BAP -30

Effects of Stage of Growth on Mineral, Proximate and Phytochemical Composition of Moringa Leave Extract

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Abstract
The concentration and availability of plant chemicals depend on the age or stage of growth of such plant. *Moringa oleifera* leave is one of such plant which are rich in mineral, fibre, alkaloids, saponins and tannins. This study seeks to investigate the effect of stage of growth on mineral, proximate and phytochemical composition of Moringa leave extract. A six-week old seedling were purchased and planted. Fresh leaves of *Moringa oleifera* were harvested at 12, 14, 16,18 and 20 weeks of age, air dry, grind into powder and kept in air tight container. Methanol was used for extraction. Proximate composition, phytochemicals Mineral were determined using the standard procedure. Data obtained were analysed using descriptive statistics and ANOVA. There were no significant differences in all the mineral, phytochemical composition and proximate parameters measured although week 20 had the highest crude protein, ether extract, ash and crude fibre. Alkaloids were significantly higher (250.00mg/g) at week 20 with least alkaloid valve at week 12 (235.56mg/g). Week 20 had the highest saponins (161.33mg/g) with least saponin value at week 12 (153.27mg/g). Tannins were significantly higher (149.78mg/g) at week 20 with least tannins valve at week 12 (132.22mg/g). Calcium at week 20 was significantly higher (800.00mg/g) with least calcium value at week 12 (741.67mg/g). Similar trend was observed for magnesium, sodium, chlorine, potassium, iodine and phosphate. A consistent pattern was observed as the stage of growth increases, the mineral composition and phytochemical increased. Week 20 had the highest proximate, mineral composition and phytochemical.

Keywords: Alkaloids, saponins, tannins, mineral composition, phytochemical,.

Introduction

Plants have been and will remain vital to mankind, animals as well as environment. The rapid growth of human and livestock population, which is creating increased needs for food and feed in the less developed countries, demand that alternative feed resources must be identified and evaluated. *Moringa oleifera* leave is one of such plant which is rich in phytochemicals. Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties. The concentration and availability of such plant chemicals depend on the age or stage of growth of the plants. Moringa is also known to produce primary and secondary metabolites which encompass a wide array of functions (Crotean *et al.,* 2000) many of which have been subsequently exploited by humans for their beneficial role in a diverse array of applications (Balandrin *et al*., 1985). The most important of these bioactive constituents of plants are the secondary metabolites which include alkaloids, phenolic compounds, tannins, phytosterols, saponins and terpenoids.

This study seeks to investigate the effect of stage of growth on proximate, phytochemical composition and mineral composition of *Moringa oleifera* leave extract.

Materials and methods

A total of twenty (20), six-week old seedlings were purchased from a horticulturist at National cereal research institute Ibadan (NCRI) and transported to Abeokuta where it was transplanted on a plot of land located at Obada-oko area of Abeokuta, Nigeria. It was planted at a spacing of 2 m × 2m in the month of May, 2013 and harvested at 12,14,16,18 and 20 weeks of age. Fresh leaves of *Moringa oleifera* were harvested at random by cutting the plant from the stem at every two-week interval and the leaves removed from the stem by hand and spread on a clean flat table under shed to air dry, grind into powder and kept in air tight container. Methanol was used for extraction. Proximate composition, phytochemicals Mineral were determined using thestandard procedure.Proximate analyses were carried out on the methanol leave extract according to the procedure of Association of Official Analytical Chemist (AOAC, 1990).

Phytochemical screening procedures carried out were adapted from the previous work on plant analysis (Sofowora, 1993).Calcium, magnesium, potassium, sodium, iron, iodine, phosphorus and chloride were determined using atomic absorption spectrophotometer (AAS-buck205) as described by the method of

Association of Official Analytical Chemist (AOAC, 1990). Data obtained were analysed using descriptive statistics and ANOVA (SAS 2003)

Results andDiscussion

Proximate analyses of *Moringa oleifera* leaves meal at different stages of growth are shown in the table 1 below.12 week old leaves had the highest mean moisture content of 8.96% and 20 week old leaves with the least mean moisture content of 7.82%, which were not too far from the value of the mean obtained for all the treatments. For protein content, 12 week old leaves had the highest mean protein value of 22.82 and least mean value of 22.11 for 20-week old leaves respectively; there is adecrease in crude protein of Moringa from 12 week all through to 20- week old leaves. Ether extract shows a marginal increase from 12-week to 20-week of age. In the case of Ash content, there was an increase in mean value as the plant mature. The fibre content follows the same pattern of increase from 12-week all through to 20-week as the plant matured.Table 2 below shows the Mineral composition of the *Moringa oleifera* at different stages of growth. All the minerals with the exemption of iodine follow the same pattern of increase in mean value with an increase in age of the plant.Table 3 below shows the result of the phytochemical composition of *Moringa oleifera* at different stages of growth. The result as revealed an increase in the content of Phytochemicals with an increase in ages. That is more phytochemicals are deposited as the plant matures.

