Effect of aqueous and hydroethanolic extracts of avocado seeds (*Persea Americana*) on nutrient digestibility in guinea pigs (*Cavia Porcellus*)

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Abstract

Feeding is the aspect with the greatest cost in livestock breeding. This work was launched in an attempt to find natural growth promoters in the breeding of domestic animals. This work was carried out in the city of Dschang in the western part of Cameroon. It focuses on the evaluation of two extraction solvents (water and water-ethanol mixture) on the phytochemistry of avocado seed extracts and their effect on feed digestibility in guinea pigs. To this end, three experimental rations (without extracts; 200 g aqueous extracts/100 kg rations and 200 g hydroethanolic extracts/100 kg rations) were tested on 30 guinea pigs divided into three groups of 10 (5 males and 5 females) similar in terms of body weight. The main results revealed the presence of secondary metabolites such as phenols and tannins in all extracts. However, the aqueous extracts had higher phenol content (1337.18 mg/100 g) as compared to the hydroethanol extracts (561.5 mg/100 g). Moreover, adding extracts to the ration resulted in an improvement in nutrient intake compared to the control (without extracts). In effect, the aqueous extract induced an improvement in feed intake, cellulose digestion (51.85 ± 5.35) and in digestibility (93.27 ± 0.72) compared to other rations. In short, aqueous extracts can be used to improve feeding efficiency of guinea pigs. Nevertheless, a study on the inclusion rate is still necessary to better control its effect.

Material and method

This study was carried out in the Animal Production and Nutrition Laboratory (LAPRONAN) based in the Dschang University.

Key words: digestibility, guinea pig, avocado seed, extracts

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LAPRONAN is situated at latitude 05°26’ of north, and longitude 10°26’ east at an altitude of 1420 m in the agro-ecological area of the Western Highlands in Cameroon. Its climate is equatorial, typical of Cameroon and has two seasons; a rainy season that runs from mid-March to mid-November and a dry season that runs from mid-November to mid-March. Annual rainfall stands at 2000 mm while average temperature stands at 21°C. Average annual insolation stands at 1873 hours and average relative humidity stand at 76.8%.

Plant material

Plant material was made up of extracts (aqueous and hydroethanolic) from *Persea americana* and *Pennisetum purpureum* avocado seeds. Seeds of the Hass variety of avocado were obtained from a producer in the town of Penka-Michel with the same agro-ecological conditions as LAPRONAN. These were then dried in the shade until they reached a constant weight and then crushed. Two types of extracts were prepared: the hydroethanolic and aqueous extracts.

For the hydroethanolic extract, a maceration of avocado powder in a 2000 ml mixture consisting of 1000 ml ethanol and 1000 ml distilled water was prepared. The mixture was stirred six times a day for two days and then the resulting macerate was filtered using whatman paper No. 1. The resulting filtrate was evaporated under vacuum using a rotary evaporator (BUCHI R200) at 40°C. The residual solvent was evaporated by drying in an oven at 40°C and the crude extract was stored in the refrigerator.

The aqueous extract was prepared by adding 400 g of avocado seed powder in 2000 ml of distilled water and the mixture was boiled for 15 minutes. The resulting decoction was filtered using coffee filter paper and the resulting filtrate was evaporated by drying in an oven at 40°C. The crude extract was stored in a refrigerator.

*Pennisetum purpureum* was harvested around LAPRONAN and served fresh to the animals.

Animal material

Thirty (30) local species guinea pigs (15 female and 15 males) were used for this test. Prior to the study the animals were subjected to 10 (ten) days of adaptation to the feed and digestibility cages, after which data was collected over five (5) days.

