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Posted Date: 3 September 2024

doi: 10.20944/preprints202409.0241.v1

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Guinea Pigs in Balance: Impact of Diet on pH, Microbiota and Intestinal Performance

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Abstract: The study assessed the impact of different diets on gastrointestinal pH, intestinal microbiota, digestive tract morphometry, and productive performance in guinea pigs. A total of 160 improved genotype guinea pigs were used, distributed into three groups with different diets: alfalfa (T1), alfalfa + concentrate (T2), and concentrate (T3), to which a mixture of probiotics combined with vitamins, minerals was added and amino acids in T2 and T3. Gastrointestinal pH showed significant differences between treatments in the various segments of the digestive tract. The intestinal microbiota varied according to the diet, with *Escherichia coli* being the predominant bacterium in weaned guinea pigs. Intestinal morphometry was significantly altered with the addition of a reinforced probiotic mixture, improving the length and density of intestinal villi. Productive parameters such as weight gain, feed consumption, and feed conversion were better in guinea pigs fed a mixed diet with 0.5% probiotic mixture. These results indicate that intestinal pH may influence microbial composition, which impacts productive efficiency and immune health, highlighting the importance of balanced nutrition and supplementation to optimize the health and performance of guinea pigs.

Keywords: guinea pigs; diet; gastrointestinal pH; intestinal microbiota; intestinal morphometry

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1. Introduction

The relationship between diet and animal health, as well as the interaction between gastrointestinal microbiota and metabolism, has been studied for decades, and its importance continues to be relevant in the field of animal production [1]. In this context, guinea pigs (Cavia *porcellus*) emerge as an invaluable model due to their herbivorous nature and their widespread use in meat production in many regions of the world [2]. Diet plays a crucial role in performance and significantly influences various physiological and metabolic aspects of animals. However, the relationship between diet and parameters such as gastrointestinal pH, intestinal microbiota composition, intestinal morphometry, and productive performance has not yet been fully elucidated in guinea pigs.

Diet can alter the functional metabolism of the intestinal microbiome [3] and, along with genetic factors and certain additives, influence the predominance of some microorganisms over others [4]. Moreover, the microbiota is associated with body growth, immune development, and nutrition [5, 6, 7], while intestinal morphometry provides invaluable information on nutrient absorption capacity and gastrointestinal tract health. Similarly, gastrointestinal pH can either promote or hinder digestion and nutrient absorption [8]. For example, in rabbits, exposure to excessive amounts of easily fermentable substrates (proteins and starch) leads to hyperfermentation when incompletely ingested before reaching the cecum, causing changes in cecal pH and inhibiting normal microbiota [9]. In non-herbivorous monogastrics such as chickens, protein-rich diets cause an alkaline pH at the cecum, promoting intestinal health and productive parameters [10].

Despite existing evidence on the influence of diet on these physiological aspects, a deeper understanding is still needed of how different dietary components can modulate gastrointestinal pH, which in turn may affect probiotic mechanisms. This is especially relevant considering the discrepancies in the results reported in various studies using Lactobacillus to improve the productive performance of guinea pigs.

The present study analyzed the impact of different diets on gastrointestinal pH, intestinal microbiota composition, digestive tract morphometry, and guinea pig performance. It is expected that the findings of this research will contribute to the design of more effective nutritional strategies to improve the health and performance of these animals in production systems.

2. Materials and Methods

2.1. Study Area

The trial was conducted in the Azuay province, Cuenca canton, Ecuador, at an average altitude of 2,500 meters above sea level, with an annual average temperature of 14.6ºC and an average precipitation of 900 mm per year [11]. A total of 160 improved genotype guinea pigs were used, weaned at 21 days of age, with an average weight of 351 g for males and 307 g for females. The animals were randomly assigned to three treatments: T1 (Alfalfa - Medicago sativa), T2 (Alfalfa + Concentrate), and T3 (Concentrate), with four subgroups per treatment and 10 animals per subgroup (9 females and 1 male). After three weeks, 2 females were removed from each subgroup for euthanasia, leaving groups of 7 females and 1 male, as recommended by Cruz [12].

