**Effects of thyme and garlic powder on the reproductive performance and pre-weaning growth in guinea pigs (*Cavia porcellus*)**

**ABSTRACT**

In order to study the effects of thyme and garlic powder on reproductive performance and pre-weaning growth in guinea pigs, 72 guinea pig (60 female and 12 males) aged 5 months reproduced at the Application and Research Farm (FAR) of the university of Dschang, weighing on average 450 ± 50 g was carried out in the Animal production and Nutrition Research Unit (URPRONAN) of the University of Dschang between September 2019 and December 2020. Four rations (T0, TI, T2 and T3) were used. The control ration allocated to animals without additives. The animals of treatment T1, T2 and T3 respectively received 1% thyme power; 1% garlic powder and 0.5% thyme powder + 0.5% garlic powder in their diet *Trypsacum Laxum* was served *ad-libitum* as staple feed. The animals were randomly distributed in to 4 groups of 18 animals each (15 females and 3 males) and crossed over a period of 31 days, after which the males were removed. The breeders were filled until weaning. At birth, each newborn was identified with metal loops, numbered and then weighed every 7 days until weaning of pups. The quantities of feed served were maintained in the lactating mothers until weaning of pups (21 days after birth). The result showed that, the highest (1.6) litter size was in treatment T1. It was the same for other reproduction parameters. Without consideration of sex, the highest body weights of young guinea pigs (136,50g) were obtained in treatment T1. The highest total weight gain (TWG) and daily weight gain (DWG) (184.25 g and 11.51 g/day respectively) was obtained in treatment T1. It appears that diets containing 1% thyme powder (T1) was suitable for guinea pigs during pregnancy and pre-weaning.

**Keys words:** Guinea pig, Thyme, garlic, reproductive performance, pre-weaning growth.

## INTRODUCTION

Africa suffers from poverty, malnutrition and other known social diseases, especially in the rural landscape share lack of capital and necessary experience prevent intensive animal protein production. In the face of this situation, mini-farming, often neglected must be considered (Ndébi *et al.,* 2015). Caviaculture appears to be one of the opportunities to be seized to help poor households get out of food insecurity (Noumbissi *et al*., 2014). The high growth rate of guinea pigs and their lean protein-rich meat are major assets for their production (Miégoué *et al*., 2016a). The diet of this animal's species is mainly base on kitchen waste. This does not allow the animal to exteriorize its genetic potential (Niba *et al.,* 2004b, Zougou *et al.,* 2017) and also to satisfy the needs of their caecal flora (Noumbissi *et al.,* 2014; Miégoué *et al.,* 2016). Its optimal use as a source of protein and income therefore requires an increase in its productivity, which necessary requires improved breeding strategies on one hand and better rational production management method on the other (Mieggoué *et al.,* 2018). In animal husbandry in general and in caviar farming in particular, feeding and prevention of certain gut pathologies play a key role (Tao *et al.,* 2006; Bindelle and Picron, 2013). It has been reported that the use of growth promoters (phytobiotic, prebiotics and symbiotics) can improve growth performance, prevent diseases and promote the growth of beneficial microorganisms present in the animal gut flora (Toa *et al.,* 2006). Among these compounds, phytobiotics have many advantages such as Oxidative capacity, antimicrobial activity, improved digestion, and immune system stimulation (Noura *et al.,* 2018)

Thyme, which originated in the Mediterranean basin has been famous for thousands of years for its culinary, cosmetic and medicinal uses. Its use to calm coughs and inflammation of the upper respiratory tract. It is also used to relieve minor digestive and gastrointestinal disorder; in addition, thyme essential oil has remarkable antioxidant, anti-bacterial and antiseptic properties. In rodents, it has been observed that thyme essential oils can block pain sensations (Takaki *et al.,* 2008). Which can be beneficial to the animals' well-being. Garlic (*Allium Sativum*), a spice native to the middle East is an anticholesterol agent. This additive contains inulin which stimulates the development of bacteria beneficial to the intestinal flora (Barnes *et al*. 2000). Thanks to chemical component such as Tocopherols, Sternoids, Flavonoids and Vitamin (Garlic also has anti-free radical properties. Work conducted by Arukwe et *al,* (2012) showed that consumption of fresh garlic (raw or cooked) would increase antioxidant activity in plasma of rats.

