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PRELIMINARY STUDIES ON MILLIPEDE: PROXIMATE COMPOSITION, NUTRITIONALLY VALUABLE MINERALS AND PHYTATE CONTENTS.

F. O. ABULUDE and R. O. FOLORUNSO

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ABSTRACT
The nutritive potential of millipede was evaluated with respect to its proximate composition, energy value, mineral and phytate contents. It contained 24.85g/100g DM crude protein, crude fibre 4.88g/100g DM while ash was 2.23g/100g DM. The sample had low level of fat (5.20/100g DM). The energy level was 397.56Kcal. The concentration of Ca, K, Mg, Na, Cl and I were found to be high whereas Zn, Fe and Mn were low. The levels of phytate and phytate phosphorus were generally high and the sample had more than 80% of its total phosphorus linked to phytate. The phytate: Zn molar ratio of the sample was relatively low, indicating excellent Zn bioavailability. Based on the results, it is suggested that nutritional potentials of millipede should be harnessed.

KEYWORDS: Millipede, proximate composition, minerals, phytate, bioavailability.

INTRODUCTION

Millipede belongs to the class Diplopoda. They have between 11 to 100 trunk segments. They are world wide in distribution and are nearly always found in or under leaf litter, humus, or decaying logs. Their many legs help bull dose through the habitat. They feed on decaying plant matters and few, suck plant juices (Miller and Harley, 1996).

Nutrition is perhaps the most important consideration in livestock management, supplying feed in adequate amount or feeding poor quality feeds are responsible for the low livestock production in the tropics. The quest for least-cost dietary formulation, especially in non-ruminant feeding, has involved the replacement of the more expensive conventional feeding stuff with cheaper alternatives. Agbede and Aletor, (1997) have partially or wholly replaced conventional protein resources such as fish meal, groundnut cake and Soya-bean cake (ingredient with high import content) with cheaper alternative protein resources such as blood meal, cotton seed cake, palm kernel cake, brewer's yeast etc. with varying degrees of success.

Detailed information on the nutritional values of millipede is yet to be documented. The main objective of this work therefore, is to investigate the proximate composition, mineral and phytate contents. This study is important to establish the nutritional values of millipede with a view to ascertain its nutritional potentials in livestock production.

MATERIALS AND METHODS

Sampling

The millipede sample was collected at the Federal College of Agriculture, Akure, Ondo state campus. 250g of the sample was washed in distilled water, oven dried at 550C for 6h; then finely ground, sieved (1mm sieve) and mixed thoroughly. After mixing, the sample lots were quartered and sampling for analyses was carried out by the procedure described by Pearson (1976).

METHODS

Sample was analysed for proximate composition using the AOAC (1990) procedures, carbohydrate was determined by difference. Total energy was calculated according to the following equations (Manzi et al., 2001).

Energy (Kcal) = 4 x (g protein + g carbohydrate) + 9 x (g fat).

Phosphorus was determined using a Spectronic 20 colorimeter by the phosphovanadomolybdate method (AOAC, 1990). Phytate phosphorus (P) and phytate were determined using the methods of Young and Greaves (1940) as modified by Oduguwa et al., (1998). Phytate P as % total P and phytate: Zn were calculated using the methods of Abulude (2001).

Minerals were analysed using the solution obtained by dry ashing the sample and dissolving it in 10% hydrochloric acid and making up to 100cm3. Ca, Mg, Zn, Fe, Mn were determined with a Buck atomic absorption spectrophotometer (AAS: Model SP9). Na and K were measured with a Corning 405 flame photometer (AOAC, 1990). Chloride and iodide were determined using the methods in Vogel (1989). All chemicals were BDH analytical grade. Data collected were subjected to statistical analysis including analysis of variance.

F. O. ABULUDE Dept. of General Studies,Federal College of Agriculture, Akure, Nigeria.
R. O. FOLORUNSO Dept. of Animal Production, Federal College of Agriculture, Akure, Nigeria.

Table 1: Proximate Composition (g/100gDM[a]) of Millipede

Parameter	Mean	SD[b]	CV (%)[c]
Moisture	10.26	0.51	4.01
Carbohydrate (by difference)	62.84	0.25	0.40
Crude protein	24.85	0.42	1.69
Crude fat	5.20	0.35	6.73
Crude fibre	4.88	0.44	9.02
Ash	2.23	0.52	23.32
Energy	397.56	20.42	5.14

[a]DM Dry matter [b] SD - Standard Deviation [c] CV(%) Coefficient of variation (percent)

Table 2: Mineral Composition (Mg/100g DM[a]) of Millipede

Parameter	Mean	SD[b]	CV (%)[c]
Na	214.21	4.08	2.14
K	1752.05	28.05	1.60
Ca	3703.60	31.60	8.53
Mg	873.33	2.89	0.33
Zn	4.30	0.20	4.65
Fe	5.20	0.35	6.75
Mn	1.20	0.21	17.35
Cl	1251.01	2.08	0.17
I	780.25	1.98	0.25
Ratios			
K/Mg	2.01	0.10	4.73
K/Ca	0.48	0.04	7.89
Mg/Ca	0.24	0.01	4.00
Na/K	0.12	0.02	11.46

a, b, c see footnote Table 1.

