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Growth of four guinea pig (*Cavia porcellus*) genotypes under two feeding systems

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Abstract

The main technical parameters of four improved guinea pig genotypes currently available and subjected to two feeding systems (mixed and integral) during the growth stage were evaluated. Ninety-six newly weaned male guinea pigs (15 ± 3 days) belonging to the genotypes: Cieneguilla-UNALM, Peru-INIA, Cuy G-IVITA/Mantaro/UNMSM, and Inkacuy-UCSS were used. Pelletized diets as well as water, were offered *ad libitum* for eight weeks, while forage (maize husks) was only supplied to the mixed treatments. A completely randomized design with a factorial arrangement of eight treatments and three replicates of four animals in each was used. The factors were the genotype on the one hand, and the feeding system (mixed and integral) on the other hand. The results showed that, at the genotype level, Cieneguilla, Cuy G and Inkacuy recorded better weights and weight gains ($p < 0.05$) compared to Perú. Feed conversion favored ($p < 0.05$) the T2 treatment (Cieneguilla-integral); in general, the Cieneguilla-UNALM genotype performed better than the others; meanwhile, the systems with and without forage, except for intake that was higher in the first ($p < 0.05$), showed a similar behavior ($p > 0.05$).

Keywords: animal feed, food consumption, genetic gain, genotype environment interaction, guinea pig

Crecimiento de cuatro genotipos de cuyes (*Cavia porcellus*) bajo dos sistemas de alimentación

Resumen

Se evaluaron los principales parámetros técnicos de cuatro genotipos de cuyes mejorados disponibles en la actualidad y sometidos a dos sistemas de alimentación (mixto e integral) durante la etapa de crecimiento. Se utilizaron 96 cuyes machos recién destetados (15 ± 3 días) pertenecientes a los genotipos: Cieneguilla-UNALM, Perú-INIA, Cuy G-IVITA/Mantaro/UNMSM e Inkacuy-UCSS. Las dietas peletizadas y el agua fueron ofrecidos *ad libitum* durante ocho semanas, mientras que el forraje (chala) solo se suministró a los tratamientos mixtos. Se utilizó un diseño completo al azar con arreglo factorial de ocho tratamientos y tres repeticiones de cuatro animales por cada repetición, donde los factores fueron el genotipo, por una parte, y el sistema de alimentación (mixto e integral), por otra. Los resultados indican que, a nivel de genotipos, Cieneguilla, Cuy G e Inkacuy registraron mejores pesos y ganancias de peso ($p < 0,05$) que el genotipo Perú. La conversión alimenticia favoreció ($p < 0,05$) al tratamiento T2 (Cieneguilla-integral); en general, el genotipo Cieneguilla-UNALM tuvo mejor desempeño que los demás, mientras que los sistemas con y sin forraje —con excepción del consumo que fue mayor en el primero ($p < 0,05$)— tuvieron un comportamiento similar ($p > 0,05$).

Palabras clave: alimentación animal, consumo de alimentos, cuy, interacción genotipo ambiente, mejora genética

Introduction

Genetic improvement work in guinea pigs began in Peru in the early 1960s by evaluating germplasms of different origins sampled at the national level, and starting at Universidad Nacional Agraria La Molina (UNALM). Subsequently, towards the middle of that decade and the beginning of 1970, a research and selection program was carried out at Estación Experimental Agropecuaria La Molina –currently called Instituto Nacional de Innovación Agraria (INIA)– aiming at improving the creole guinea pig and, in at the same time, other breeding and genetic improvement processes in guinea pigs were carried out in various institutions such as Universidad Nacional del Centro del Perú (UNCP) in Huancayo and Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA) of the Faculty of Veterinary Medicine of Universidad Nacional Mayor de San Marcos, especially at Estación del Valle del Río Mantaro (Solórzano & Sarria, 2014).

