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The ameliorating effects of *Telfairia occidentalis* and *Pterocarpus mildbraedii* on piglet anemia

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Abstract

Telfairia occidentalis and *Pterocarpus mildbraedii* have been shown to contain mineral elements which may possess hematinic potentials. The aim of this study is to determine the ameliorating effect of the crude extract of *Telfairia occidentalis* and *Pterocarpus mildbraedii* leaves on suckling piglet anemia in comparison with the inorganic oral iron (Ferrous Sulphate). A total of 3 litters were used divided into three treatments: The treatments were **TO Extract**: 1000 mg crude sap of *Telfairia occidentalis* (TO) leaf, **PM Extract**: 1000 mg crude sap of *Pterocarpus mildbraedii* (PM) leaf and **FG**: Iron in paste form (140 mg Ferrous gluconate (FG)).

Hemoglobin level and growth performance parameters were monitored weekly over a period of 21 days. FG piglets had significantly higher ($p < 0.05$) body weight and weekly weight gain compared with PM group of piglets but not significant when compared with piglets in TO at 14days of age. There were no significant differences ($p > 0.05$) for body weight and weight gain of TO, PM and FG piglets at 21days of age.

At 14 days of age, the mean hemoglobin levels for FG piglets were significantly higher ($p < 0.05$) than the PM piglets but not significant when compared with TO piglets. There were no significant differences ($p > 0.05$) for the hemoglobin levels of TO, PM and FG piglets at 21 days of age.

Hence, TO as an organic iron source will be preferable since it possess hematinic property as this will eliminate the side effect associated with inorganic iron administration.

Keywords: *Telfairia occidentalis*; *Pterocarpus mildbraedii*; Piglet anemia; Hemoglobin; Growth performance; Hematinic property

1. Introduction

Swine production, among other species has a high potential to contribute to high economic gain, because pigs have high fecundity, high feed conversion efficiency, early maturing, short generation interval and relatively small space requirement, and they are multipurpose animals providing about 40% of meat in the world market, cooking fats and bristles [1, 2]. It is produced under a variety of production systems ranging from simple backyard pigs, pigs living on garbage belts to family operated farms or large scale integrated pig industries with sophisticated biosafety measures [1, 3].

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Telfairia occidentalis is one of the most commonly consumed leafy vegetables in Nigeria and belongs to the plants family called Cucurbitaceae which thrives well in many parts of West Africa, and is mainly cultivated in Igbo-land, south-eastern Nigeria, where it is used primarily in soups and herbal medicines [4]. Previously, the consumption of fruits and vegetables has been linked with reduced risk of chronic diseases [5] and *T. occidentalis* is one of such plants with so much acclaimed medicinal potentials [6]. The leaves of this plant are rich in mineral elements as well as antioxidants. [7]. According to Akanbi et al [8], the leaves are abundant in fat (18%), protein (29%), and minerals and vitamins (20%). The leaves are also a rich source of phosphorus, calcium, zinc, iron, and copper [9].

Pterocarpus mildbraedii leaves locally known as "Oha" in Eastern Nigeria are used as vegetables in the preparation of soup in Nigeria. *Pterocarpus mildbraedii* is a green leafy vegetable which grows more like a big tree reaching a height of 2 m and having stem diameter of 20 m [10]. The phytochemical screening of *Pterocarpus mildbraedii* leaves showed that it contains alkaloids, flavonoids, tannins, saponins [10]. The leaves of *Pterocarpus mildbraedii* were also found to contain mineral elements such as calcium, potassium, magnesium, phosphorus, sodium, iron, zinc etc and these elements are very important in human and nutrition [10].

Newborn piglets are susceptible to iron deficiency as they are born with insufficient iron reserve at 50 mg and sow milk contains low level of iron at 1 mg/L although the piglets require 7–16 mg of iron per day [11, 12]. Iron injection at birth with 150–200 mg is a common practice to prevent piglets from iron deficiency anemia during the suckling period in pig production [11]. A single dose of 200 mg/ml iron-dextran is effective against iron deficiency anemia. However, the method is very stressful to the piglets. They will suffer more pain if a greater dosage of iron is given intramuscularly [13].

