

Performance and Haematological Characteristics of Weaner Pigs Fed Wild Sunflower (*Tithonia diversifolia* Hemsl. A Gray) Leaf Meal

Olayeni, T.B., G.O. Farinu, V.A. Togun, O.S. Adedeji and A.O. Aderinola
Department of Animal Production and Health, P.M.B. 4000,
Ladoke Akintola University of Technology, Ogbomoso, Nigeria

Abstract: A feeding trial lasting 49 days was conducted using 16 weaner pigs of mixed breeds (Large White x Landrace) with initial average weights of between 8.13 ± 0.80 kg and 8.25 ± 0.85 kg to determine the effects of different levels of wild sunflower (*Tithonia diversifolia* Hemsl. A Gray) leaf meal on their growth, haematology and organ characteristics. The animals were randomly assigned to four dietary treatments using Complete Randomized Design (CRD). There were four individually penned animals per treatment. The Wild Sunflower Leaf Meal (WSLM) was included at 0, 10, 15 and 20% levels. Feed and water were offered *ad-libitum*. Records of growth performance, blood parameters and organ characteristics were taken. The values of average final weight, daily weight gain, daily feed intake and feed gain ratio were not significantly influenced ($p > 0.05$) by the dietary treatments. Significant differences were not indicated ($p > 0.05$) in haemoglobin, packed cell volume, red blood cells, mean corpuscular haemoglobin, mean corpuscular volume and mean corpuscular haemoglobin concentration. However, platelets, white blood cells, neutrophils and lymphocytes were significantly influenced ($p < 0.05$). Kidney weight significantly increased ($p < 0.05$) as levels of WSLM increased while heart, liver and spleen weights were not different significantly ($p > 0.05$). It is evident that WSLM can be incorporated into the diet of weaner pigs at 200 g kg^{-1} .

Key words: Performance, haematological, weaner pigs, wild sunflower leaf meal

INTRODUCTION

The leaves of leguminous plants have been sparingly used as sources of crude protein in pig diets^[1]. This in spite of their appreciable high crude protein content and luxuriant growth in various parts of the tropics. The crude protein of these legumes which are often fed to pigs fresh to fill-up and provide some vitamins compare favourably with 19, 21.1 and 23.7% reported for palm kernel cake, bambara nut wastes and pigeon pea, respectively^[2,3] which are popular alternatives used by Nigerian farmers.

So far, various leaf meals have been tested in poultry diets including those of cassava^[4], sweet potato^[5], centrocema^[6,1], leucaena^[7] and amaranthus^[8] among others.

The protein from leaves may be recovered and fed as solution in form of leaf concentrates^[9]. However, the technology for this is not yet developed in tropical Africa.

The supply of animal proteins in the form of meat in Nigeria has been mainly from such species as poultry, cattle sheep goat and pigs. Although pigs are numerically fewer than some other domestic species, more pigment produced than any other meat especially in developed world and even up to 1985 in tropical Africa^[10]. If one

wishes to develop modern pig/or production; it will then be necessary to intensify efforts to the use of technologies adapted with a maximum of inputs from within the country^[11]. Maintenance and sustainability of these technologies would equally assist the industry.

Limited information exists on the effect of wild sunflower meal in particular and other forage meals in general on the growth performance and haematological indices of pigs.

Wild sunflower as one of the leaf meals is a weed of crops, wasteland and roadsides. Its incorporation in poultry diets had been reported by^[12]. It could be cultivated by resource poor farmer who could manipulate planting density to achieve maximum yield^[13]. It is abundant in nature. It also has limited processing demand and it is not in competitive demand for human consumption^[14]. Inclusion of wild sunflower meal in pig diets would therefore be an addition to the worldwide interest in investigating the use of non-conventional feed resources in animal diets.

The objective of this study is to determine the optimum inclusion level of wild sunflower leaf meal in the diet pigs and to assess growth performance, haematological and organ characteristics of weaner pigs.

MATERIALS AND METHODS

Preparation of materials: Wild sunflower stands were harvested when the first inflorescence had opened in 50-80% of plants. The cut plants were spread on a concrete slab and air-dried to constant weights. The dried leaves were removed and ground into wild sunflower leaf meal using a hammer mill and stored in air tight condition. At the end of the processing, proximate components were determined (Table 1).

Experimental diets: Four experimental diets were formulated. Diets 1 which served as the control did not contain wild sunflower leaf meal while diets 2, 3 and 4 contained 10, 15 and 20% inclusion levels of wild sunflower leaf meal respectively. The four diets contained equal amount of other ingredients except maize and corn bran (Table 2). The crude protein level ranged between 19.42 and 21.50% while Metabolizable Energy (ME) level ranged between 3300.43 and 3357.35 kcal kg⁻¹ diet.