Feed composition

From a main feed that was prepared to meet the feeding needs of guinea pigs as described by Nzokou et al. (2015), two other feeds were prepared with 200 g/100 kg of aqueous extracts and 200 g/100 kg of hydroethanolic extracts, respectively (Table 1).

| Ingredients          | Quantities |
|----------------------|------------|
| Corn                 | 25         |
| Cassava              | 8          |
| Remolading           | 23         |
| Soya meal            | 8          |
| Cotton meal          | 5          |
| Palm kernel meal     | 20         |
| Fish meal            | 5          |
| Bone meal            | 2          |
| Palm oil             | 2          |
| Premix 2%            | 2          |
| **Total**            | **100**    |

The data was subjected to a two-factor analysis of variance (extract type and sex). In case of any significant difference between treatments, averages were separated using the Duncan test at a 5% threshold. The software used for its analyses was SPSS 20.0.

Results

The effect of the extraction solvent on the output and the presence of some secondary metabolites in avocado seed extracts are summarized in Table 2.

In general, it appears secondary metabolites were present in the extracts regardless of the extraction solvent. However, saponins were absent in hydroethanolic extracts and present in aqueous extracts. On the other hand, the yield of the hydroethanolic extract is higher than that of the aqueous extract.

Moreover, quantitative analysis revealed that the total phenol content was higher in the aqueous extracts compared to hydroethanolic extracts (Figure 1).

Table 1. Percentage composition of feed

### Effect of Avocado seed extraction solvent on Guinea pig nutrient intake

Table 3 is a summary of the effect of the extraction type on guinea pig nutrient intake. Regardless of its sex or nutrient, higher values were recorded among animals that received aqueous avocado extracts in their ration.
In addition, the amount of forage consumed was higher than that of the concentrated feed. Mores, adding extracts significantly (p<0.05) increased the females' ration consumption.

The digestive use of nutrients by guinea pigs as presented in Table 4 did not vary significantly depending on the extract and sex type. In general, the digestibility of crude fiber was higher (p<0.05) in guinea pigs receiving aqueous extract from avocado seed (AC) compared to other rations.

The digestibility utilization of nutrients regardless of sex is summarized in Figure 3. Adding extracts in the rations tends to increase digestive utilization of nutrients. However, with the exception of the (AC) group which had the highest level of fiber utilization, all other nutrients were the same (p ≥ 0.05).

### Table 2. The effect of the extraction solvent on the output and the presence of some secondary metabolites in avocado seed. + =present, - =absent, Yd =extractions yield of (%)

| Extracts          | Alkaloids | Phenols | Flavonoides | Sterols | Terpenoids | Tannins | Saponins | Anthocyanins | Anthrachinones |
|-------------------|-----------|---------|-------------|---------|------------|---------|----------|--------------|----------------|
| Aqueous           | +         | +       | +           |         | +          |         | +        | +            | +              |
| Hydroethanolic    | +         | +       | -           | -       | +          | +       | +        | -            | +              |

### Table 3. Effect of avocado seed extract type on guinea pig nutrient intake

| Nutrients (pp. purpureum) | Sex | Treatment | p |
|---------------------------|-----|-----------|---|
| Fodder                    | M   | 67.139 ± 1.20 | 0.588 |
|                           | F   | 64.464 ± 0.53 | 0.588 |
| Concentrated              | M   | 13.990 ± 3.12 | 0.588 |
|                           | F   | 11.185 ± 2.96 | 0.588 |
| DM                         | M   | 81.13 ± 6.05** | 0.017 |
|                           | F   | 75.65 ± 7.34** | 0.017 |
| MF                         | M   | 78.39 ± 2.80*  | 0.017 |
|                           | F   | 71.58 ± 6.43** | 0.017 |
| OM                         | M   | 76.59 ± 5.14** | 0.017 |
|                           | F   | 74.08 ± 3.59** | 0.017 |
| CP                         | M   | 15.92 ± 0.90** | 0.017 |
|                           | F   | 14.93 ± 1.18** | 0.017 |
| CF                         | M   | 15.43 ± 0.42** | 0.017 |
|                           | F   | 32.23 ± 1.12** | 0.017 |
| MF                         | M   | 33.06 ± 0.43*  | 0.017 |
|                           | F   | 66.59 ± 5.14** | 0.017 |