2.2. Zootechnical Management of Guinea Pigs

The identification of the animals was carried out by placing a numbered metal tag on the left ear pavilion. The environmental variables within the pen (temperature, humidity, and light), density, and health program were similar for all experimental units. The nutritional program was adjusted according to the nutritional requirements based on the physiological stage of the guinea pigs.

2.3. Procedure

The study was divided into two phases:

2.3.1. First Phase

The influence of diet on the gastrointestinal pH of the guinea pigs was analyzed. A 7-day adaptation period to the diet was implemented. After 21 days, 8 female guinea pigs per treatment (2 per group) were selected for euthanasia using Sodium Pentobarbital (25-40 mg/kg) administered intravenously, following the recommendations for the euthanasia of experimental animals issued by Close et al. [13, 14]. Subsequently, the gastrointestinal tract segments (stomach, duodenum, jejunum, ileum, and cecum) were exposed, and the pH of these segments was measured using pH strips.

2.3.2. Second Phase

The study investigated whether the variability in pH recorded with the three diets influenced the mechanism of action of the enhanced probiotic mixture (Probiolyte® WS), incorporated at 0.5% in T2 and 1% in T3, with T1 serving as the control treatment. To identify the gut microbiota of the lactating guinea pigs and those in T2 and T3, samples were first plated on specific culture media using streaking techniques to facilitate the isolation of individual colonies. The isolated colonies were then purified on fresh culture media to ensure pure cultures. Once pure colonies were obtained, MALDI-TOF MS (Matrix-Assisted Laser Desorption Ionization-Time of Flight-Mass Spectrometry) technology was used for identification due to its high precision and speed in microbial species characterization [15].

Additionally, intestinal morphometric parameters (width and length of intestinal villi and Lieberkühn crypt depth) were analyzed before and after 60 days of including the enhanced probiotic mixture. For this procedure, samples (segments of the duodenum, jejunum, and ileum) were fixed in 10% formalin and analyzed using Hematoxylin-Eosin (H-E) staining, with morphometric changes evaluated through a digital trinocular microscope with 10X magnification. Finally, the productive parameters of the guinea pigs were recorded and analyzed.

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2.4. Statistical Analysis

The collected data were analyzed using the R statistical software. First, a normality test was performed using the Shapiro-Wilk test to verify the distribution of the data. For each studied variable, including gastrointestinal pH, intestinal morphometry, and productive parameters, a one-way analysis of variance (ANOVA) was conducted to compare means among the three treatments (T1, T2, and T3). The composition of the gut microbiota was analyzed through frequency and prevalence analysis. Additionally, Pearson correlation analysis was used to assess the influence of pH on intestinal morphometric variables in each intestinal segment. Finally, a linear regression model was employed to investigate how independent variables (diet, gastrointestinal pH, and microbiota composition) affect dependent variables (productive parameters and intestinal morphometry). A value of $p < 0.05$ was considered statistically significant in all analyses.

3. Results

3.1. Gastrointestinal pH

The pH of the gastrointestinal tract in guinea pigs fed with different diets showed statistically significant differences ($p<0.05$) across the various segments analyzed. Guinea pigs fed an alfalfa-based diet had the highest pH in the stomach (5.88). In contrast, those fed a concentrate diet exhibited the highest pH values in the duodenum and jejunum, with readings of 7.13 and 8.38, respectively. No statistically significant differences ($p>0.05$) in pH were observed in the ileum and cecum based on the type of diet. The data are presented in Table 1.

Table 1. Gastrointestinal pH Across Different Treatments.

Treatments	Stomach	Duodenum	Jejunum	Ileum	Cecum
T1. Alfalfa Diet	5.88^{b}	5.75^{a}	7.38^{ab}	7.38^{a}	7.25^{a}
T2. Mixed Diet	5.00^{a}	5.88^{a}	6.75^{a}	7.25^{a}	6.75^{a}
T3. Concentrate Diet	5.13^{a}	7.13^{b}	8.38^{b}	8.25^{a}	7.13^{a}
p_Value	0.0195	0.0055	0.0066	0.1067	0.5397

^{a,b} Values represent the mean pH measurements of each segment for guinea pigs fed with different diets. Statistical significance was assessed with a p-value < 0.05.