Furthermore, poor iron injection techniques may cause considerable trauma to the muscles, staining of hams or create abscesses and lead to downgrading of the carcasses [13]. Since there are several drawbacks to the iron injection, alternative methods need to be considered in intensive farming i.e. supply iron orally [13].

The oral administration of iron has two advantages: it is cost effective and the fact that absorption through oral route is regulated by the intestinal mucosae. Early administration of oral iron within the first few days of life will meet the iron needs of the suckling pig. However, it is critical to administer early before gut closure to large molecules [13].

This study was conducted to determine the ameliorating effect of the crude extract of *Telfairia occidentalis* and *Pterocarpus mildbraedii* leaves on suckling piglet anemia in comparison with the inorganic oral iron (Ferrous Sulphate) and to also establish organic iron source as a probable replacement for inorganic iron which will ease the problem of oral iron absorption and the scouring that accompanies oral dosing with iron [14].

2. Material and methods

2.1. Animal care

All procedures used in the experiments were approved by the Institutional Animal Care and Use of Peace House Agricultural Training Institute Isarun, Ondo State. The experiments were conducted in the farrowing facility of the Institute

2.2. Preparation of crude sap extract

50 g each of fresh leaves of *Telfairia occidentalis* and *Pterocarpus mildbraedii* were washed with distilled water and sliced. 250 ml of distilled water were added to fresh sliced leaves and blended with the use of a motorized grinder and filtered with the use a sieve with small pores to make a concentration of 200 mg/ml. The filtrate was used as the crude sap extract.

2.3. Animals and experimental design

A total of three (3) litters from Yorksire and Duroc breed were used in this study. The litter size ranged from 7–8 piglets. All the sows used were in their second to fourth parity. Piglets were given free access to both feed and water and weaned at 28 days of age. The animals were assigned to three treatments with one litter (7 piglets) per treatment. The treatments were **TO Extract**: 1000 mg crude sap of *Telfairia occidentalis* (TO) leaf, PM Extract: 1000 mg crude sap of *Pterocarpus mildbraedii* (PM) leaf and FG: Iron in paste form (140 mg Ferrous gluconate (FG)). The crude sap extracts and the iron paste was applied at the caudal area of the tongue with a dose size of 5mls from the first day of birth until day seven post-partum.

All piglets from each treatment groups was bled through the anterior vena cava route at days 1, 7, 14, 21post-partum. The blood was collected into a 5 ml EDTA tube. The blood samples were analyzed for hemoglobin (Hb) concentrations and pack cell volume (PCV). Body weight (kg) was recorded on the same days as blood samples were taken.

2.4. Statistical analysis

The means and standard error of mean (SEM) of the data were calculated. The results were analyzed by one-way analysis of variance (ANOVA) with Tukey-Kramer Multiple Comparisons Test using Graph pad prism 5.0 Software (www.graphpad.com) to determine significant differences between means and where applicable, least significant difference (LSD) was used to determine significant results. The differences between groups were considered significant at $P < 0.05$.

3. Results

3.1. Growth performance

Growth performance results are presented in Tables 1 and 2. The piglets in FG had significantly higher ($p < 0.05$) body weight and weight gain compared with PM group of piglets but not significant when compared with piglets in TO at 14days of age. There were no significant differences ($p > 0.05$) for body weight and weight gain of TO, PM and FG piglets at 21days of age.