Unfortunately, little information is available on the use of thyme and garlic powder in guinea pig diets. The objective of this work was to evaluate the effects of these phytobiotic on the reproductive and pre-weaning parameters of guinea pigs.

## MATERIALS AND METHODS

### Experimental site

This study was conducted between March and December 2020 at the Animal production and Nutrition Research Unit (URPRONAN) of the faculty of Agronomy and Agricultural sciences (FASA) of the University of Dschang. The city of Dschang is located at 50° degrees east meridian, at latitude 536°-44° North and longitude 09° 85°-10° 06° East. The climate of the region is equatorial of Cameroonian type modified by altitude. Rainfall varies between 1500 and 2000 mm per year. The average annual temperature is around 20°C, the total annual insolation at 1800 hours and an average relative humidity varying between 40 and 90°.

### Animal material and housing

For this trial,71 animals (60 females and 12 males) were housed in plywood boxes, each measuring 1m in length, 0.8m in width, and 0.6m in height, equipped with a lighting system that also serve as a heating system. The animals were reared on the floor, on a 5cm thick dry untreated wood shavings bedding, renewed every 2 days to avoid accumulation of faeces and urine. Each compartment or lodge was equipped with a wooden feed trough for concentrated feed and a concrete drinking trough. The different boxes were equipped with a fine mesh cover to protect the animals from mice and other predators that could enter the barn.

### Plan material

The plan material consisted of thyme and garlic purchased in Santchou (West Cameroon) and *Trypsacum laxum*, harvested from the farm's forage field 2days before, stored in one of the dwellings of the bran and pre-farming before being serve ad-libitum to the animals the next day.

### Evaluation of the phytochemical composition of thyme

Phytochemical screening was performed to determine the presence or absence of bioactive compounds present in thyme and garlic powder, following the method described by Talukdar *et al*. (2010). The main compounds found in these spices are presented in Table 1.

**Table 1:** Phytochemical Composition of Thyme and Garlic Powder

| N° | Retrieved From | Alkaloids | Phenols | Flavonoids | Sterols | Triterpenoids | Tannins | Saponins | Anthocyanins | Anthraquinon |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **Garlic** | + | - | - | + | + | - | - | - | - |
| **2** | **Thyme** | + | + | + | + | + | + | - | + | + |

Key : + = present ; - = absent

**Formulation of expérimental diets**

The proportion of the different by-products purchased from feed dealers in the city of Dschang was used to make the compound feed as well as their value (Table 2)**.** The feed formular was established from a diet without additives (T0). The animals in treatment (T1), (T2) and (T3) received 1% thyme powder, 1% garlic powder and 0.5% thyme powder + 0.5% garlic powder respectively in their diets. *T. laxum* was served *ad-libitum* for each treatment group.

**Table 2 :** Formulation of Experimental Diet

| **Ingredients** | **Different rations** | | | |
|---|---|---|---|---|
| | **T0** | **T1** | **T2** | **T3** |
| Modulat | 32 | 32 | 32 | 32 |
| Corn | 30 | 30 | 30 | 30 |
| Cotton seed meal | 11 | 11 | 11 | 11 |
| Palm kennel meal | 15 | 15 | 15 | 15 |
| Soybeans meal | 1.5 | 1.5 | 1.5 | 1.5 |
| Fish meal | 2 | 2 | 2 | 2 |
| Oyster shell | 2 | 2 | 2 | 2 |
| Premix 5% | 0.5 | 0.5 | 0.5 | 0.5 |
| Oil | 3 | 3 | 3 | 3 |
| Garlic | - | 1 | - | 0.5 |
| Thyme | - | - | 1 | 0.5 |
| **Total** | **100** | **100** | **100** | **100** |
| **Chemical composition** | | | | |
| Metabolizable Energy (%MS) | 2846 | 2805 | 2818 | 2777 |
| Crude Protein (%MS) | 18. 32 | 18. 16 | 18. 13 | 17. 98 |
| Raw cellulose (%MS) | 10. 09 | 12. 89 | 9. 99 | 12. 76 |
| Ca/P (% MS) | 1. 964 | 1. 98 | 1. 97 | 1. 99 |
| Fats content (% MS) | 5. 86 | 7. 24 | 5. 8 | 7. 17 |