Animals, feeding and management: A total of sixteen (16) weaner Large white x Landrace pigs were used for this study. They were selected from three litters farrowed almost at the same time. The piglets were creep-fed on a diet containing 24% crude protein until they were weaned at 8 weeks of age. The weaner pigs with initial average weights of between 8.13±0.80 kg and 8.25±0.85 kg were assigned to four dietary treatments of four pigs per treatment in a completely randomized design experiment. They were fed 5% of their body weight twice daily while water was provided ad-libitum. The animals were fed with the treatment diets for a period of 7 weeks when the experiment was terminated. Routine management practices were strictly followed. Feed offered and the left-over were weighed to determine feed intake of the animals.

The animals were housed in standard experimental pens each measuring 1.83x0.46x0.92 m with concrete floors and equipped with feeding and watering troughs. Weekly weights and daily feed intake were taken. These records were used to monitor and assess the performance parameters, in terms of mean weight gain and feed-gain ratio. At 49th day, all the animals were slaughtered after fasting for 24 hrs.

Sample collection: Blood samples meant for haematological parameters were collected into tubes containing Ethylene Diamine Tetraacetic Acid (EDTA). Packed Cell Volume (PCV) was determined by the micro-haematocrit method^[15]. Haemoglobin concentration was determined by the cyanomethaemoglobin method^[16]. Schilling method of differential leukocyte counts to

Table 1: Proximate composition of Wild Sunflower Leaf Meal (WSLM)

Nutrients	% (DM)
Crude protein	18.9
Crude fibre	11.0
Ether extract	5.5
Ash	13.2
Nitrogen free extract	51.4

Table 2: Percentage composition of the experimental diets

Ingredients	Diets			
	1	2	3	4
Maize	25.0	20.0	18.0	15.0
Corn bran	20.0	15.0	12.0	10.0
Soybean	10.0	10.0	10.0	10.0
Groundnut cake	10.0	10.0	10.0	10.0
Palm kernel cake	15.0	15.0	15.0	15.0
Wheat offal	14.0	14.0	14.0	14.0
Fish meal	2.0	2.0	2.0	2.0
Wild sunflower meal	-	10.0	15.0	20.0
Bone	3.0	3.0	3.0	3.0
Salt	0.5	0.5	0.5	0.5
Premix*	0.5	0.5	0.5	0.5
Total	100.0	100.0	100.0	100.0
Determined Analysis				
Metabolizable energy (kcal kg ⁻¹)	3357.39	3314.20	3305.81	3300.43
Crude protein	19.42	20.71	21.10	21.50
Crude fibre	7.06	7.56	7.76	8.06
Ether extract	3.99	4.15	4.24	4.31
Ash	3.59	5.37	5.54	6.00
NFE	65.14	62.21	61.36	60.63

*Each kg feed contained: Vit. A, 1500IU; Vit. D₃ 2500IU; Vit. E, 11IU; Vit B₂ 10 mg; Vit B₃ 40 mg; Vit. B₆ 20 mg; Choline chloride, 400 mg; Mn 120 mg; Fe 70 mg; Cu. 10 mg; I₂ 2.2 mg; Se, 0.2 mg; Zn 45 mg; Co.0.02 mg. WSLM-Wild sunflower leaf meal

determine the distribution of the various blood cells^[17]. Red and white blood cells and white blood cells counts were estimated using the improved Neubauer haemocytometer method as described by^[18]. Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were computed according to^[18].

The carcasses were opened from the neck to the pelvic region breaking through pubic symphysis and the following organs; liver, heart, spleen and kidney were quickly removed, blotted free of blood and all adhering connective tissues and weighed and expressed as percentage of carcass weight.

Test ingredients (wild sunflower leaf meal) and the experimental diets were analyzed (Tables 1 and 2, respectively) for their proximate composition using the methods of^[19].

Following the experimental design, all data generated were subjected to one-way analysis of variance (ANOVA) according to^[20] and where significant differences were indicated, Duncan's multiple range tests^[21] were used to separate the means.

RESULTS AND DISCUSSION

Wild sunflower leaf meal (WSLM) was analysed to contain 18.9% CP, 13.2% ash; 5.5% ether extract 11.00%

Table 3: Performance characteristics of weaner pigs fed different levels of wild sunflower leaf meal

Ingredients	Diets				Significance level
	1	2	3	4	
Avg. initial liveweight (kg)	8.25±0.85	8.13±0.80	8.25±0.78	8.13±0.97	NS
Avg. final liveweight (kg)	17.13±1.14	16.50±2.04	16.88±1.59	16.13±1.89	NS
Avg. weight gain (kg/day)	0.18±0.01	0.18±0.02	0.17±0.02	0.16±0.02	NS
Avg. feed intake (kg/day)	0.74±0.03	0.78±0.05	0.79±0.04	0.72±0.07	NS
Avg. feed: gain ratio	4.18±0.22	4.87±0.44	4.68±0.33	4.58±0.17	NS

NS = No significant difference ($p>0.05$)

CF and 51.4% NFE. These values are similar to those recorded by^[22]. The 18.9% CP was lower than the value of pigeon leaf meal (24.5%)^[7]. The values were also similar to the values recorded by^[23].