Table 1 Growth Performance of treatment groups (Kg)

Groups	TO Extract	PM Extract	FG
Day 1	0.91±0.05^{a}	0.84±0.05^{a}	1.01±0.03^{a}
Day 7	1.93±0.09^{a}	1.62±1.00^{a}	1.87±0.07^{a}
Day 14	2.95±0.19^{a}	2.40±0.18^{a}	3.80±0.09^{b}
Day 21	4.12±0.16^{ab}	3.50±0.29^{a}	4.23±1.00^{b}

The values in the same row with different superscript shows significant difference (P<0.05) while the values in the same row with the same superscript show no significant difference. Values are presented as mean±SEM

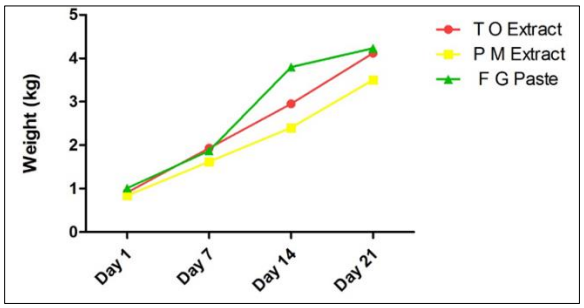

Figure 1 Growth Performance of treatment groups (Kg)

Table 2 Weight Gain (kg)

Groups	TO Extract	PM Extract	FG
Day 7	1.02±0.04^{a}	0.78±0.95^{a}	0.78±0.04^{a}
Day 14	2.04±0.14^{ab}	1.56±0.13^{a}	2.79±0.06^{b}
Day 21	3.21±0.11^{a}	2.66±0.24^{a}	3.22±0.07^{a}

The values in the same row with different superscript shows significant difference (P<0.05) while the values in the same row with the same superscript show no significant difference. Values are presented as mean±SEM.

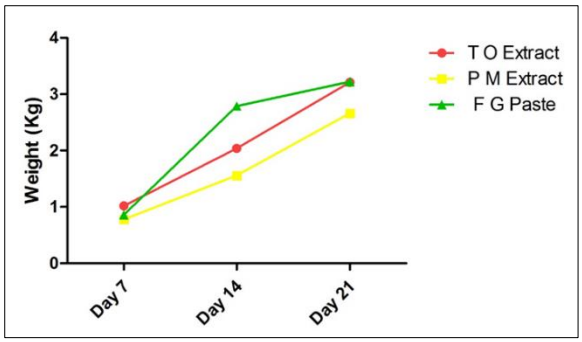

Figure 2 Weight Gain (Kg)

3.2. Hemoglobin Concentration (Hb)

Hemoglobin levels for different treatment groups of piglets are shown in Table 3. The initial Hb levels were not statistically significant ($p > 0.05$) for different groups of piglets at day one post-partum. At 14 days of age, the mean Hb levels for FG piglets were significantly higher ($p < 0.05$) than the PM piglets but not significant when compared with TO piglets. There were no significant differences ($p > 0.05$) for the hemoglobin levels of TO, PM and FG piglets at 21 days of age. There were no significant difference ($p > 0.05$) between the Hb values at Day 1 and Day 21 in TO and FG piglets but there is a significant decrease ($p < 0.05$) in the Hb values of PM piglets at Day 21 when compared with Day 1.

Table 3 Effects of TO, PM extract and FG on hemoglobin levels (g/dl)

Groups	TO Extract	PM Extract	FG
Day 1	8.60 ± 0.5^{c}	9.80 ± 0.7^{bc}	10.70 ± 0.5^{c}
Day 7	7.50 ± 0.1^{c}	8.50 ± 0.6^{abc}	9.70 ± 0.5^{c}
Day 14	8.40 ± 0.9^{abc}	7.30 ± 0.6^{a}	9.50 ± 0.2^{bc}
Day 21	8.40 ± 0.4^{ac}	7.40 ± 0.3^{a}	9.20 ± 0.3^{ac}

The values in the same row with different superscript shows significant difference ($P<0.05$) while the values in the same row with the same superscript show no significant difference. The values in the same column with different superscript shows significant difference ($P<0.05$) while the values in the same column with the same superscript show no significant difference. Values are presented as mean±SEM.