**Pre-weaning growth and reproduction assessment**

Once identified by numbered metal loops, animals were crossed in a sex ratio of 15 female to 3 male for 31 days, after which the male were removed. At the beginning of the trial, number of breeding females and their weights were recorded. The animals were fed daily, vitamin water supply ad-libitum (240mg tablet in 1.5 liters of water). During this trial, the different experimental diets were distributed each morning between 8 and 9 am at a rate of 60g DM/animal/day and the leftover were collected and weighed before any new distribution. After farrowing, female breeders were monitored until weaning. At birth, each newborn was identified with metal buckles, numbered and then weighed every 7 days, until weaning of the young. The amount of feed was maintained in lactating females until the pups were weaned (21 days after birth).

During gestation, the number of females that aborted were recorded. The number of females that gave birth and the date of parturition were noted. At birth the number of stillborn and live-born piglets was recorded. The number of dead piglets before weaning and the number of weaned piglets were also recorded. All these data were used to evaluate the reproductive performance.

- Fertility rate or parturition rate $= \frac{Numer\ of\ females\ with\ calves}{Number\ of\ females\ bred} x\ 100$
- Little size = $\frac{Number\ of\ births}{Number\ of\ females\ bred}$
- Fertility rate = $\frac{Number\ of\ still\ borns + Number\ of\ live\ births}{Number\ of\ females\ bred} x100$
- Net fecundity rate = $\frac{Number\ of\ live\ birth}{Number\ of\ females\ bred} x\ 100$
- Viability at birth = $\frac{Number\ of\ live\ births}{Number\ of\ births} x\ 100$
- Stillbirth rate = $\frac{Number\ of\ still\ born\ piglets}{Number\ of\ piglets\ weaned} x\ 100$
- Pre-weaning mortality rate = $\frac{Number\ of\ piglets\ dead\ before\ weaning}{Number\ of\ piglets\ born\ alive} x\ 100$
- Post-weaning mortality rate = $\frac{Number\ of\ piglet\ deadafter\ weaning}{Number\ of\ piglets\ weaned} x\ 100$

Total weight gain (TWG) (g) = The total weight gained for each experimental unit was obtained by calculating the differences between the weight at the end and start of the trial.

- Daily weight gain (DWG) (g) = $\frac{Total\ \ gain}{Duration\ of\ the\ period\ considered}$

**Statistical analysais**

Data on intake of pregnant guinea pig reproductive characteristics, pre-weaning and post-partum weight growth of lactating cows were subjected to one way analysis of variance test by the general linear model procedure (GLM). When differences existed between treatments, the means were separated by the Waller Document test at 5% significance level (Steel and Torrie, 1980).

**RESULTS**

**Evaluation of the reproductive performance**

The average reproductive performance of guinea pigs according to treatment is presented in Table 3. It can be seen that the highest average fertility rate (100%) was obtained in animals fed T1, T2 and T3 diet while the lowest (93%) was obtained with the T1 control (T0) treatment. The highest litter size (1.6) was obtained in animal fed diet T1 while the lowest (1.42) was observed in the control (T0) diet. The highest fecundity rate (153%) was obtained in animal fed diet containing 0.5% thyme (T1) while the lowest (232%) was obtained when the animal were fed diet containing no addictive (T0). The highest net fertility rate (140%) was obtained in animal fed (0.5%) thyme (T1) while the lowest (126%) was obtained in animals in the control (T0) treatment.

The highest viability at birth (95%) was observed in animals receiving T1 diet containing 0.5% thyme powder while the lowest (86%) was obtained inT0 diet.

The highest viability rate (956) servicing was obtained in animals T1 diet while the lowest (88%) was obtained with animals in the control (T0) group. The highest mortality rate (27%) was recorded in animals that received garlic powder (T2) in their diet while the lowest was recorded in animals of the control (T0).

