype compared to the Peru genotype. This difference is mainly due to the higher ($p< 0.05$) oleic acid content in the Cieneguilla genotype and the cumulative sum of the other monounsaturated fatty acids. Similar results were reported by Anwar & Kegan (2020) in the percentage of oleic acid in the loin of capybara (*Hydrochoerus hydrochaeris*). Likewise, Flores–Mancheno et al. (2015) recorded statistical differences ($p<0.05$) in oleic acid content in favor of the improved Peruvian guinea pig compared to Criollo, corroborating the results of the present study. This difference could also be due to the physiological and biochemical characteristics of each genetic strain, as mentioned by Flores-Mancheno et al. (2015). In this regard, in monogastric species, such as guinea pigs, low levels of stearic acid, high levels of oleic acid and other monounsaturated acids would indicate that there is an appropriate enzymatic activity of stearoyl-CoA desaturase and mainly of the enzyme Δ9 desaturase in the liver or the possible bacterial isomerization of 18:1 n-9 (Cordain et al. 2002).

In polyunsaturated fatty acid content, it is observed that the percentage of polyunsaturated fatty acids in the carcass of guinea pigs of the Peru genotype is higher ($p<0.05$) than the Cieneguilla genotype, due to the higher content ($p<0.05$) of linoleic acid and α linolenic mainly. Similar results were reported by Flores-Mancheno et al. (2015) in three strains of guinea pigs (Andean, Criollo and improved Peruvian). They registered statistical differences in linoleic acid in favor of the first two genetic strains with respect to the third strain; Likewise, they observed statistical differences ($p<0.05$) in α-linolenic acid content in favor of the improved Peruvian line compared to the other two genetic lines. The linoleic acid and α linolenic acid content found in the present study in both genotypes are lower than those reported by Mustafa et al. (2019) in the muscle of guinea pigs of both sexes, fed with and without the inclusion of flaxseed, this increase ($p<0.05$) in the total concentration of n-3 SPOL can be mainly attributed to the greater deposition of α-linolenic acid in the muscle of the guinea pig and that polyunsaturated fatty acids would be inhibiting the activity of Δ9 desaturase which is involved in the synthesis of SPOLs (Garg et al. 1988). The linoleic and linolenic acid content in the rabbit muscle reported by Betancourt & Díaz (2014) is lower than the values reported in the present study in both genotypes.

Conclusions

The asymptote of moisture content and crude protein in adulthood was higher ($p<0.05$) in the Peru genotype. Meanwhile, fat deposition was statistically similar in both genotypes. Maximum moisture and crude protein deposition at the inflection point in the Cieneguilla genotype occurred at a younger age than in the Peru genotype, and maximum fat deposition occurred after 15 weeks of age in both genotypes.

Regarding total and individual saturated fatty acids, there are no statistical differences between both genotypes, but the Cieneguilla genotype contains a higher ($p<0.05$) percentage of monounsaturated fatty acids compared to the Peru genotype. And this last genotype contains a higher ($p<0.05$) percentage of polyunsaturated fatty acids compared to the Cieneguilla genotype. The content of polyunsaturated fatty acids, such as linoleic and linolenic acid in the Peru genotype was statistically higher ($p<0.05$) than that of Cieneguilla genotype.

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Author contributions

VH: Experimental design, carried out the field work, review of statistical analysis of results, discussion of results, manuscript review.

CV: Conceptualization of the work, experimental design, statistical analysis of results, discussion of results, support, and supervision of the study.

Conflict of interest / Competition interests

The signing authors of this research work declare that they have no potential conflict of personal or economic interest with other people or organizations that could unduly influence this manuscript.

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