The adequate supply of nutrients leads to improve animal production; therefore, knowledge of the nutritional requirements of guinea pigs allows us to develop diets that meet the maintenance, growth, and production needs, notably correlated with the genetic quality available. The technical feeding of guinea pigs commonly involves green forage and concentrated feed; the first is used as bulk food, providing water, fiber and vitamins; the second provides protein and energy (Sarria, 2011). The evolution of guinea pig feeding systems transcends from the initial and historical traditional modalities with exclusive use of vegetables, horticultural residues, and pastures, which became generalized until the end of 1950, to the development of technified breeding systems. In the latter, the use of the so-called mixed feeding (forage plus concentrate) was recommended to adequately cover the nutritional requirements by the supplementation given by the concentrate feed, especially in the case of improved guinea pigs. This practice persisted for almost three decades in most commercial, technical farms and in some family farming systems, even empirical, until the end of the 1990s.

Subsequently, and given the need to reduce dependence on the use of forage –increasingly scarce and expensive, a very overwhelming situation in certain parts of the country where agricultural frontiers are progressively reduced– the development of a new system is encouraged with the total exclusion of forage, and called *integral feeding system*, to be applied as long as the technical and economic viability justifies it. As in this alternative vegetables are excluded, vitamin C and fiber must be incorporated in other ways. This then began to be studied by testing levels of vitamin C as a possible substitute for green forage in guinea pig feed. It is important to mention that in Peru, the three systems mentioned above subsist under different conditions and appreciations of breeders (Solórzano & Sarria, 2014).

Today, improved guinea pigs –as meat producers– require a complete and well-balanced diet, which is not achieved if only forage is provided. Thus, by improving the nutritional level of guinea pigs, their breeding can be intensified, so that their precocity, prolificity or fertility and, by derivation, their productive and economic ability in general, are used and optimized. With guinea pigs improved through different supplemented feeding systems, it is possible to significantly increase weight gain (Inga, 2008), achieving the improvement of feed conversion by providing a balanced, integral ration, leading to the total exclusion of forage. For this reason, the integral balanced food covers all nutritional requirements without the need for forage. This system also allows the use of inputs with a high content of dry matter, being necessary for its formulation, the adequate use of vitamin C (Remigio, 2006). Care must be taken with its stability since, during the pelletizing process, the food particles are forced to join by the action of driving force, pressure, heat and humidity; nevertheless, the resulting pellet has nutritional and economic advantages (Castro & Chirinos, 2008).

Various studies affirm that guinea pigs are classified into types and varieties. Animals are grouped by type according to external aspects of their phenotype (body shape, hair shape, and coat color, among others). Thus, Solórzano and Sarria (2014) classify them by the coat shape as follows: type 1 (short hair, straight and close to the body), type 2 (short hair with rosettes or swirls that do not follow the same direction), type 3 (long hair that can be straight or curly), and type 4 (bristly hair). Furthermore, by the number of toes: non-polydactyl (four toes on each front leg and three toes on each hind leg), and polydactyl (with more than four toes on each front leg; and more than three toes on the hind legs). Also, by the color of the eyes (black and red), and by their coat coloration: light (white, reddish-brown, and brown), and dark (black, gray, and brown).

On the other hand, the concept of variety brings together guinea pigs according to productive characteristics, i.e., improved and non-improved, eventually and improperly called creole or native. In some instances, improved guinea pigs can be considered as genotypes or pre-racial groups, which will depend on the progress and continuity of their selection through registries and the level of compliance with requirements and minimal apparent protocols. The concept of race implies a higher demand in the development and demonstration of these protocols, being a term that has been used widely and improperly throughout the country (J. Sarria, pers. comm., November 22, 2018).

Accordingly, the aim of this research was to evaluate the productive performance of four improved guinea pig genotypes from four renowned guinea pig production institutions, subjected to two feeding systems – with and without forage– during their growth stage.

Materials and methods

The study was carried out in the facilities of the guinea pig shed of the Laboratory for Small Animals of Programa de Investigación y Proyección Social en Animales Menores (PIPSAM) of Universidad Nacional Agraria La Molina (UNALM) located in the district of La Molina, province and department of Lima, with an average temperature of 20 °C, with a minimum of 15 °C and a maximum of 25 °C. The balanced feed used in the experiment were produced at the food plant of Programa de Investigación y Proyección Social en Alimentos (UNALM).