**Table 3:** Average reproductive performance in guinea pig fed thyme and ginger

| **Treatments** | **$T_0$** | **$T_1$** | **$T_2$** | **$T_3$** |
|---|---|---|---|---|
| Fertility rate (%) | 93 | 100 | 100 | 100 |
| Fecundity rate (%) | 66,7 | 86.7 | 93.3 | 86.0 |
| Net fecundity rate (%) | 135[a] | 153 | 140 | 146 |
| Litter size | 1,42 | 1.6 | 1.46 | 1,5 |
| Viability at birth (%) | 86 | 95 | 90 | 90 |
| Viability at weaning (%) | 88 | 95 | 91 | 95 |
| Post-weaning viability (%) | 89 | 94 | 90 | 90 |
| Mortality rate (%) | 27 | 20 | 20.8 | 21 |
| Pre-weaning mortality rate (%) | 11 | 4 | 5 | 6 |

**Effect of treatments on pre-weaning growth of young guinea pig**

- **Pre- weaning growth of young male guinea pig fed thyme and ginger**

Figure 1 shows the evolution of weight gain of young male guinea pigs from birth to weaning, according to treatments. The young male all showed weight gain from birth to weaning.

It was observed that all animals, Regardless of the treatment, obtained a significant increase ($p< 0.05$) in weight from birth to weaning. However the animals fed T1 diet showed significantly ($p<0.05$) higher weight gain compared to the animals of the other treatments.

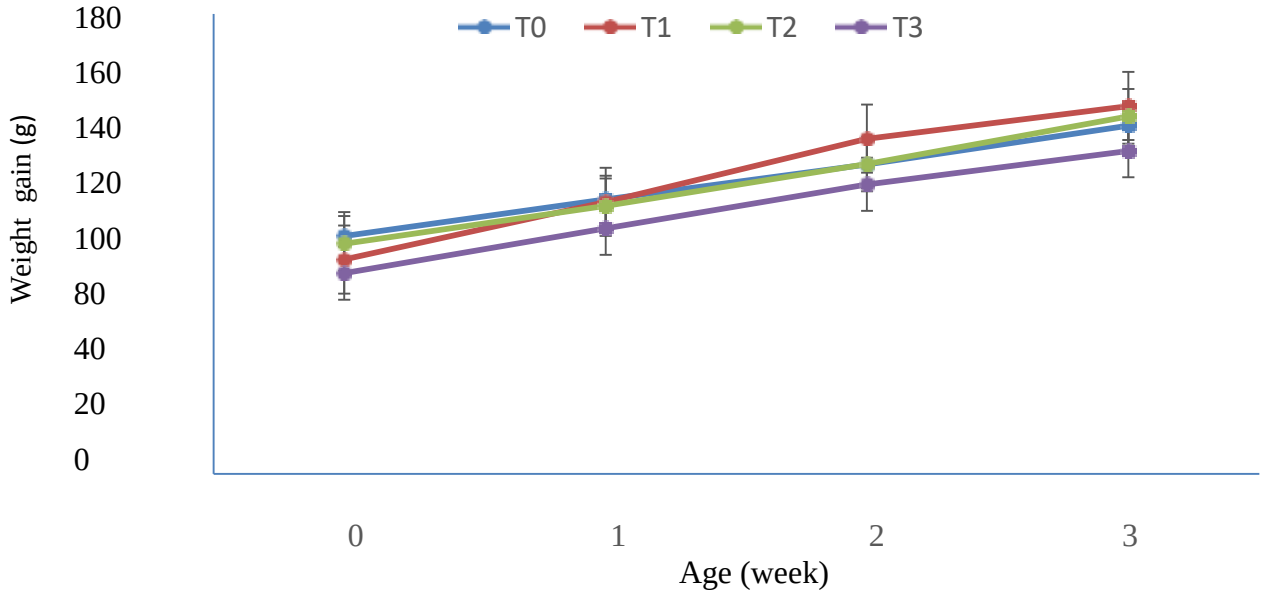


**Figure 1:** Evolution of weight gain of young male guinea pig from birth to weaning, according to treatment.

- **Pre-weaning growth of young female guinea pigs**

Figure 2 is an illustration of the evolution of weight gain of young female guinea pigs from birth to weng, according to treatments.