### Table 4. Effect of the type of avocado seed extract on guinea pig digestive use of nutrients

**Characteristics** | **Sex** | **Treatment** | **p** |
|-------------------|---------|---------------|-------|
| DMaDU             | M       | 8.96 ± 2.78*  | 0.914 |
|                   | F       | 8.54 ± 4.69*  | 0.914 |
|                   | MF      | 8.62 ± 2.28*  | 0.914 |
| OMaDU             | M       | 88.09 ± 2.62* | 0.914 |
|                   | F       | 86.72 ± 4.26* | 0.914 |
|                   | MF      | 87.41 ± 2.08* | 0.914 |
| CPAaDU            | M       | 92.96 ± 1.60* | 0.914 |
|                   | F       | 88.39 ± 1.95* | 0.914 |
|                   | MF      | 90.67 ± 1.00* | 0.914 |
| CFaDU             | M       | 89.95 ± 2.82**| 0.914 |
|                   | F       | 89.03 ± 3.35**| 0.914 |

A, b: averages with the same letters on the same line are not significantly different by 5% A, b: averages with the same letters on the same column are not significantly different p = probability. C=control; AC=aqueous extract; Thy=hydroethanolic extract; M=male; F=female; MF=mixed DM=dry matter; OM=organic matter; CP=crude protein; CB=Crude fiber. PP=pennisetum purpureum
Tatsinkou AS (2020) Effect of aqueous and hydroethanolic extracts of avocado seeds (*Persea Americana*) on nutrient digestibility in guinea pigs (*Cavia Porcellus*).

**Figure 1.** Effect of the extraction solvent on the tannin and phenol content.

**Figure 2.** Effect of avocado seed extraction solvent on guinea pig nutrient intake regardless of sex.

**Figure 3.** Effect of the type of avocado seed extract type on guinea pig nutrient digestive utilization.
Adding extracts significantly (p<0.05) increased ration consumption in females, suggesting that females are more responsive to extracts than males. Regardless of sex, extracts increased the consumption of the ration. This finding corroborates the work of Tendonkeng et al. who obtained a significant increase (p<0.05) in dry matter, organic matter and cell wall (NDF) intakes of rations by small ruminants using the essential oil of the leaves of C. vinimalis [9].

Nutrient intake increased significantly (p<0.05) with the adding of aqueous extracts in the ration. These findings are in line with the work of Tendonkeng et al. who obtained an improvement in feed intake with the adding of phytobiotics (essential oils) in the ration of ruminants [10]. These findings could be explained by the higher phenol content in aqueous extracts. In effect, since the extraction yield is higher with the hydroethanolic solvent and the phenol content lower with the same solvent, these extracts would therefore be richer in other compounds such as alkaloids which are known to obstruct the DNA of eukaryotic cells, which damages the health of animals. They are therefore not good phytobiotics (Sarah 2011). This allows us to suppose aqueous extracts in guinea pigs compared to hydroethanolic extracts.

Adding extracts has increased the digestive utilization of all nutrients in terms of numbers. This supposes that that a change in the addition rate could produce more remarkable effects. Furthermore, as concerns crude fiber, adding aqueous extracts produced a digestive utilization significantly (p<0.05) higher among guinea pigs irrespective of their sexes. This finding corroborates the work of [11-13] Hernández et al. who noted an improvement in the digestibility of proteins or starch following the intake of Forsythia suspensa, orogano essential oil, and mixtures containing several essential oils (oregano, cinnamon and pepper) or extracts (thyme and rosemary sage) in the ration. This could be explained by the varied contents of the different phenol extracts, given the use of these in digestion [14-16].

Conclusion

This trial focused on comparing the effect of aqueous and hydroethanolic extracts on guinea pig digestibility. Findings reveal that, regardless of the type of extract considered, this is an improvement in the intake of nutrients compared to the control (without extracts). The aqueous extract significantly improved the intake and digestive utilization of fiber. This situation supposes the use of aqueous avocado seed extracts in guinea pig feed. A further study on dose and effect on growth performance would be necessary.

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