Ninety-six improved male guinea pigs (24 animals per genotype) weaned at 15 ± 3 days old, were used. Eight treatments or combinations resulting from the two feeding systems during the growth stage (mixed and integral) and four guinea pig genotypes (Cieneguilla-UNALM, Peru-INIA, Cuy G-IVITA/Mantaro and Inkacuy of Universidad Católica Sedes Sapientiae [UCSS]) were evaluated. The comparative performance was assessed through weight gain, feed intake, feed conversion, and carcass yield of the treatments.

Animals were identified with numbered aluminum earrings and distributed randomly within the eight treatments, each consisting of three repetitions of four animals. One week before receiving the animals, the breeding cages were conditioned, efficiently cleaned, and subsequently disinfected by spraying with a phosphorous insecticide of low toxicity and final sterilization with flamethrowers. The guinea pigs weaned at 15 days of age arrived at the experimental site to begin the pre-experimental period that lasted 15 days, time in which the animals were accustomed to the new installation conditions, handling and feeding, after which the experimental period began.

The pelletized food was offered in feeders, type clay bowls of 500 g capacity. The daily supply schedule for the balanced feed (which was *ad libitum*) was held at 8:30 a.m. Fresh, clean water was supplied daily in half-liter capacity clay bowls placed in the cages of all treatments; materials and equipment were cleaned daily. The residues of the concentrate, both mixed and integral, were weighed weekly, while those of the forage was weighed on a daily basis, to avoid moisture loss. Green forage comprised of fresh corn husks of the Marginal 28 variety sown in line and harvested at the beginning of flowering from the UNALM Vegetable Program was provided to complement the mixed diet. This forage was supplied daily in the morning at 9:30 a.m. to all the treatments correspondingly at a rate of 20 % of the average live weight of the animals, according to the weight record of each week; this amount was considered as sufficient to cover their vitamin C requirements (Rivas, 1995). In this research, the commercial concentrate called *Mixto* of UNALM plus maize husks (forage) and water was used as conventional balanced feed.

Table 1 shows the nutritional characteristics of the two types of concentrate feed. Chemical analyzes for the concentrate and forage were performed at Laboratorio de Evaluación Nutricional de Alimentos (LENA) of Universidad Nacional Agraria de La Molina. Table 2 shows a summary of the nutrients measured in the two feeds considered.

Table 1. Nutritional value of conventional (mixed) and integral pelleted balanced feeds for guinea pigs in the growth stage

Nutrients/Feed	Conventional	Integral
Digestible energy (Mcal/kg, minimum)	2.80	2.80
Protein (min%)	18.00	18.00
Fiber (min%)	8.00	8.00
Calcium (max%)	0.80	0.80
Total phosphorus (min%)	0.80	0.80
Sodium (min%)	0.20	0.20
Lysine (min%)	0.84	0.84
Met-cyst (min%)	0.60	0.60
Arginine (min%)	1.20	1.20
Threonine (min%)	0.60	0.60
Tryptophan (min%)	0.18	0.18
Ascorbic acid (mg/100 g)	--	20.00
Physical characteristics		
Pellet diameter (mm)	4.50	4.50
Pellet length (mm)	12.00	12.00
Moisture (%)	10.00	10.00

Source: Programa de Investigación y Proyección Social en Alimentos, UNALM

Table 2. Proximal analysis of feed and maize husk forage (fresh base)

Analysis	Conventional UNALM	Integral UNALM	Maize husk forage
Moisture (%)	13.09	14.63	81.48
Total protein (N × 6.25) (%)	18.97	19.11	1.31
Fat (%)	4.72	4.26	0.35
Crude fiber (%)	8.59	10.66	7.00
Ash (%)	7.33	7.01	2.04
Nitrogen-free extract (NFE) (%)	47.30	44.33	7.81

Source: Food Nutrition Assessment Laboratory (LENA-UNALM)

Within a completely randomized design (CRD) with three replications, a 4 × 2 factorial arrangement (four genotypes × two feeding systems) was applied. The size of the experimental unit was comprised of four animals to establish the differences between the means of the treatments using Duncan's multiple range test ($p \leq 0.05$); in addition, the variables under study were weight, feed intake, feed conversion, mortality, and carcass yield.