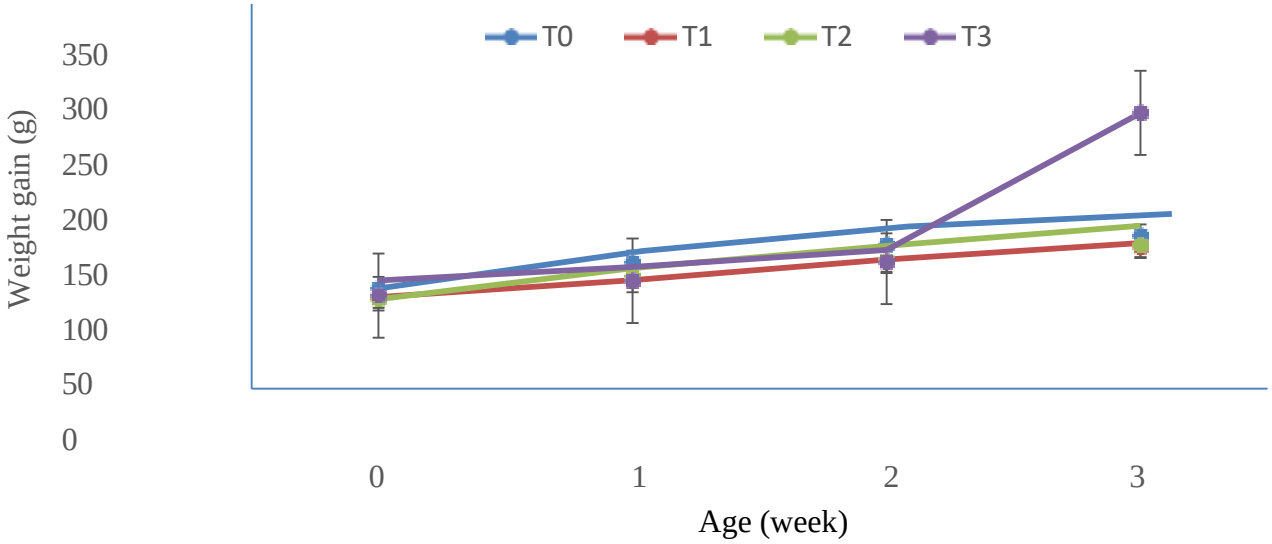


**Figure 2:** Evolution of weight gain of young female guinea pigs from birth to weaning, according to treatments.

It is observed that from the first to the second location, all animals independent of the diet were comparable ($p>0.05$). The young females showed increased in weight gains from birth to weaning (Figure 2). It can be observed that all animals, regardless of the treatment obtained a significant increase ($p<0.05$) in weight from birth to weaning. However, the animals fed T1 diet had significantly ($p<0.05$) higher weight gain compared to the animals in the other groups or treatment.

**Effect of treatments on average birth and weaning weights.**

The average birth weight, weaning weight and weight gain of young guinea pigs from birth to weaning according to treatment are shown in table 3.

