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Proximate and Elemental Compositions of Animal Dung Collected from Owerri, Southeast Nigeria

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Abstract
This study evaluatedthe proximate and elemental compositions of poultry, cattle and pig dung produced at the in the Teaching and Research farm of the Federal University of Technology Owerri, Southeast Nigeri**a** as a first step towards processing the dung into value-added products. Results obtained showed species influence on the proximate compositions of the dung. Carbohydrate (19.29±0.11), ether extract (8.3±0.15), and moisture values (12.02±0.04) were higher in the pig dung compared to the others, while crude protein (13.79±0.18), total ash (35.58±0.05) and crude fiber (35.30±0.02) were higher in poultry dung.Poultry dung also recorded the highest pH, organic matter, phosphorus, potassium, sodium, calcium, magnesium, aluminum exchangeable base, and effective cation exchange capacity, which were significantly higher than the cattle values ($p<0.05$), while pig dung recorded highest values of nitrogen and exchangeable acidity. Poultry dung again contained significantly higher ($p<0.05$) copper, lead and arsenic levels than pig dung, and significantly higher ($p<0.05$) nickel and zing levels than cattle dung. All the dung were however exceptionally high in their zinc levels. Poultry and pig dung were superior to cattle dung in all the parameters measured and may therefore, be more suited as fertilizers for crop farming. The results of this study could aid in decisions on further processing the dung for value-added products production.

Keywords: Heavy metals, poultry dropping; pig manure, cattle dung

Introduction

Wastes produced from intensive commercial livestockventures are gradually becoming major sources of environmental pollution, and is therefore, aserious challengeto modern livestock farming. Animaldung is however nutrient-rich agricultural fertilizer that could be used to improve crop yield when properly processed and handled (Anitha *et al.,* 2015). For example, animal dung contents mineral elements which could be used to improve soil properties in agricultural farmland without any consequence on ecosystem (Abulude *et al.,* 2003). Animal wastes have also been shown to be beneficial resources for bioremediation of contaminated soils (Udebuani *et al.,* 2012) and for renewable energy production (Toma *et al.,* 2016).

A Considerable amount of heavy metals, pesticides, drug residues and varied metabolites have been reported to be contained in animal waste (Irshad *et al.,* 2012; Asagbara, *et al.,* 2015). Such heavy metals contamination of our environment is particularly a potential health risk on living biota (Yahaya *et al*., 2009).This has therefore raised concern about the possible contamination of environment when animal waste is used for soil amendment.

This study evaluated the proximate and elemental compositions of animal dung produced at the Teaching and Research farm of the Federal University of Technology Owerri, Southeast Nigeri**a** as a first step towards processing the dung into value-added products.

Materials and Methods

Fresh poultry dung (PD), cow dung (CD) and pig manure (PM) used in the study were collected from the Teaching and Research Farm of School of Federal University of Technology, Owerri (FUTO), southeast Nigeria. They were spread out on brown paper to air dry at room temperature for 7 days until they became free flowing and thereafter subjected to particle reduction and stored in properly labeled polyethylene bags until needed for analysis.

Biochemical analysis of the dung samples such as proximate composition, pH, organic carbon, elemental analysis, effective cation exchange capacity, exchangeable acidity, total hydrocarbon content, base saturation, sodium absorption ratio and exchangeable base among others were carried out using the methods of AOAC (1990). Data generated were subjected to analysis of variance and significant means separated with the aid of the Least Significant Difference (LSD).

Results and Discussion

Proximate composition of poultry, pig and cattle dung: Table 1 showed that the animal dung had statistically similar dry matter, carbohydrate and crude protein (CP). However, poultry dung contained significantly higher ($p<0.05$) crudefibre and total ash than the pig dung, but similar to cattle dung. Pig dung contained significantly higher ($p<0.05$) ether extract and moisture than poultry dung. The variations in nutrient compositions are expected because these animals have their different feed formulations, while the nutrient composition of the feeds and digestibility could also be major factors (Okoli *et al.,* 2009). The CP values recorded in the animal dung are similar to the values reported by Okoli *et al.* (2003) for some indigenous leaf meals from the study area and the CP values reported in palm kernel cake by Okata (2016).

Table 1: Proximate composition (%) of animal dung collected from Owerri

Parameters	Poultry dung	Pig dung	Cattle dung	SEM
Carbohydrate	12.42±0.04	19.29±0.11	13.53±0.05	5.4477
Crude protein (CP)	13.79±0.18	12.16±0.03	11.44±0.13	3.5307
Ether extract (EE)	3.00±0.02 [b]	8.3±0.15 [a]	5.25 ±0.05 [a b]	1.5357
Total ash (TA)	35.58±0.05 [a]	23.70±0.11 [b]	34.98±0.17 [a b]	3.8638
Crude fiber (CF)	35.30±0.02 [a]	24.53±0.08 [b]	34.80±0.09 [a b]	3.5096
Moisture (MO)	8.74±0.15 [b]	12.02±0.04 [a]	8.17±0.14 [b]	1.1996
Dry matter (DM)	91.26 ±0.04	87.98±0.26	91.83±0.02	1.6965