Results and discussion

Weight gain is a variable that mainly depends on the genetics of the animal and the food received, as evidenced in the current study. In table 3, the values denote significant statistical differences ($p < 0.05$) between the treatments (T1 to T8), as well as the effect of the genotypes Cieneguilla (T1 and T2), Perú (T3 and T4), Cuy G (T5 and T6), and Inkacuy (T7 and T8) in final live weight, total gain, and daily gain. No significant differences ($p > 0.05$) were found for the effect of the feeding system. The increase in weight of the animals was presumably affected by the degree of heterosis of each variety, leading to a certain level of hybrid vigor present in a population of animals, as stated by Benito (2008), who mentions that this condition is directly related with the genetic variability of the parents, being only desirable in terminal crossings. The presence of a high degree of less homozygous genes in the Cieneguilla-UNALM genotype is probably responsible for these results if we consider that this variety comes from the crossing of several genotypes since the incorporation of the Cieneguilla farm to Universidad Nacional Agraria La Molina. However, the lack of genealogical records prevents a more precise explanation of whether the observed statistical difference in weight gain between genotypes is exclusively due to this factor (Sarria, 2011).

Table 3. Initial and final live weight, total intake and feed conversion, according to treatments, genotypes, and feeding systems

Treatments	Genotypes	Feeding systems	Initial weight (g)	Final weight (g)	Total intake (g) DM	Food conversion
T1	Cieneguilla	Mixed	365.78^{a}	1,171.23^{a}	4,530.14^{b}	5.64^{b}
T2	Cieneguilla	Integral	365.70^{a}	1,160.37^{ab}	3,825.57^{d}	4.82^{c}
T3	Perú	Mixed	354.37^{a}	1,047.83^{cd}	4,518.04^{b}	6.52^{a}
T4	Perú	Integral	362.10^{a}	1,034.60^{d}	3,740.91^{d}	5.57^{b}
T5	Cuy G	Mixed	365.77^{a}	1,145.77^{ab}	4,823.65^{a}	6.19^{a}
T6	Cuy G	Integral	365.70^{a}	1,119.53^{abc}	4,018.79^{c}	5.34^{b}
T7	Inkacuy	Mixed	367.37^{a}	1,151.43^{ab}	4,912.83^{a}	6.27^{a}
T8	Inkacuy	Integral	368.00^{a}	1,089.67^{bcd}	4,051.66^{c}	5.63^{b}
Genotypes		Cieneguilla	365.73^{a}	1,165.80^{a}	4,177.86^{b}	5.23^{b}
		Perú	358.23^{a}	1,041.22^{b}	4,129.47^{b}	6.05^{a}
		Cuy G	365.73^{a}	1,132.65^{a}	4,421.22^{a}	5.77^{a}
		Inkacuy	367.68^{a}	1,120.55^{a}	4,482.25^{a}	5.95^{a}
Feeding systems		Mixed	363.32^{a}	1,129.07^{a}	4,696.16^{a}	6.16^{a}
		Integral	365.38^{a}	1,101.04^{a}	3,909.24^{b}	5.34^{b}

Note: a, b, c, d, different letters indicate that there is a statistical difference ($p < 0.05$).

Source: Elaborated by the authors

Camino (2011) evaluated two of these genotypes with two feeding systems (with and without forage), and observed gains of 15.6 g/animal/day for guinea pigs of the Cieneguilla-UNALM genotype and 14.0 g/animal/day for the so-called Perú genotype of INIA. For his part, Vargas (2014) evaluated three feeding systems on commercial-scale farms and found daily gains of 12.36 g/animal/day for the treatment of Cieneguilla-UNALM, unlike a private commercial variety called *Allin Perú*, which only reached 11.94 g/animal/day, results that are lower than those obtained in the current research in the case of the Cieneguilla-UNALM variety, although similar to the other genotypes such as Perú, Cuy G, and Inkacuy.