**Table 4:** Average birth weight, weaning weight and weight gain of young guinea pigs from

| **Parameters** | **Treatments** | | | | **SEM** | **p** |
|---|---|---|---|---|---|---|
| **Sex (n)** | **T0** | **T1** | **T2** | **T3** | | |
| Birth weight (g) | | | | | | |
| ♂**(28)** | 83.13[a](6) | 93.88[a](8) | 90.3[a](7) | 78.50[a](7) | 2.28 | 0.10 |
| ♀**(33)** | 83.25[a](7) | 90.50[a](9) | 81.63[a](8) | 84.88[a](9) | 2.50 | 0.57 |
| ♂♀**(61)** | 83.19[a](13) | 92.63[a](17) | 85.88[a](15) | 81.69[a](16) | 2.39 | 0.34 |
| **P** | 0,43 | 0,56 | 0,74 | 0,91 | | |
| Weight at 3 week (g) | | | | | | |
| ♂**(27)** | 120.25[a](5) | 144.88[a](8) | 139.88[a](7) | 126.38[a](7) | 5.15 | 0.68 |
| ♀**(29)** | 124.13[a](6) | 129.12[a](8) | 130.38[a](7) | 126.00[a](8) | 4.98 | 0.83 |
| ♂♀**(56)** | 125.69[a](11) | 137.50[a](16) | 133.,13[a](14) | 126.19[a](15) | 5.06 | 0.76 |
| **P** | 0,75 | 0,32 | 0,40 | 0,65 | | |
| Total weight gain (DWG) (g) | | | | | | |
| ♂ | 168.13[a] | 197.50[a] | 169.63[a] | 172.75[a] | 8.24 | 0.57 |
| ♀ | 151.00[a] | 171.00[a] | 134.88[a] | 139.63[a] | 6.18 | 0.23 |
| ♂♀ | 159.56[a] | 184.25[a] | 152.69[a] | 151.69[a] | 7.21 | 0.40 |
| | 0,00 | 0,00 | 0,00 | 0,00 | | |
| Average daily weight gain (AWG) (g) | | | | | | |
| ♂ | 10.50[a] | 12.34[a] | 10.60[a] | 10.79[a] | 0.51 | 0.57 |
| ♀ | 9.43[a] | 10.68[a] | 8.42[a] | 7.67[a] | 0.38 | 0.24 |
| ♂♀ | 9.96[a] | 11.51[a] | 9.51[a] | 9.48[a] | 0.44 | 0.41 |
| **P** | 0.00 | 0.00 | 0.00 | 0.00 | | |

[a,b,c] Means with the same letters on the same row are not significantly different ($p>0.05$); SEM: Standard Error of Mean**;** P: Probability ; ♂ = Male ♀ = Female

Overall, regardless of sex and treatment, the average birth and weaning weights of piglets, total gains and average daily gains showed no significant difference ($p>0.05$). However, the highest average birth and weaning weights (92.63 and 136.50 g respectively) were recorded by animals fed thyme powder in their ration (T1) while the lowest (81.69 and 124.19 g respectively) were

observed in animals fed ration containing thyme-garlic mixture (T3). Similarly, the highest weight gain (184.25 and 11.51 g respectively) was recorded by the animals fed thyme powder in their ration (T1) while the lowest (151.69 and 9.48 g respectively) were observed in animals fed thyme powder combined with garlic powder (T3). Furthermore, it was observed that both the birth, weaning weights and weight gains (WG and AWG), the highest values were obtained by males compared to females.

The animals fed thyme diet (T1) had the highest average birth weight (93.8%), while the lowest value was recorded by the control animals (T0). The same observation was made for the average weaning weight, total gain and average daily gain.

## DISCUSSION

### Effect of including thyme and garlic powder in the diet on reproductive performance.

The fertility rate was not influenced by the inclusion of thyme and garlic powder. The highest fertility rate (100%) was obtained in female breeders receiving additives in their diet and the lowest (93%) in the control animals (T0). The highest rate (100%) obtained in this study was higher than those reported by Noumbissi (2016) (93.33%), Zougou *et al*. (2017) (96%), Nguedia *et al*. (2019) (86.66%) and Fokom *et al*. (2020) (85.00%) who fed guinea pigs with diet containing different levels of protein. This rate is also higher than that obtained by Djoumessi *et al*. (2021) (66.70%) who incorporated C. longa powder in the diet of guinea pigs. The lowest fertility rate (93.00%) obtained with animals of the control group (T0) was higher than those obtained by Zougou et al. (2017) (40%), Todou (2013) (35%) and Djoumessi *et al.* (2021) (60.00%). This could be due to the nature of the supplement, the quality of the protein or the nature of the feed additive. The highest rate (153.00%) obtained in animals fed diet containing thyme powder (T1) is much lower than that obtained by Kouakon *et al*. (2012) (187.5%), Zougou *et al*. (2017) (184%), Mwengang (2016) (206.67%) and Noumbissi (2016) (180%) but higher than that observed by Nguedia *et al*. (2019) (113.33%) and Djoumessi *et al*. (2021) (93.30%). This could be due to the size of the litter per female and/or to the antibacterial property of thyme that promotes the development of beneficial bacteria that help transform the food and make it available to the animal, thus promoting the availability of all the nutrients needed to ensure its growth and proper functioning of its organs (Bento *et al*. (2013). The lowest fertility rate (135.00%) obtained in this study was higher than that obtained by Fokom *et al.* (2020) (80.00%) and Djoumessi *et al.* (2021) (66.70%). In our study, no significant difference was observed in litter size independent of diet. However, the highest litter size (1.6) was found in breeding females of T1, while the lowest (1.42) was found in the control (T0) group. This

