



## TOTAL WEIGHT OF GUINEA PIGS UNDER FEEDING CONDITIONS WITH HYDROPONIC GREEN FORAGE OF BARLEY, CORN HUSK AND CONCENTRATE

### PESO TOTAL DE CUYES EN CONDICIONES DE ALIMENTACIÓN CON FORRAJE VERDE HIDROPÓNICO DE CEBADA, MAÍZ CHALA Y CONCENTRADO

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The total weight of guinea pigs under experimental conditions of feeding with hydroponic green forage of barley, corn husk and concentrate was analyzed. The study was performed in Santa Rosa farm, Tacna (Peru). A total of four treatments were established for the animal feeding T1) hydroponic green forage with free barley + limited concentrate, T2) hydroponic green forage with limited barley + free concentrate, T3) limited corn husk + free concentrate and T4) free corn husk + limited concentrate. The total weight was analyzed when the fourth week finish. The order was: T3=661.33±47.17 g > T2=644.77±17.23 g > T1=499.56±8.34 g > T4=474.33±7.68 g. T3 and T2 showed significant difference (p<0.05) compared to T1 and T4. The total weight of guinea pigs was higher in the treatments with free concentrate.

**Key words:** breeding, feeding, guinea pig, hydroponic green forage, sustainable technology

Se analizó el peso total de los cuyes en condiciones experimentales de alimentación con forraje verde hidropónico de cebada, maíz chala y concentrado. El estudio se realizó en la Granja Santa Rosa, Tacna (Perú). Se establecieron cuatro tratamientos para la alimentación de los animales: T1) forraje verde hidropónico con cebada libre + concentrado limitado, T2) forraje verde hidropónico con cebada limitada + concentrado libre, T3) maíz chala limitado + concentrado libre y T4) maíz chala libre + concentrado limitado. El peso total se analizó al finalizar la semana cuatro. El orden fue: T3 = 661.33±47.17 g > T2 = 644.77±17.23 g > T1 = 499.56±8.34 g > T4 = 474.33±7.68 g. T3 y T2 mostraron diferencia significativa (p<0.05) en comparación con T1 y T4. El peso total de los cuyes fue mayor en los tratamientos con concentrado libre.

**Palabras clave:** alimentación, crianza, cuy, forraje verde hidropónico, tecnología sostenible

Among the alternatives to the adaptation and survival to water stress are the agricultural practices climatically intelligent metabolomic (Patel *et al.* 2020). These practices are necessary in some regions from Peru, as Tacna, located in the head of Atacama, second biggest and dry desert of the world due to their hyper dryness. The water resource in this geographical zone is limited for the development of the agricultural activity (Pino and Chávarri 2022), where the traditional and commercial breeding of guinea pig (*Cavia porcellus* Linnaeus, 1758) constitutes one of the more

widespread alternatives due to their easy reproduction, palatability and high nutritional value. To guarantee the viability and productivity of the animals (Tellez *et al.* 2022) there are animal health practices, based on the supplementation of mineral elements and vitamins. However, the guinea pig feeding requires the high forage intake, extensive land demand and requirement of excessive volumes of water. Therefore, faced the water lack and the exhaustion of the agricultural frontier, the hydroponic green forage (HGF) constitutes one of the sustainable technologies for the

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guinea pigs feeding in Tacna region (Ibtissame et al. 2021). Despite of the excellent quality in carbohydrates, protein level and sugars content in the short production of HGF (Narváez and Guerrero 2021), it may that the biomass yield of the guinea pigs be limited during the first stages in the breeding.

The objective of this technical note was to analyze the total weight of guinea pigs under feeding conditions with hydroponic green forage of barley, corn husk and concentrate.

The study was carried out in Santa Rosa Farm, Pocollay district, Tacna (Peru), located in the coordinate 17°56'28 of latitude and an altitude of 702 m o.s.l.

The hydroponic green forage (HGF) with barley (*Hordeum vulgare* L.) and corn husk (*Zea mays*) (table 1) was considered for guinea pigs feeding. The barley seed corresponded to the mutant variety Centenario, unbreakable, free of straw, ground and disinfectant. Each seed was weighed, washed and disinfected in 1% sodium hypochlorite solution for 24h. Later, was twice rinsed with distilled water and aired for their sowing. In the case of the concentrate, it was formulated in the veterinary foods production enterprise VITAPRO, S.A. This concentrate provides the following nutrients: protein (16 %), potassium (1.3 %), magnesium

(0.3 %), calcium (1.0 %), phosphorous (0.6 %) and fiber (10.0 %). In addition of having DL-methionine (0.20 %), L-threonine (10.0 %), L-lysine (0.1 %), PrimeEQH 101 (3.5 %), Quantum blue (0.01 %), Mycoadaz (0.1 %) and Antigen (0.5 %).

A shelf of four levels as bracket and greenhouse structure was build (1.8 m length x 0.70 m width x 1.8 height). The distance between each level was 0.4 m, with longitudinal and transversal slope of 10 % for the water drainage in the trays. The culture trays were of dark plastic boxes (0.6 m length x 0.40 de width).