3.2. Identification of the Intestinal Microbiota

A total of 17 bacteria were identified in the fecal microbiota of suckling guinea pigs, with *Staphylococcus vitulinus* and *Escherichia coli* being the most frequent. These bacteria belong to the Firmicutes and Proteobacteria phyla, respectively. In weaned guinea pigs integrated into treatments T2 and T3, a total of ten bacteria were identified, with *Escherichia coli* being the predominant bacterium. See Tables 2 and 3.

Table 2. Intestinal microbiota of lactating guinea pigs.

Microorganisms	Frequency	Prevalence
Staphylococcus vitulinus	4	13.3
Staphylococcus sciuri	3	10
Bacillus subtilis/amyloliquefaciens/vallismortis	2	6.7
Lysinibacillus fusiformis	1	3.3
Pantoea spp	1	3.3
Staphylococcus equorum	2	6.7
Bacillus cereus group.	2	6.7
Escherichia hermannii	1	3.3

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Pseudomona putida	2	6.7
Paenibacillus thiaminolyticus	1	3.3
Bacillus licheniformis	1	3.3
Exiguobacterium acetylicum	1	3.3
Enterobacter cloacae	2	6.7
Escherichia coli	4	13.3
Staphylococcus gallinarum	1	3.3
Enterobacter ludwigii	1	3.3
Siccibacter turicensis	1	3.3
	30	**100**

Table 3. Intestinal microbiota of guinea pigs supplemented with a reinforced probiotic mixture

Microorganisms	Frequency	Prevalence
Escherichia coli	13	48.1
Micrococcus luteus	3	11.1
Acinetobacter lwoffii	3	11.1
Staphylococcus cohnii ssp urealyticus	2	7.4
Serratia liquefaciens	1	3.7
Staphylococcus xylosus	1	3.7
Lysinibacillus fusiformis	1	3.7
Staphylococcus equorum	1	3.7
Bacillus licheniformis	1	3.7
Acinetobacter johnsonii	1	3.7
	27	**100**

3.3. Intestinal Morphometry

Statistical differences ($p<0.05$) were observed between treatments, and it was determined that age also influences the intestinal morphometric variables, with these variables increasing with age. Mixed feeding with the addition of 0.5% of the enhanced probiotic mixture (Probiolyte® WS) significantly increased the length of intestinal villi in the duodenum (537.83 µm) and ileum (293.64 µm) and the density of villi in the duodenum (67 per 4X field). Mixed feeding with the addition of 1% improved the width of intestinal villi in the duodenum (56.90 µm) and the depth of villi in the ileum (48.83 µm). Guinea pigs fed with concentrate increased the length of intestinal villi in the jejunum (433.70 µm) and the width in the ileum (51.87 µm). Concentrate feeding with the addition of 1% reinforced probiotic blend improved the depth of villi in the jejunum (52.93 µm). See Table 4.

Table 4. Intestinal microbiota of guinea pigs supplemented with a reinforced probiotic mixture.

			Treatments							
Segment	**Variable**	**Phase**	**Alfalfa**	**Mixed**	**Mixed 0.5%**	**Mixed 1%**	**Concent.**	**Concent. 0,5%**	**Concent. 1%**	**p-Valor**
Duodenum	**Length (µm)**	**1**	353.98^{abcd}	319.33^{ab}	349.79^{abcd}	335.73^{abc}	333.40^{abc}	317.13^{ab}	$353. 98^{abcd}$	0.00356
		2	462.27^{bcde}	456.70^{de}	537.83^{e}	410.10^{bcde}	428.77^{cde}	303.57^{a}	442.06^{de}	
	Width (µm)	**1**	34.77^{abc}	38.87^{abcde}	39.57^{abcdef}	36.83^{abcd}	34.27^{ab}	34.20^{a}	34.77^{abc}	0.0072
		2	41.43^{abcde}	49.80^{ef}	45.23^{cdef}	56.90^{f}	47.57^{def}	38.47^{abcde}	42.35^{bcdef}	