In table 3, Duncan's test revealed that the isolated effect of the genotype shows that the Cieneguilla, Cuy G, and Inkacuy genotypes achieved statistically equal weight and weight gain values, but higher than the Perú genotype. Studies on feeding systems, such as the one carried out by Garibay (2009), found no statistical differences ($p > 0.05$) between mixed feeding programs for fattening guinea pigs, with increases in average daily accumulated weight of 13.1, 13.5 and 14.8 g/animal with forage supply (broccoli stubble).

In integral systems, there are some conflicting results on total and daily weight gains. The results obtained by Beller (2010), who recorded increases of 11.75, 9.88, and 12.12 g/day for growing male guinea pigs, being the lowest reported yields for the integral treatment ($p < 0.01$). On the other hand, Tenorio (2007) evaluated forage-exclusion feeding programs, in which study daily gains of 12.96, 13.39, and 14.06 g/animal were achieved using commercial feed from the same origin as ours. In the current investigation, the isolated effect of the feeding system did not show statistical differences ($p > 0.05$) between the mixed and the integral systems, which is consistent with Villafranca (2003), who observed daily weight gains after seven weeks of evaluation in a range of 12.9 to 13.3 g/animal/day, values very similar to those achieved in our experiment, i.e., 13.14 g/animal/day on average for the integral system and 13.68 g/animal/day for the mixed system.

Camino (2011), regardless of the genotypes used, also evaluated concentrate plus green forage (mixed system) compared to the green forage-exclusion system (integral system), without finding statistical differences ($p > 0.05$) in the final weight, total weight gain and daily gain between the two. In this study, the corresponding daily weight gains were, on average, 14.9 g/animal/day in the forage and balanced diet (mixed) and 14.6 g/animal/day when only the balanced (integral) diet was used. In this regard, it should be noted that the reference study started with 3-week-old animals (20 to 21 days and over 300 g of live weight), prolonging the growth for additional nine weeks, unlike the current investigation that lasted eight weeks and started with 14-day-old animals.

Total food intake is presented in table 3, along with values referring to treatments, genotypes, and feeding systems. Concerning the isolated effect of the genotype, without considering the feeding systems, the lowest intakes ($p < 0.05$) were found in the Perú and Cieneguilla genotypes, and the highest were found in Inkacuy and Cuy G. The effect of the feeding system showed significant differences ($p < 0.05$) in the total dry matter intake between both alternatives, being lower in the integral modality during the eight weeks of evaluation. The daily expression was 69.80 g/animal/day for the integral system, and 83.87 g/animal/day for the mixed system. These averages were higher than those reported by Camino (2011), who found no significant differences in the total intake of dry matter, since he obtained for the Perú genotype a total intake of 3,035.1 g (48.2 g/day), which was similar ($p > 0.05$) to the value observed with the Cieneguilla-UNALM genotype of 3,087.1 g (49.0 g/day), values that, as can be seen, are below the data reported in the current investigation.

The averages found in this study regarding food intake on a dry basis are also higher than those found by Vargas (2014), who reported a total food intake on a dry basis of 2.91 kg for both systems after eight weeks. Tenorio (2007), when evaluating three feeding programs excluding forage for ten weeks, reported total intake of balanced pelletized feed on a dry matter basis of 5.07, 4.91, and 5.22 kg, which means an average of about 72 g/animal/day without significant difference between treatments, i.e., a value close to that achieved in the current experiment. All the animals had the same opportunity to transform the nutrients offered into bone growth and muscle mass; however, there was no exact reciprocal correspondence between the intakes and increases achieved, as discussed in feed conversion.