RESULTS AND DISCUSSION

Table 1 shows the proximate composition of the sample in g/100g edible portion. This result shows the chemical composition as g/100g DM and also the energy in Kcal. From the Table, it can be deduced that this sample is low in moisture content. This content is 10.26g/100g DM with coefficient of variation in percent (CV%) of 4.01. The result is in close agreement with that reported for variegated grasshopper (13.5/100g: Olaofe et al; 1998). The observed low moisture level favours the keeping quality of the sample.

In terms of the protein level (22.85g/100 DM), the sample can be considered as a good source of protein. The protein content is in close agreement with results obtained by Aduku (1993) for grasshoppers (26.8%) and termites raw (20.4%). The sample is low in crude fat (5.20g/100g) crude fibre (4.88g/100g) and ash (2.23g/100g). Results of the proximate composition of the sample indicate the potentials for its use as source of good quality feed in livestock production. This millipede cannot be considered as rich sources of fat and fibre. The total carbohydrate is high making it a very good source of this nutrient. This sample is a good energy source and the energy is derived mainly from carbohydrate. The energy provided by the sample is shown in Table 1.

The mineral composition is shown in Table 2 and shown in mg/100g DM edible portion. The sodium content (214.21mg/100g) is higher than those reported for grasshopper, 36.0mg/100g (Olaofe et al., 1998; grasshopper, 40mg/100g Aduku, 1993); edible fish, 12.5 63.1mg/100g (Adeyeye, 1996), but lower than that reported for prawns, 88mg/g (Adeyeye, 2000). The potassium content is higher than result recorded for prawns (Adeyeye, 2000). The calcium content (3703.60mg/100g) surpasses those reported for grasshoppers, 40mg/100g (Aduku, 19993), rain termite and prawns, 7300mg/g (Adeyeye, 2000). The values of some of the trace minerals in the millipede sample as reported here are (mg/100g): Zn (4.30); Fe (5.20) and Mn (1.20). The values of these minerals in literature as reported by Olaofe et al., (1988) and Adeyeye, (2000) for grasshopper and prawns respectively are lower than the current results. The levels of trace minerals may not be of concern in terms of toxicity to livestock animals. They are below the upper limit of safe intake of 2 to 5mg/day (Mn), 12 to 15mg/day (Zn) and 10 to 15mg/day (Fe). Iodine content of this sample is 780.25mg/100g. The result compares favourably with fish (750mg/100g), but higher than those reported for meat (240mg/100g) and milk (230mg/100g) (Wenlock et al., 1981). The value obtained in this work is ideal for feeding laying hens because high levels of iodine have indicated that production of the hormone was not impaired (Marcilese et al., 1987). The major role of iodine in nutrition arises from the importance of thyroid hormones in the growth and developments of humans and animals (Hetzel and Dunn, 1989). Chlorine content is high. The combination of this with sodium is good for the animal because sodium chloride is meant to maintain the water balance of the body, also the osmotic balance in cell. Excess is lost in the urine of animals (Roberts et al., 1996 and Tull, 1990).

The concentration ratios of K/Mg, K/Ca, Mg/Ca and Na/K are shown in Table 2. All the ratios show a low variability. The interpretation of these low variabilities is that animals consuming this millipede sample are taking in more potassium, magnesium and sodium than other minerals from this source.

Phytate, phosphorus (P) and calculate phytate: Zn of the

sample are shown in Table 3. Total P has a mean value of 183.40mg/100g DM. The level reported is in total agreement with results recorded for vegetables (Abulude, 2001), but higher than that reported for some varieties of mushroom (Abulude et al., 2001). Phytate P and phytate levels are 154.32mg/100g and 549.38mg/100g respectively. The level observed are in the same range reported for cereals and legumes (Reddy et al., 1982)and lupin seeds (Trugo et al., 1993). This sample may be the choice when considering feeds with low phytate content for livestock. The phytate P as % total P represents the percentage of the total P present in the sample. The ratio of phytate: Zn is 12.00.

Table 3: Phosphorus, Phytate and Calculated phytate: Zn molar ratio of Millipede.

Parameter	Mean	SD[b]	CV (%)[c]
Total Phosphorus (mg/100g)	183.40	2.50	1.36
Phytate Phosphorus (mg/100g)	154.32	3.47	2.25
Phytate (mg/100g)	549.39	1.74	0.32
Phytate Phosphorus as % total Phosphrous	84.14	0.23	0.04
Phytate: Zn	12.00	0.15	1.27

Phytate may reduce the intestinal absorption of Mg, Ca, Zn and Fe by forming insoluble compounds in the conditions of the intestinal tract, but the result observed in this report may not have any serious adverse effects on the animals that feed on them. Phytate content is not considered to be absolute and may vary depending upon the variety, climatic conditions, locations, type of soil and the year during which they are found. Phytate: mineral ratio rather than absolute phytate levels are limiting in terms of mineral bioavailability. Foods with a molar ratio of phytate: Zn less than 10 showed adequate availability of Zn and problems were encountered when the value was greater than 15. Values obtained here are compatible with results recorded for lupin seeds (Trugo et al., 1993).

CONCLUSION

This research shows that millipede is rich in protein and mineral contents and contains phytate, which may not inhibit Zn availability. This sample may prove to be good ingredient that can be used in well-balanced livestock feeds.

Further work.

It is our intention to carry out further work on the effect of millipede supplementation of mixed concentrate rations on feed intake and growth rate in poultry birds.

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