ab Mean on the same row with different superscripts are significantly different

Table 2 showed the chemical characteristics of the poultry, pig and cattle dung used in the study. The results obtained showed that poultry dropping recorded significantly higher ($p<0.05$) values of all the parameters measured except for exchangeable acidity, for which the pig dung had a significantly higher value. Specifically, poultry dropping recorded significantly ($p<0.05$) higher values of these parameters than cattle dung. Cattle dung however, recorded the lowest values of all the parameters measured. Based on these characteristics, it would seem that poultry dropping will serve as a better nutrient source for animals than pig and cattle dung. Vanfaasen and vanDijk (1987) reported such variations depend upon several factors, namely species, types and age of the animal, diet composition, management conditions, production system and the climatic conditions of the region. Hatch *et al*. (2000) reported they are related to the transformation produced in the organic matter and nitrogen contents of animal dung during the mineralization processes.

Table 2: Chemical characteristics (g/kg) of animal dung collected from Owerri

Parameters	Poultry dropping	Pig dung	Cattle dung	SEM
pH	8.0[a]	7.60[ab]	6.9 [b]	0.3214
Organic carbon	30.80±0.11 [a]	16.85±0.12 [a b]	16.2±0.03 [b]	4.7620
Organic matter	53.41±0.1 [a]	29.05±0.08 [ab]	27.90±0.05 [b]	8.3182
Potassium	0.72±0.04 [a]	0.26±0.03 [b]	0.49±0.07 [a b]	0.1327
Sodium	1.23±0.03 [a]	0.35± 0.03[b]	0.62±0.02 [ab]	0.2602
Calcium	143.0±0.95 [a]	60.50±0.01 [a b]	38.0±0.2 [b]	31.9178
Magnesium	16.4±0.21[a]	4.72±0.03[b]	5.70±0.02 [ab]	3.7407
Phosphorus	45.0±0.5 [a]	19.30±0.03 [b]	42.3±0.13 [a b]	8.1540
Nitrogen	1.4±0.03 [ab]	2.06±0.03 [a]	1.72±0.05 [b]	0.1905
Aluminum	1.60±0.03 [a]	1.80±0.01 [a]	1.13±0.02 [b]	0.1985
Hydrogen	3.7±0.05 [a]	4.25±0.06 [a]	1.20±0.01 [ab]	0.9385
Exchangeable acidity	5.3±0.05 [b]	6.05±0.02 [a]	2.33±0.02 [b]	1.1358
Exchangeable base	206.35 ± 0.17 [a]	85.13±0.02 [b]	87.11±0.02 [a b]	40.0807
ECEC	211.65 ± 0.07 [a]	91.18±0.08 [ab]	89.44±0.01 [b]	40.4497

Table 3 showed the heavy metals concentrations of poultry, pig and cattle dung. Poultry dung contained significantly higher ($p<0.05$) copper, lead and arsenic levels than pig dung, and significantly higher ($p<0.05$) nickel and zing levels than cattle dung. All the dung were however exceptionally high in their zinc levels. The higher values of heavy metals reported in this study are in accordance with those of Yahaya*et al*. (2009). Other previous studies also showed that heavy metal contents vary greatly in animal manure types, animal categories

and farms (Menzi *et al*., 1993). The higher content of zinc and copper especially in poultry dung could be as a result of copper and zinc added to feeds for antimicrobial and growth stimulating effects.

Conclusion

Poultry and pig dung were superior to cattle dung in all the parameters measured and may therefore be more suited as fertilizers for crop farming. The results of this study could aid in decisions on further processing the dung for value-added products production.

Table 3: Heavy metals characteristics (g/kg) of animal dung collected from Owerri

Heavy metal	Cattle dung	Pig dung	Poultry dung	SEM
Nickel	0.34±0.03^{b}	0.3±0.05^{ab}	0.6±0.03^{a}	0.107
Copper	1.05±0.02^{ab}	0.81±0.03^{b}	4.07±0.03^{a}	1.049
Lead	0.12±0.02^{ab}	0.04±0.01^{b}	0.26±0.04^{a}	0.0643
Cadmium	0.52±0.03^{ab}	0.83±0.05^{ab}	0.9±0.2^{a}	0.117
Chromium	0.28±0.05^{b}	0.53±0.02^{ab}	1.15±0.06^{a}	0.259
Arsenic	0.03±0.01^{ab}	0.02±0.02^{b}	0.05±0.01^{a}	0.0088
Mercury	0.03±0.01^{ab}	0.05±0.02^{a}	0.02±0.01^{b}	0.0088
Zinc	13.19±0.02^{b}	29.28±0.03^{ab}	37.14±0.03^{a}	7.049

abmean in the same row with different superscripts are significantly different

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