Significant statistical differences ($p < 0.05$) were found in feed conversion influenced by treatments, genotypes, and feeding systems (table 3). Regarding the treatments, it is observed that the Cieneguilla-UNALM genotype showed the best productive performance (4.82) with the integral feeding system. The average of all the other treatments reached a nutritional conversion of 5.92. However, these values are generically more inefficient than those reported by other authors such as Chauca et al. (2005), who calculated an average of 3.03 for the Perú genotype, a difference that could be attributed to the times used and other nutritional or environmental factors employed in each case and moment. Similarly, Camino (2011) reports significant differences between the Perú and Cieneguilla-UNALM genotypes in nine weeks of evaluation, with an advantage for the Cieneguilla-UNALM genotype that achieves a feed conversion of 3.13, much higher ($p < 0.05$) compared to the Perú genotype that records 4.42 in this experiment. In this sense, Vargas (2014) found feed conversion results with good productive performance (3.78 and 3.99). On the other hand, unlike our research concerning food systems, Camino (2011) did not show significant differences with a diet based on concentrate and green forage with a cumulative feed conversion of 3.35, similar ($p > 0.05$) to that observed with the diet with only balanced feed (3.20).

Benito (2008) found highly significant differences in feed conversion in the treatments assessed (integral systems) with values between 3.1 and 3.3 versus the control (mixed feed) that showed the worst performance with 3.6. These feed conversion values were generically more efficient than those of our treatments, which originates from the lower feed intake and the higher average weight gain recorded in this research.

Finally, it should be noted that the isolated effect of the feeding systems and the genotypes used, considered in the statistical model of the current investigation, established statistical differences ($p < 0.05$) in both contexts, as shown in table 3, where there is a higher value in the genotype effect in favor of the Cieneguilla variety (5.23), as well as in the integral system (5.34 vs. 6.16).

All this is related to the fact that the Cieneguilla-UNALM genotype shows more efficient values than the other genotypes, with high weight gains of 816.67 g and 798.03 g, and dry matter intakes of 4,530.14 g and 3,825.57 g for mixed and integral feeding, respectively. Then, the Cuy G genotype subjected to integral feeding follows with 753.83 g of increase and 4,018.79 g of dry matter intake. The next treatment was the Inkacuy genotype with integral feeding, with a weight gain of 721.67 g with a dry matter intake of 4,051.66 g. Finally, the Perú genotype with integral feeding recorded values of 672.50 g in weight gain and a dry matter intake of 3,740.21 g.

In table 4 significant differences ($p < 0.05$) for live weight (for slaughter), carcass weight, and carcass yield in percentage are shown. The averages represent the indicators achieved by the effect of the treatments, genotypes, and feeding systems during the 56 days of evaluation. Thus, due to the effect of the genotype, numerical differences were mainly observed, highlighting the average of the Cuy G with 75.04 % carcass yield. Nonetheless, the only genotype that was statistically inferior ($p > 0.05$) to Cuy G was Inkacuy.

Finally, in terms of weight and carcass yield, there were no statistical differences due to the isolated effect of the type or food system regarding carcass weight or carcass yield. The carcass yield is influenced by the degree of crossing, which in this situation was probably not evidenced in this experiment due to the level of specialization of all the genotypes assessed. In the same way, it is necessary to indicate that the carcass of all the treatments did not show any abnormal characteristic that limits, delays or prohibits their commercialization and intake; no presence of accumulated fat was observed in noble organs (liver, kidney), which could be due to the short evaluation period, time that was sufficient to obtain animals with commercial weights.

Post-fasting average final live weights of 1,089.83 g were observed with the integral balanced diet, and 1,095.17 g with the mixed feed plus forage. Values similar to those reported in this study were found by Garibay (2009), who recorded no statistical differences in carcass yield between the feeding programs tested, varying between 68.66 % and 71.44 %, similar to those of Tenorio (2007) that, without showing significant differences between feeding programs, reached averages of 68.6 %, 68.8 %, and 71.0 % in the treatments. This trend is similar to that observed by Inga (2008), who reported a carcass yield of 72.78 % for the control treatment based on concentrate plus green forage (mixed system), and 70.75 % in the treatment exclusively based on concentrate (integral system). On the other hand, Camino (2011) reported carcass yield data for the Perú genotype of 72.4 %, and 73.3 % for the Cieneguilla-UNALM genotype, similar to what was found in our study, since we used guinea pigs of these same genotypes. With the Cieneguilla-UNALM variety, the value obtained was 73.68 %, and with the Peru-INIA genotype, the value was 71.90 %, fed with the two feeding systems (integral and mixed).