Table 1: Effect of stages of growth on proximate composition of *Moringaoleifera*leaves

Parameters(%)	Week 12	Week 14	Week 16	Week 18	Week 20	Mean*	SD
Moisture	8.96	8.81	8.56	7.93	7.82	8.42	0.46
Crude protein	22.82	22.66	22.36	22.13	22.11	22.42	0.28
Ether extract	2.38	2.42	2.48	2.48	2.53	2.46	0.07
Ash	5.59	6.16	6.26	6.36	6.51	6.25	0.32
Crude fibre	7.16	7.90	8.39	8.41	8.45	8.06	0.49
NFE	53.09	52.05	51.95	52.69	52.58	52.39	0.43

SD- Standard deviation; NFE- Nitrogen free extract; * Mean of triplicate analyses

Table 2: Effect of stages of growth on mineral compositions of *Moringaoleifera*leaves

Parameters(mg/g)	Week 12	Week 14	Week 16	Week 18	Week 20	Mean*	SD
Calcium	741.67	761.67	766.67	770.00	800.00	768.00	18.78
Iron	17.32	17.28	16.63	16.44	16.39	16.81	0.31
Magnesium	128.33	130.55	136.67	141.66	141.67	135.78	5.53
Sodium	611.67	625.56	627.78	632.22	637.22	626.89	8.60
Chlorine	305.56	328.33	340.00	345.67	346.11	333.33	15.21
Potassium	238.33	250.00	253.33	264.44	270.00	255.22	11.13
Iodine	0.28	0.30	0.30	0.36	0.40	0.33	0.05
Phosphate	658.11	694.89	697.17	705.56	705.11	694.89	17.76

*Mean of triplicate analyses

Table 3: Effect of stages of growth on phytochemical constituents of *Moringaoleifera*leaves

Parameter (mg/g)	Week 12	Week 14	Week 16	Week 18	Week 20	MEAN*	SD
Alkaloids	235.56	242.78	244.22	247.78	250.00	244.22	4.96
Saponins	153.27	154.22	159.16	159.55	161.33	157.55	3.17
Tannins	132.22	146.11	150.56	150.56	169.44	149.78	11.91

The results (Table 1) obtained from proximate analysis of the *Moringa* leaves establishes that there was no significant difference within the treatment but the old plant was higher in proximate composition which could be due to the stage of growth. The high protein and lower fat characteristic of *Moringa* leaves has been previously reported by Makkar and Becker (1996). These results are in agreement with the values reported by Oduro *et al*. (2008).Yameogo *et al*. (2011) reported that, on a dry matter basis, *Moringa oleifera* leaves contained 27.2% protein, 5.9% moisture, 17.1% fat, and 38.6% carbohydrates were not in agreement with this study. The findings of Anwar and Rashid (2007) were in line this study. They noticed that on a dry matter basis, *Moringa oleifera* seeds contained 34.80% ether extract, 31.65% protein, 7.54% fiber, 8.90% moisture, and 6.53% ash contents. The stage of growth of *Moringa oleifera* does not have an effect on mineral in this study. The old plant has more concentration of the minerals than the younger plant. This could be due to climatic factors and stages of maturity could cause variation in distribution.

Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties, they are found generally in plants. There was no significant increase ($p>0.05$) between the mid and late stage but with a corresponding decrease in the early stage of maturity. The result obtained could be due to phenological stage of the plant. However, It has been reported that climatic factors and stages of maturity could cause variation in the distribution of these phytochemicals in leaves of *M. oleifera*as well as the choice of solvent as different solvents have different extraction capabilities and spectrum of solubility for phytoconstituents.

Conclusion

There are indications that all the stages are good sources of nutrients and phytochemicals at varying degrees. Although, the leaves of all the stages have varying percentages of the nutritional composition tested for, the late stage (20-week) recorded the highest. Therefore, the choice depends on the individual as it is a potential leaf source of food that is suitable for fortification of foods and their use as nutritional supplements is highly promising.

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