The performance characteristics of the weaner pigs are indicated in Table 3. Average final liveweight, feed intake, weight gain and feed-gain ratio were not significantly different ($p>0.05$) among the dietary levels of WSLM. Although^[23] observed depressed feed intake in broilers which lead to reduced weight gain as inclusion level increased^[24], also reported that feed intake, weight gain and feed conversion ratio were similar up to 5% inclusion level in broiler chicken while 7.5 and 10.0% levels significantly depressed these parameters. Non-significant effects of WSLM on the growth performance is similar to the 200 g of dietary inclusion of cassava leaf as supplement in the diet of pigs^[25].^[26] also showed that 40% rate of cassava leaves in goat ration significantly enhanced the digestibility of nutrients and growth of the animals.

Data on blood parameters as influence by the diets are presented in Table 4. Haemoglobin (Hb), PCV, RBC, MCH, MCHC and MCV were not significantly affected ($p>0.05$) while significant effects were noticed ($p<0.05$) in the values of WBC, platelets, neutrophils and lymphocytes. The similarity in the levels of Hb, PCV, Rbc, MCV, MCH and MCHC in weaner pigs further substantiated the nutritional adequacy and safety of WSLM. It could also be related to the ability of test ingredient to provide and maintain the essential amino acids and minerals in the diets which are necessary for the normal functioning of the blood cells producing tissues and organs. This finding is similar to the observation of^[25] who used cassava leaf meal in weaner pigs diets. WBC and lymphocytes were not significantly different ($p>0.05$) between diets 1 and 4.^[27] However observed gradual decrease in WBC counts with increasing levels of wild sunflower meal in poultry diets. The presence of sesquiterpene lactones which are feeding deterrents that were identified in the leaves of wild sunflower^[28] could have excited the WBC and differential counts to the significant level observed in this study. Eating as well as moderate exercise may cause a slight increase in the number of WBC, but the maximum will not exceed twice the minimum count^[17].

The weights of some organs of weaner pigs expressed as percentage of final weight are presented in

Table 5. Different inclusion levels of WSLM in the diets showed no significant influence ($p>0.05$) on the relative weights of liver, heart and spleen while kidney weights for diets 3 and 4 were significantly heavier ($p<0.05$) than diets 1 and 2. This could be as a result of kidney trying to eliminate and extract the suspected feeding deterrents in the WSLM. Difference in the weight of kidney is similar to the dissimilarity observed by^[12] in the values of internal organs of broiler chickens fed wild sunflower forage meal.

CONCLUSION

It is evident from the results obtained from this study that wild sunflower (*Tithonia diversifolia*) leaf meal, a lesser known feedstuff can be tolerated by weaner pigs up to 20% (200 g kg⁻¹) level of dietary inclusion.

REFERENCES

1. Ugwu, S.O.C. and C.O. Chukwuka, 2001. The effects of inclusion of dried centro (*Centrocema pubescens*) leaves as a source of protein in the diet of growing pigs. Proc. 6th Ann. Conf. of ASAN, University of Maiduguri, Maiduguri, pp: 81-82.
2. Holness, D.H., 1991. The Tropical agriculturist. CTA-Publ. Macmillan Education Ltd. London, pp: 22-24.
3. Aduku, A.O., 1993. Tropical feed analysis Table. Published by Dept. of Animal Science, Ahmadu Bello University, Zaria. Nigeria, pp: 1-2.
4. Ogbonna, J.U. and A.O. Oredein, 1998. Growth performance of cockerel chicks fed cassava leaf meal. Nig. J. Anim. Prod., 25: 129-133.
5. Tegua, A., R.M. Njive and C.N. Foyette, 1997. Effect of replacement of maize with dried leaves of sweet potato and perennial peanuts on the growth performance of finishing broilers. Anim. Feed. Sci. Tech., 66: 283-287.
6. Ngodigha, E.M., 1995. Incorporation of centrocema pubescens in broiler diets: Effects on performance characteristics. Bull. Anim. Health. Prod. (Afr.), 42: 159-161.
7. Udedibie, A.A. and F.A. Igwe, 1989. Dry matter yield and chemical composition of pigeon pea (*Cajanus cajan*) leaf meal and the nutritive value of pigeon pea leaf meal and grain meal for laying hens. Anim. Feed. Sci. Tech., 66: 283-287.