	Depth (µm)	1	36.80ᵃ	34.53ᵃ	41.67ᵃ	39.80ᵃ	41.97ᵃ	38.83ᵃ	36.80ᵃ	0.2121
		2	38.50ᵃ	39.17ᵃ	34.27ᵃ	33.17ᵃ	36.07ᵃ	36.83ᵃ	38.57ᵃ	
	Density	1	32.67ᵃ	33.67ᵃᵇ	33.67ᵃᵇ	32.67ᵃ	34.00ᵃᵇ	34.00ᵃᵇ	35.00ᵃᵇᶜ	0.0006
		2	62.00ᵈ	58.00ᵈ	67.00ᵈ	46.00ᵃᵇᶜᵈ	56-00ᶜᵈ	51.00ᵇᶜᵈ	44.00ᵃᵇᶜᵈ	
Jejunum	Length (µm)	1	213.06ᵃᵇᶜᵈᵉ	199.67ᵃᵇᶜᵈ	166.20ᵃ	173.91ᵃ	181.38ᵃᵇ	182.69ᵃᵇᶜ	213.06ᵃᵇᶜᵈᵉ	0.004
		2	49.87ᵈᵉ	272.10ᵇᶜᵈᵉ	284.07ᵇᶜᵈᵉ	293.77ᶜᵈᵉ	433.70ᵉ	426.70ᵉ	403.67ᵉ	
	Width (µm)	1	35.07ᵃᵇ	32.73ᵃ	38.50ᶜ	35.03ᵇᶜ	37.40ᵃᵇᶜ	32.37ᵃ	35.07ᵃᵇ	0.0061
		2	37.50ᵃ	45.33ᵃ	46.90ᵃ	39.13ᵃ	43.40 ᵃ	40.30ᵃ	34.52ᵃ	
	Depth (µm)	1	35.10ᵃᵇ	35.83ᵃᵇ	36.23ᵃᵇ	33.17ᵃ	37.73ᵃᵇᶜ	36.60ᵃᵇ	35.10ᵃᵇ	0.0022
		2	52.37ᵈ	43.97ᵇᶜᵈ	42.53ᵃᵇᶜᵈ	50.40 ᶜᵈ	46.23ᵇᶜᵈ	49.50ᶜᵈ	52.93ᵈ	
	Density	1	37.00ᵃ	37.00ᵃ	37.00ᵃ	37.00ᵃ	37.00ᵃ	41.00ᵃᵇ	36.00ᵃ	0.0006
		2	53.33ᵇᶜ	62.00ᶜ	62.00ᶜ	62.00ᶜ	56.00ᵇᶜ	50.00ᵃᵇᶜ	42.00ᵃᵇᶜ	
Ileum	Length (µm)	1	208.82ᵃ	214.77ᵃᵇ	213.88ᵃᵇ	208.53ᵃ	209.58ᵃ	216.01ᵃᵇ	208.82ᵃ	0.0018
		2	213.77ᵃᵇ	219.60ᵃᵇᶜ	293.64ᶜᵈ	210.70ᵃᵇ	245.30ᵃᵇᶜᵈ	213.97ᵃᵇ	283.80ᵇᶜᵈ	
	Width (µm)	1	33.80ᵃ	36.07ᵃ	32.13ᵃ	33.87ᵃ	36.20ᵃ	40.37ᵃ	33.80ᵃ	0.0001
		2	38.17ᵃᵇ	48.53ᶜᵈ	36.70ᵃ	45.97ᵇᶜᵈ	51.87ᵈ	51.07ᵈ	41.07ᵃᵇᶜ	
	Depth (µm)	1	38.57ᵃ	39.17ᵃ	34.27ᵃ	33.17ᵃ	36.07ᵃ	38.83ᵃ	38.57ᵃ	0.0516
		2	45.50ᵃ	43.43ᵃ	41.00ᵃ	48.83ᵃ	44.23ᵃ	40.57ᵃ	48.25ᵃ	
	Density	1	43.67ᵃ	43.67ᵃ	43.67ᵃ	43.67ᵃ	43.67ᵃ	43.67ᵃ	43.67ᵃ	0.0055
		2	57.33ᵃᵇᶜ	68.00ᶜ	53.00ᵃᵇᶜ	58.00ᵇᶜ	61.00ᵇᶜ	48.00ᵃᵇ	57.00ᵃᵇᶜ	