For the guinea pigs breeding, the shed has adobe walls and windows with meshes with polypropylene curtains to guarantee the lighting and airing. In each shed, there was four breeding cages (1.20 m x 0.90 m), equipped with feeders and water trough. The breeding cages were replicated in two, and each of them had 12 experimental units (2 males and 10 females from Inti breed). The experimental treatments for the feeding analysis were four:

- T1 = HGF with free barley (230 g/d) + limited concentrate (30 g/d)
- T2 = HGF with limited barley (200 g/d) + free concentrate (40 g/d)

**Table 1.** Chemical composition of feeding

Feeding	Indicators	Value, %
Hydroponic green forage with barley	Digestibility	80-92
	Crude protein	13-20
	Crude fiber	12-25
	Fat	2.8-5.37
	Nitrogen free extract	46-67
	Total digestible nutrients	65-85
	Calcium	0.11
	Phosphorous	0.30
	pH	6.0-6.5
	Dry matter	12-20
	Vitamin C	45.1-154 mg/kg
	Vitamin A	25.1 UI/kg
	Vitamin E	26.3 UI/kg
	Dry matter	89.0
	Lysine	0.40
	Linoleic acid	0.65
	Corn husk	Humidity
Dry matter		18.00
Crude protein		10.45
Crude fiber		25.70
Nitrogen free extract		41.30
Ash		10.30
Phosphorous		0.22
Potassium		0.26
Calcium		0.03

- T3 = limited corn husk (200 g/d) + free concentrate (40 g/d)
- T4 = free corn husk (230 g/d) + limited concentrate (30 g/d)

The initial intake of HGF with barley and corn husk was 100 g, while the concentrate consisted in 10g. The experimental period lasted four weeks. The food restriction was based on rations of three daily supplies every 8h, with 10g less and the free feeding was the same amount of grams during 24h. As the weeks goes, the diet was increased at double (National Research Council 1985). The initial total weight of guinea pigs was measured with a gram digital scale Patrick's AM3 (precision = 1 g). The initial weight (g) in each treatment was: 273.33±0.88, 275±6.56, 274.44±3.47 and 275.89±4.55 for T1, T2, T3 and T4, respectively.

The total weight of guinea pigs considering the type of feeding in the pure experimental design, although, a validity control was not indicated, it was analyzed with the statistical program Statgraphics Centurion 18® (Versión 18.1.16). The normality of data was considered by the Shapiro and Wilk (1965) test. The comparison between the average of the experimental treatments was performed through the analysis of variance and the homogeneity among groups by the Duncan Multiple Range test (Duncan 1955). The data were considered significant when  $p < 0.05$ .

The bioethics aspects of the research were fulfilled with the biosafety protocols. There was not animal manipulation that caused their stress. The paraphrases construction was adequate from the consulted scientific theory. The statistical treatment was justified from the biometrics.

After the fourth week, Shapiro and Wilk (1965) test was performed, based on the comparison of quartiles from the normal distribution, fitted to the data for the experimental treatments. The P-values were higher to the significance level (0.05). Therefore, the total weights of guinea pigs come from a distribution rule with 95.0 % of confidence:

- T1 = .998 (statistical), .912 (significance)
- T2 = .775 (statistical), .055 (significance)
- T3 = 1.000 (statistical), .965 (significance)
- T4 = .998 (statistical), .912 (significance)

Table 2 show the final weight of guinea pigs. There were significant differences between the experimental treatments. T1 and T4 were homogeneous to each other. Their total weights at fourth week were lower than the experimental treatments T2 and T3, respectively.

Taboada (2022) showed that during the growing stage of guinea pigs, the HGF with barley can be used without needing to feed the animal with corn husk, even, when the guinea pigs growing was compared it was recorded low weight in the feeding systems with HGF of barley and fresh forage of corn husk. This result coincides with the analysis of T1 and T4 treatments, in which the total weight gain responded to the combination with the limited concentrate.

Yanchaliquin (2022), in his curricular integration study with hydroponic forages in guinea pigs feeding, showed that the higher weight and best yield of the carcass for the guinea pigs was recorded with HGF of barley and HGF of corn, but with the concentrates supply, which correspond with the results find in this study.

The lower total weight of guinea pigs in the experimental treatments T1 and T4 compared with T2 and T3, maybe should due to the decrease of protein level during the production cycle of HGF. This loss could influence on the adequate feeding of guinea pigs, although in this study it was not previously measured this production cycle to start the optimum feeding of animals.

The concentrate, when having high percentage of protein, potassium, magnesium, calcium, phosphorous and fiber, in addition of supplying free, generates in treatments T2 and T3 higher total weight for the guinea pigs. It is possible that the chemical composition of the HGF with barley and corn husk did not fulfill the nutritional requirements in the treatments T1 and T4. However, is not possible to finance the feeding based on concentrate. Face the water stress that there is in Tacna region, the agricultural practice with HGF allow their mitigation and the guinea pigs, has been herbivorous species, need a diet wit forage.

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**Table 2.** Final weight of guinea pigs in each treatment, g

Experimental treatment	Average, g	Standard error	Variation coefficient, %	Homogeneity of groups	P value
T1	499.56	4.82	1.67	a	≤ 0.001
T2	644.77	9.95	2.67	b	
T3	661.33	27.24	7.13	b	
T4	474.33	4.44	1.62	a	

Legend: letters a, b shows significant differences between the experimental treatments, according to Duncan (1955) for  $p < 0.05$

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