8. Fragas, I.M., N. Ramos, M. Vener Co, R.O. Martinez and M. Sistatchs, 1993. Amaranthus forage in diets for broilers. *Cuban. J. Agric. Sci.*, 27: 193-198.
9. Farinu, G.O., S.O. Ajiboye and S. Ajao, 1992. Chemical composition and nutritive value of leaf protein concentrate from *Leucaena leucocephala*. *J. Sci. Food. Agric.*, 59: 127-129.
10. FAO, 1989. Quarterly bulletin of Statistics cited by CTA. The Tropical Agriculturist Macmillan Education Ltd. London, pp: 1-4.
11. Tacher, G., 1992. Postscript: Economic problems and future methods on livestock production. In *Animal production in the tropics and subtropics* by Jean Pagot (Translated by John Wilding). Macmillan/CTA. London and Basingetroke, pp: 493-501.
12. Odunsi, A.A., G.O. Farinu, J.O. Akinola and V.A. Togun, 1999. Growth, carcass characteristics and body composition of broiler chickens fed wild sunflower (*Tithonia diversifolia*) forage meal. *Trop. Anim. Prod. Invest.*, 2: 205-211.
13. Akinola, J.O., A. Larbi, G.O. Farinu and A.A. Odunsi, 1999. Seed treatment methods and duration effects on germination of wild sunflower. *Expl. Agric.*, 36: 63-69.
14. Odunsi, A.A. and G.O. Farinu, 1997. Assessment of Nigerian mango (*Mangifera indica*) seed kernel as a partial replacement for maize in finishing broiler diets. *Indian. J. Anim. Sci.*, 67: 605-607.
15. Dacie, J.V. and S.M. Lewis, 1991. *Practical Haematology* 7th Edn. ELBS with Churchill Living ton, England, pp: 37-85.
16. Kelly, W.R., 1979. *Veterinary Clinical Diagnosis*. 2nd Edition Bailliere Tindall. London, pp: 266.
17. Mitruka, B.M. and H. Rawnsley, 1977. In: *Clinical, Biochemical and Haematological Reference Values in Normal Experimental Animals*. Masson Pub. U.S.A. Inc. N.Y., pp: 11-174.
18. Jain, C.N., 1986. *Schalm's Veterinary Haematology*, 4th Ed. Lea and Febiger, Philadelphia, pp: 443-678.
19. A.O.A.C., 1990. *Association of Official Analytical Chemists. Official Method of Analysis* 15th Edn. Washington, D.C., pp: 69-88.
20. Steel, R.G.D. and J.H. Torrie, 1980. *Principles and procedure of statistics. A Biometrical Approach*. 2nd Ed. McGraw-Hill Book Co. Inc., New York., pp: 481.
21. Duncan, D.B., 1955. Multiple range and multiple f-Tests. *Biometrics*, 11: 1-42.
22. Kuti, O., 1991. Potentials of meal made from *Tithonia rotundifolia* and *Chromolaena odorata* as protein sources to rabbits. B.Sc. Project Report. Dept. of Biochemistry, University of Ilorin, Ilorin, Nigeria, pp: 88.
23. Odunsi, A.A., G.O. Farinu and J.O. Akinola, 1996. Influence of dietary wild sunflower (*Tithonia diversifolia* Hemsl A. Gray) leaf meal on layers performance and egg quality. *Nig. J. Anim. Prod.*, 23: 28-32.
24. Farinu, G.O., A.A. Odunsi and V.A. Togun, 1999. Effect of varying levels of mango-seed kernel meal on growth performance, nutrient digestibility and blood components of weaner rabbits. *Trop. J. Anim. Sci.*, 3: 199-225.
25. Iyayi, E.A., 2001. Cassava leaves as supplement for feeding weaner swine. *Trop. Anim. Prod. Invest.*, 4: 141-150.
26. Oluwadamilare, I.E., 1997. Effects of supplementation of Guinea grass (*Panicum maximum*) with cassava leaf silage on the feed intake, digestibility and nitrogen balance of West African Dwarf goats. M.Sc. Thesis University of Ibadan, Ibadan, Nigeria, pp: 15-37.
27. Farinu, G.O., 1996. Agronomic and nutritive evaluation of the wild sunflower (*Tithonia diversifolia* Hemsl. A. Gray). *Comprehensive Project Implementation Brief.*, pp: 1-6.
28. Dutta, P., P.R. Bhattacharyya, L.C. Rabha, D.N. Bordoloi, N.S. Barva, P.K. Chowdhury, R.P. Sharma and J.V. Barau, 1986. Feeding deterrents for *Philosamia ricini* (*Samia cyntia* subsp. *ricini*) from *Tithonia diversifolia*. *Phytoparasitica*, 14: 77-80.