Means with a common letter are not significantly different (p > 0.05).

3.4. Productive Parameters

The productive parameters (weight gain, feed intake, and feed conversion ratio) showed a significant difference ($p < 0.05$) between treatments. The guinea pigs fed with a mixed diet plus 0.5% of the reinforced probiotic blend reached the highest weight gain (284.67 g), the highest feed intake (1046.08 g), and the best feed conversion ratio (3.70) by the seventh week of the study, compared to the other treatments. See Table 5.

Table 5. Productive Performance of Experimental Guinea Pigs.

	Age Weeks	T1 Alfalfa	T2 Mixed	T2 Mixed (0,5%)	T2 Mixed (1%)	T3 Concentrated	T3 Concentrated (0.5%)	T3 Concentrated (1%)	p-Value
Weight Gain (g)	4	110.00ᵃ	108.67ᵃ	116.00ᵃ	144.33ᵃ	121.33ᵃ	119.33ᵃ	98.33ᵃ	0.0929
	5	131.33ᵃ	123.67ᵃ	146.33ᵃ	161.67ᵃ	131.00ᵃ	165.67ᵃ	134.33ᵃ	0.1855
	6	79.67ᵃ	153.67ᵃ	171.00ᵃ	186.33ᵃ	154.67ᵃ	197.67ᵃ	167.33ᵃ	0.0962
	7	217.33ᵃ	228.00ᵃ	284.67ᵇ	200.33ᵃ	212.33ᵃ	224.00ᵃ	184.67ᵃ	0.0004
	4	511.33ᵃᵇ	435.23ᵃᵇ	506.80ᵃᵇ	584.73ᵇ	379.03ᵃ	537.13ᵃ	407.53ᵃ	0.0125

Feed Intake (g)	5	586.03a	578.56a	657.72a	709.67a	520.67a	703.65a	527.63a	0.0185
	6	699.59ab	691.88ab	772.24ab	838.27b	649.04a	857.92b	634.48a	0.0049
	7	929.32abc	901.60abc	1046.08c	986.83abc	812.28a	1020.45bc	836.08ab	0.0070
Feed Conversion	4	4.63b	4.00ab	4.33ab	4.10ab	3.17a	4.57b	4.13ab	0.0254
	5	4.50a	4.67a	4.47a	4.43a	4.00a	4.33b	3.97a	0.5156
	6	3.90a	4.53a	4.50a	4.50a	4.20a	4.37a	3.83a	0.0915
	7	4.33ab	4.00ab	3.70a	4.93b	3.87ab	4.57ab	4.57ab	0.0167

Means with a common letter are not significantly different (p > 0.05).

3.5. Correlation Analysis

The correlation analysis suggests that pH has a variable influence on the morphometric characteristics of intestinal villi depending on the segment of the digestive tract. In the jejunum and ileum, pH shows a stronger association with the length and width of the villi, whereas in the duodenum, the influence of pH is more limited. These findings highlight the importance of considering the specific segment when evaluating the impact of pH on intestinal morphometry. See (Table 6).

Table 6. Correlation between gastrointestinal pH and intestinal morphometry.