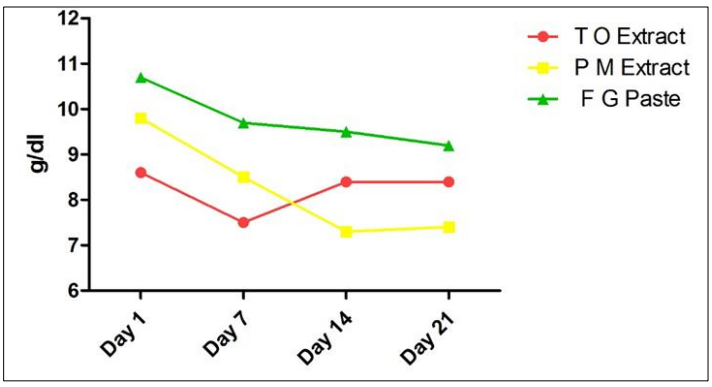

Figure 3 Hemoglobin Concentration of treatment groups (g/dl)

4. Discussion

The use of plants as source of remedies for the treatment of diseases can be traced back to the prehistoric times [15]. According to the World Health Organization [16], between 65% and 80% of the populations of developing countries currently use medicinal plants as remedies, and medicinal plants would be the best source to obtain a variety of drugs [17].

According to Chwen et al., [13], iron in paste form should be supplied more than as a single dose at different periods to the piglets. In this study, Crude sap extract of *Telfairia occidentalis* (TO) and *Pterocarpus mildbraedii* (PM) and Ferrous gluconate (FG) paste were administered for 7days consecutively post-partum which significantly increases weight gain at day 21 post-partum. There was no significant difference in the final weight gain of piglets administered with TO and PM when compared with FG. This could have been due an increase in the absorption of iron by the piglets because of an increase in the frequency of administration suggested by Chwen et al., [13] who reported that there was a significant reduction in the weight gain of piglets administered a single dose of iron in paste form at day 21 post-partum.

Without iron supplementation piglets rapidly develop iron deficiency anemia and appears few days after birth [11]. At day 1 the piglets were not anemic as a result of their hemoglobin concentration which was above 8 g/dl across all treatment groups. This finding is similar to the report of previous studies [18, 19].

Lipinski et al., [19] reported that at weaning hemoglobin concentration will drastically decreased even down to 4–5 g/dl, which indicates a state of extreme anemia. In this study, the hemoglobin concentration of piglets across the treatment group were above 4-5 g/dl at 21day though there was a slight reduction in the hemoglobin concentration from the day 1 across all treatment groups but there was no significant decrease in hemoglobin (Hb) concentration of piglets administered with TO and FG which were above 8 g/dl. The Hb of piglets administered with PM significantly reduced when compare to the value at day 1, the PM Hb value was slightly below the 8 g/dl which show that if concentration PM is increased, it has tendency to ameliorate piglet anemia.

The ameliorating effect of *Telfairia occidentalis* on piglet anemia was significant when compared across other treatment group (PM and FG). *Telfairia occidentalis* and *Pterocarpus mildbraedii* has been documented to contain substantial amounts of essential amino acids and iron and this perhaps explains the mechanism behind the current findings [6, 10]. The ameliorating effect of TO and PM could be as a result of some constituents such as iron and some B complex vitamins which they possesses.

5. Conclusion

As iron is a good nutrient for most bacterial species to grow, excessive iron in the bloodstream and intestinal tract of preweaning piglets may be associated with the occurrence of polyarthritis, septicemia and colibacilosis. In addition, providing excess amounts of iron at one time may be toxic. Hence, the use of TO as an organic iron source in piglets will be preferable since it possess hematinic property as this will eliminate the side effect associated with inorganic iron administration.

Recommendation

We recommend that the dose or concentration of which *Pterocarpus mildbraedii* exert it hematinic property should be further elucidated.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no Conflict of interest.

Statement of ethical approval

Ethical approval with reference number - AEC/22/11/001 was obtained from the Institutional Animal Care and Use of Peace House Agricultural Training Institute, Isarun, Ondo State.

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