could be explained by the calving rate of the females, all of which were primiparous. However, Ngoupayou *et al*. (1995) report that among primiparous females, 80% of the litter consists of a single calf. The value of litter size obtained in our study (1.6) is higher than that recorded by Nguedia *et al*. (2019) (1.45) and Djoumessi *et al.* (2021) (1.55) in breeding females fed diet containing spirulina and *C. Longa* Powder.

**Effect of ration on growth performance of guinea pigs**

Regardless of sex and treatment, the average birth and weaning weights of the piglets, the total weight gain and the average daily weight gain did not differ significantly ($p > 0.05$). However, the highest average birth and weaning weights (92.63 and 137.50 g respectively) were recorded by animals fed thyme powder in their ration. While the lowest (81.69 and 126 g respectively) were observed in animals fed diet containing thyme-garlic mixture (T3). Similarly, the highest weight gains (184.75 and 11.51 g respectively) were recorded by animals fed thyme powder in their diet (TI) while the lowest (151.69 and 9.48 respectively) were observed in animals fed thyme powder combined with garlic powder (T3). The highest values of birth and weaning weights due to the inclusion of thyme powder could be justified by the fact that the feed could have presented an appetizing taste that increased intake unlike the other treatments. The high weights could be explained by the increased absorption of nutrients, as well as by the presence of flavonoids in thyme which, due to its antimicrobial properties, could have favored the proliferation of beneficial bacteria to the detriment of pathogenic bacteria. This may have made the intestinal tract healthy allowing for proper digestion and absorption of nutrients, leading to improved growth (Zam. 2018). This result corroborates with those of Hilal and Bolukbasi (2017) who showed that incorporation of longa powder in feed at a rate of 2g/kg feed in broilers improves growth performance. Furthermore, it was observed that both for birth and weaning weights and weight gains, the high values were obtained by males compared to females. This can be explained by the fact that males have a higher weight than females and are therefore more vigorous, which caused them to ingest more (Niva *et al.*, (2004).

Furthermore, from birth to weaning, the highest weight of males (T1) increased significantly (from 93.88g to 144.88g). This could be due to the high growth rate of young guinea pigs (Cicogna, 2000). This author showed that the weaning weight (at 3 weeks of age) is almost double that of birth and doubles again during the following 6 weeks. Regardless of sex, the highest weaning weight (137.50g) obtained in this study is lower than that obtained by Djoumessi *et al*., (2021) (156 g), Nguedia *et al.*, (2019) (189.50 g) in guinea pigs fed rations containing *C. longa* powder and spirulina respectively. The increase in our study could be

related to the presence of phenols in *C. longa* powder, especially in minerals important for metabolic processes that promote animal growth. According to the Cowan (1999), phenolic compounds act by forming complexes with many proteins, cause the destruction of bacterial membranes, make some substrate unavailable for bacteria. Thus, the improvement of the immune response and reduction of the microbiota could lead to a greater availability of certain nutrients for the host and therefore promote weight gain. Moreover, the flavonoids contained in the phytobiotic may have stimulate the secretion of digestive enzymes, thus decreasing the speed of digestive transit, favoring in turn a better absorption of nutrients resulting in increased weight gain. These results are in line with those of Foldesiova *et al*. (2015), who reported that the addition of 5. % of *C. longa* powder increases weight gain as well as total gain in rabbits.

## CONCLUSION

We can conclude from this study fed diet containing 1% thyme powder compound improved reproductive performance and preventing growth in guinea pigs.