Segment	Variable	pH
Duodenum	Length	− 0.146
	Width	0.202
	Depth	0.033
	Density	− 0.256
Jejuni	Length	0.736
	Width	-0.015
	Depth	0.114
	Density	-0.383
Ileum	Length	0.619
	Width	0.539
	Depth	0.016
	Density	-0.200

Correlations between pH and intestinal morphometric variables (length, width, depth, and density of the villi) in different segments of the digestive tract of guinea pigs (duodenum, jejunum, ileum).

4. Discussion

4.1. Gastrointestinal pH

Previous studies on pH in the digestive system of guinea pigs and other species have reported varied results. For example, Merchant et al. [16] recorded a gastric pH of 2.9 in guinea pigs fed ad libitum, a pH in the small intestine ranging from 6.4 to 7.4, and pH values between 6.0 and 6.4 in the cecum and between 6.1 and 6.6 in the colon. Rechkemmer et al. [17] indicated that the pH of the jejunal microclimate in guinea pigs is 7.37, while the luminal pH is 7.27.

García et al. [18] demonstrated that pH influences the activity of amylolytic, cellulolytic, proteolytic, and lipolytic enzymes in the cecum of guinea pigs, observing lower cellulolytic enzyme activity at a pH of 5 and lipolytic activity at a pH of 9, without significantly affecting amylolytic and proteolytic activity. Pinchao et al. [19] reported that lactic acid bacteria (LAB) are more adaptable at intestinal pH levels of 2.9, 5.0, 6.4, and 7.4. On the other hand, Ramón [20] found that the pH in the stomach and cecum of guinea pigs performing cecotrophy is 1.53 and 6.63, respectively.

Vásquez et al. [8] measured pH in alpaca crias during the first 45 days of life, recording a gastric pH ranging from 6.91 to 5.95, and in the duodenum, jejunum, ileum, and cecum, pH values of 6.49 to 6.41, 6.64 to 6.71, 7.18 to 6.63, and 6.49 to 6.68, respectively. Gastrointestinal pH variations may be influenced by fiber levels in the diet, as high-fiber diets can neutralize some acidity by increasing saliva production, which is alkaline. The presence of certain minerals such as calcium and magnesium, as well as the amount and frequency of feeding, may also affect pH. Increased food intake may elevate hydrochloric acid production in the stomach, while long periods without feeding can reduce acidity. According to Miranda et al. [21], the inclusion of fermented bioadditives with lactic acid bacteria and yeasts produces organic acids (lactic and acetic acids) as metabolic byproducts, which can alter pH values along the gastrointestinal tract, Goichochea et al. [22] and thereby reduce bacterial growth, especially at pH equal to or below 4.

4.2. Identification of the Intestinal Microbiota

Different data from those found in this study have been reported by Frias et al. [23], who identified four phyla: Bacteroidota, Firmicutes, Spirochaetota, and Synergistota in the cecal microbiome of three guinea pig breeds: Andina, Inti, and Perú. The authors concluded that genetics could influence the structure and composition of the guinea pig cecal microbiome by finding unique genera for each breed.

On the other hand, Wu et al. [24] point to *Ruminococcus_albus* as the predominant bacterial community in the guinea pig intestinal microbiota. Meanwhile, Murga et al. [25] highlight Bifidobacterium longum (Phylum Actinomycetota), Fibrobacter succinogenes (Fibrobacterota), and Faecalibacterium prausnitzii (Bacillota), attributing that the composition or alteration of the microbiome may be related to the development of certain diseases or genetics. Zhu et al. [26] indicate that the addition of non-nutritive sweeteners (rebaudioside) to the diet of guinea pigs significantly alters the relative abundance of Lactobacillus.

Hildebrand et al. [27] demonstrated that the guinea pig intestinal microbiota is dominated by two phyla: Bacteroidetes and Firmicutes. Pinchao et al. [19] isolated 29 strains of lactic acid bacteria obtained from the intestines, cecum, and colon of adult and young guinea pigs, with *Ligilactobacillus salivarius* being the most prevalent strain; however, Alayande et al. [28] state that the origin of the intestinal microbiota is not well established.