In the current work, no animal with signs of disease or affectation was observed, nor did any of the total number of experimental animals die. This is probably due to the controlled and optimal conditions that were maintained in the management and care of the experimental site under investigation during the development of the experiment.

Table 4. Carcass weights and yield according to treatments, genotypes and feeding systems

Treatments	Genotypes	Feeding Systems	Average live weight * (g)	Average live weight ** (g)	Carcass weight *** (g)	Carcass yield **** (%)
T1	Cieneguilla	Mixed	1,084.33^{ab}	1,065.00^{b}	785.61^{abc}	73.75^{ab}
T2	Cieneguilla	Integral	1,155.00^{ab}	1,139.00^{ab}	838.38^{ab}	73.60^{ab}
T3	Perú	Mixed	1,047.33^{b}	1,025.67^{b}	729.38^{c}	71.09^{ab}
T4	Perú	Integral	1,062.00^{b}	1,046.67^{b}	760.38^{bc}	72.70^{ab}
T5	Cuy G	Mixed	1,109.00^{ab}	1,090.33^{ab}	823.71^{abc}	75.59^{a}
T6	Cuy G	Integral	1,091.00^{ab}	1,074.00^{ab}	799.71^{abc}	74.47^{a}
T7	Inkacuy	Mixed	1,195.00^{a}	1,178.33^{a}	865.71^{a}	73.38^{ab}
T8	Inkacuy	Integral	1,138.33^{ab}	1,121.00^{ab}	767.04^{abc}	68.49^{b}
Genotypes		Cieneguilla	1,153.00^{ab}	1,102.00^{ab}	812.00^{a}	73.68^{ab}
		Perú	1,054.67^{b}	1,036.17^{b}	744.83^{b}	71.90^{ab}
		Cuy G	1,100.00^{ab}	1,082.17^{ab}	811.67^{a}	75.04^{a}
		Inkacuy	1,166.67^{a}	1,149.67^{a}	816.33^{a}	70.94^{b}
Feeding Systems		Mixed	1,108.92^{a}	1,095.17^{a}	801.08^{a}	73.45^{a}
		Integral	1,111.58^{a}	1,089.83^{a}	791.33^{a}	72.32^{a}

Note: a, b, c, different letters indicate that there is a statistical difference ($p < 0.05$); * Average live weight without fasting; ** Average live weight with 12 hours of fasting; *** The carcass includes the bone and muscular structure of the body plus the skin, head, legs, and noble organs (heart, lungs, liver, and kidneys); **** Carcass yield with fasting.

Source: Elaborated by the authors

Conclusions

Concerning final weight and weight gains, it was evident that the best performances were recorded in the Cieneguilla, Cuy G, and Inkacuy genotypes, surpassing the Perú genotype, while, due to the isolated effect of the feeding systems, both alternatives had the same results.

Regarding food intake in total dry matter, the isolated genotype analysis determined higher intakes ($p < 0.05$) for Cuy G and Inkacuy compared to Cieneguilla and Perú. Concerning the feeding systems, there was less intake of dry matter ($p < 0.05$) in the integral system compared to the mixed system.

The feed conversion was higher in the T2 treatment (Cieneguilla-integral). The analysis by the isolated effect of the genotypes also favored Cieneguilla ($p < 0.05$), while the Cuy G, Inkacuy and Perú genotypes gave the same result, in that order of numerical efficiency.

The carcass yield between treatments was the same, except for T8 (Inkacuy-integral), which showed the lowest value. In the analysis of the isolated effect of the genotype, the same trend was maintained; however, for the effect of the feeding systems, no statistically significant differences ($p > 0.05$) were found in this parameter.

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Disclaimers

All authors made significant contributions to the document, agree with its publication, and declare that there are no conflicts of interest in this study.

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