## REFERENCES

**Aruker U. Armadi BA. Ons MKC. Agomuo EN, Adinda EA, Odika PC, Lete KC, Egejuru L. Anndike 1. 2012.** Chemical composition of Persea americana leaf, fruit and seed www.arpapress.com/Volumes/Vollths ue2/URRAS 11 2 20 pdf. 22/04/2017.Systems in Hypertensive Rats. Planta Med 2016; 82(07):612-620

**Bindelle J. and Picron P. 2013**. The guinea pig, a small herbivore easy to feed in small plots. Heras and Crape of the Tropics: Special Rodent Breeding, Kinshasa DRC CAVIK, 1-10

**Conwan M.M. 1999**, Plant products as antimicrobial agents Clinical Microbiology Reviews 1999 12:564-562

**Généviéve Nguedia, Emile Miégoue*, Feruand Tendonkeng, Camara Sawa, Proteste Ntsafack, France Gima Tob Djoumessi, Serge Alain Tatsinkou and Etienne Tedonkeng Pamo 2019.** Production performance of guinea pig (Cavia porcellus) according to the level of spirulina in the ration in the West Cameroon region. Int. J Biol. Chen, Sci. 13(3) 1245-1260.

**Kouakou N.G.D.V Kouba M. and Thys E. 2016.** Comparative study of in vivo digestibility of guinea grass (Panicum maximum Jacq.) associated with sweet potato (Ipomea batatas (L) lam) leaves and stems or milk grass (Euphoribia heterophylla I) in rabbits (Oryctologus cuniculus L) and guinea pigs (Covia porcellus L) Tropcultura, 34 (2): 158-165

**Boukila B., Pamo T.E. 2016a** Pre-wearing growth of guinea pigs fed Panicum maximum supplemented with a ration containing Arachis glabrata,Culiandra calothyrsus or Desmodium. International, Journal biology Chemical Science 10(1):313-325.http:/www.lrrd.org/lrrd28/1/mieg28012.htm

**Miégoué E., Tendonkeng F. Mweugang Ngouopoo N, Noumbissi M.N.B., Fogang M.D., and Pamo Tedonkeng E. 2016 b.** Ingestion and digestibility of Pennicentum prupreum associated with a legume (Arachis glabrata. Calliandra calothyrus or Desmodium intorsum) as a source of protein in guinea pigs Livestock Research for Rural Development 28 (1).

**Miégoué E., Tendonkeng F. Mwengang N.N., Lemoufouet J., Fossi J., Ntsafack P. and Pamo ET, 2018.** Effect of Arachis glabrata Levels in the Diet on Reproduction and Pre-Wearing Growth Performance of Guinea Pigs (Cavia porcellus L) Fed on Panicum maximum. International Journal of Animal Science and Technology Vol. 2. No. 4, 2018, pp. 36-44. doi: 10. 11648/j.ijast.20180204.11.

**Ndebi G. Niba AT. Defang HF. 2015.**Economic rationality and management objectives of production of guinea pigs (Cavia procellus L) in Tropical, areas. Topicultura 33, 1 2637

**Ngou Ngoupayou. J.D., Kouonmenioe J, Fotso Tagny J.M, Cieogna M., Castroville C... Rigoni M. & Hardouin J. 1995.** Opportunities for the development of guinea pig farming in sub-Saharan Africa, the case of Cameroon. World Animal Review FAO/AGA, 83(2)-20-28

**Niba A.T., Djoukam J, Téguia A, Kudi A.C. and Loe J.O., 2004 b.** influence of level of cottonseed cake in the diet on the feed intake, growth performance and carcass characteristics of guinea pigs in Cameroon. Tropicultura. 22 »«'‘(1). 32-29 Available

**Noumbissi M N B. Tendonkeng F. Zougou T G and Pamo T E. 2014.** Effects of different supplementation levels of Tithonia Diversifolia (Hemsl) A Gray leaf on in vivo ingestion of Pennisetum purpureum K. Schum. In the guinea pig (Cavia porcellusL) tropicultura 32.3138-146

**Noumbissi M N B., Tendonkeng F, Zougou T G and Pamo T E. 2014.** Effects of different levels of Tithonia Diversifolia (Hemsl) A Gray leaf supplementation on in vivo ingestion of Peniserum purpureum K. Schum In the guinea pig (Cavia porcellus L) tropicultura 32, 3138-146.