These discrepancies between studies could be due to several reasons, including differences in methodologies used for bacterial identification, variations in diets and living conditions of the guinea pigs, and genetic diversity among different populations and breeds of guinea pigs. Additionally, it is important to consider the physiological state of the animals (infants, juveniles, or adults) and the impact of the immediate environment on the configuration of the microbiome.

4.3. Intestinal Morphometry

The results of the study differ from those reported by Carcelén et al., and Puente et al. [29, 30], who added a probiotic mixture (*Enterococcus hirae, Lactobacillus reuteri, L. frumenti, L. johnsonii, Streptococcus thoraltensis, and Bacillus pumilus*) to a mixed diet (wheat bran plus forage) for guinea pigs, showing only benefits in the ratio of villi length to depth in the ileum and duodenum, respectively. *Saccharomyces cerevisiae*, added as a probiotic to the mixed diet of guinea pigs, also has a positive effect on villi width and the length of the crypt-villi axis.

Studies conducted on broiler chickens demonstrate the benefits of probiotics on intestinal morphometry; Roa et al. [31] report that the individual or mixed inclusion of probiotics (*Saccharomyces cerevisiae, Lactobacillus sp., and Bacillus sp.*) has a positive effect on the intestinal morphometry of the birds.

4.4. Productive Parameters

Several authors have studied the effect of additives such as probiotics, prebiotics, symbiotics, and enzymes on the diet of guinea pigs. Miranda et al. [32] assessed the impact of probiotics derived from a substrate of agro-industrial residues fermented with lactic acid bacteria and/or yeasts (*Lactobacillus acidophilus, L. bulgaricus, Saccharomyces cerevisiae*, and *Kluyveromyces fragilis*), with a molasses-vinasse substrate, and observed improvements in weight gain in guinea pigs. Andía & Lazo [33] report that the inclusion of a probiotic mixture of *Lactobacillus acidophilus*, *L. casei*, and *Saccharomyces cerevisiae* in the guinea pig diet has a significant effect on food consumption and carcass yield. Cuenca et al. [34] added garlic powder at 1%/kg of concentrated feed as a prebiotic and observed improvements in the productive parameters of guinea pigs starting from the third week of the experiment.

Contrarily, [29, 35, 36] report that the addition of probiotics, prebiotics, or symbiotics to guinea pig feed does not have a significant or consistent effect on the productive parameters of this species. Bazay et al. [37] indicate that mannan-oligosaccharides (MOS) included in the diet of guinea pigs during the fattening phase do not improve production parameters. Criollo et al. [38] report that the addition of *Saccharomyces cerevisiae* to the guinea pig diet does not have favorable effects on productive parameters.

5. Conclusions

The diet significantly influences gastrointestinal pH, intestinal microbiota, intestinal morphometry, and productive parameters in guinea pigs. These findings highlight the importance of diet composition and supplementation in the nutritional management of guinea pigs, with direct implications for optimizing their digestive health and productive performance. An optimal pH in the gastrointestinal tract promotes a balanced intestinal microbiota, which in turn positively impacts productive parameters and strengthens the immune system, emphasizing the interdependence of these factors in the health and performance of the animals.

Author Contributions: Conceptualization, Cuenca M. and Campos N.; methodology, Campos N, Cuenca M, Quinteros W.; software, Cuenca M.; validation, Cuenca M. and Campos N.; formal analysis, Cuenca M.; investigation, Cuenca M., Campos N. and Quinteros W.; resources, Cuenca M.; data curation, Cuenca M.; writing—original draft preparation, Cuenca M.; writing—review and editing, Cuenca M.; visualization, Campos N.; supervision, Cuenca M.; project administration, Cuenca M. Campos N.; funding acquisition, Cuenca M. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Catholic University of Cuenca-Ecuador, Department of Formative Research.

Data Availability Statement: Data are contained within the article.

Acknowledgments: Sixth cycle students of Veterinary Medicine - Catholic University of Cuenca-Ecuador, March-August 2024 cycle.

Conflicts of Interest: The authors declare no conflicts of interest.

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