Proximate, Mineral, Phytochemical and Antioxidant Composition of Purslane (Portulaca Oleracea) Weed as Potential Feed Supplement to Monogastric and Ruminants Nutrition

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Abstract
The Purslane (*Portulaca oleracea*) weed was bought at "Hayin-gada" along Jimeta-Girei River in Adamawa State. The proximate and phytochemical compositions of the leaves and stems of the weed was analysed according to the standard procedures. Minerals and Vitamins concentrations were determined by using Atomic Absorption Spectroscopy (AAS), Inductivity Coupled Plasma Mass Spectrometry (ICP-MS), Inductivity Coupled Plasma Optical Emission Spectroscopy (ICP-OES) and X-Ray florescence (XRF). The Proximate analysis showed moisture (9.55%), CP (17.7%), Nitrogen free extract (45.84%), Energy content value (2,415.78Kcal/Kg), Ash (9.72%), Esther extract (4.19%). Some minerals analysed were Ca (2620mg/Kg), P (3731 mg/Kg), Mg (3924mg/Kg) and K (5881 mg/Kg) while some minor minerals like Iron (82mg/Kg), Zn (36mg/Kg), Cu (11mg/Kg) and Mn (43mg/Kg) were also determined. The phytochemical analysis reveals the presence of Alkaloids (0.05mg/100g), Saponins (3.11%), Tannin (1.43%), Glycoside (0.31%), Flavonoid, Steroid, Apigenin (20.32mg/100g), oxalate (2.31%) and phytate (0.096 mg/100g). Similarly, some antioxidants components were evaluated; Vitamin C (Ascorbic Acid) (14 mg/ 100g), Vitamin E (17mg), β-Carotene (0.1mg/100g), total phenolics (420 mg/100g) and Glutathione (8.9 mg/100g). Purslane weed is widely available in riverine areas, low cost and has potentials in feeding animals as a supplement because it has all the nutrients especially protein and it can contribute to omega-3 fatty acid, vitamin A, C and E. Similarly, it has some essential major and minor minerals and it is valuable as forage supplement for ruminants due to high phytochemical content. Therefore, it is recommended to feed ruminants as supplement.

Keywords: Purslane, Weed and Supplements.

Description of the Problem

Animal nutrition is the scientific study of the dietary needs of animals for growth, reproduction, maintenance, and performance. It encompasses the processes by which animal ingest, digest, absorb, and utilize food substance. Proper nutrition is essential for sustaining life processes and optimizing health and productivity in both domestic and wild animals (1). The primary nutrients animals require include carbohydrates, proteins, fats, vitamins, minerals and water. Purslane (*Portulaca oleracea*), a common edible weed, is increasingly studied for its potential as an alternative animal feed due to its rich nutrient profile. It contains moderate protein (14 – 20%), essential fatty acids (notably omega -3), vitamins, and minerals, making it suitable for inclusion in livestock diets (2, 3). Purslane's digestible protein and low lignin content support both ruminant and monogastric nutrition (4). In feeding systems, purslane can be used fresh, dried or even fermented often replacing conventional forages or protein sources such as soybean meal (5). Its use supports low cost and sustainable feeding.

In animal nutrition, forage type like grasses, legumes, pastures, and browse plants play a key role in supplying energy, protein and fibre. Common grasses include *Pancium maximum* (guinea grass), *Cynodon dactylon* (Bermuda grass), and *Pennisetum purpureum* (elephant grass), valued for their bulk and digestible fibre (1). Unconventional weed like purslane is being explored alongside these traditional forages to diversify feed options, reduce cost, and improve nutrition-especially in low-input systems.

In many parts of the world, especially in developing countries, livestock productivity is constrained by the lack of high-quality and affordable animal feeds. According to (6), poor-quality feeds are one of the leading factors contributing to malnutrition and low performance in farm animals. This challenge has led to increased interest in exploring alternative, low-cost and nutrient-rich feed resources to improve livestock health and productivity. Purslane (Portulaca oleracea), a common but underexploited weed, is known to be rich in nutrients such as omega-3 fatty acids, proteins and essential minerals. Despite this, it remains largely neglected in animal feed formulation, partly due to limited scientific data on its nutritional value and potential risk such as mycotoxin contamination.

Purslane (Portulaca oleracea) is a fast-growing, drought-resistant weed commonly found in moist environment like riverine areas, where it grows in abundance without the need for cultivation. Its natural availability, especially in rural and semi-wild zones, makes it a low-cost and easily accessible plant resource. The high cost and limited availably of conventional animal feeds have led to increasing interest in alternative feed ingredients that are both affordable and locally available. According to the (6), utilizing local feed resources, including forage weeds, is a sustainable strategy to reduce feed costs and improve livestock productivity, especially in low-income regions which make purslane a promising weed as an alternative feed source. Many wild plants including purslane, contain anti nutritional compounds such as oxalates, phytate, and tannins. These substances can interfere with the absorption of key nutrients, reduce feed efficiency, and negatively impact animal health if consumed in large amounts (7). The aim of the study is to determine the proximate, minerals, phytochemical and antioxidant composition of Pursalane (*Portulaca oleracea*).

Materials and Methods

The research was carried out at the Laboratory of the Department of Animal Science and Range Management, Modibbo Adama University, Yola, Adamawa State. It is located within the northern Guinea Savannah of Nigeria and lies between latitude 7^0C and 11^0C North and longitude 11^0C and 14^0 C East of Greenwich Meridian. It has a tropical season and climate characterized of dry and rainy season. The rainfall ranges between 700 – 1600mm with a minimum average temperature of 15.2 and maximum temperature of 43°C (8).

Sample Collection and Preparation

The purslane weed sample were purchased fresh from "Hayin gada" a riverine area along Jimeta-Girei Area of Adamawa State. The fresh samples were dried under shade at room temperature for a period of 14 days to prevent loss of nutrients and to preserve the quality; after drying the samples were grinded into a fine powder using a manual grinder to ensure uniform particles sizes for the analysis. The grinded samples were stored in an airtight polyethene leather bag to prevent moisture absorption and contamination. The samples were then, used for the analysis.

Proximate Analysis

Proximate analysis of purslane weed was done according to (9).

Vitamins and Mineral Analysis

Major and minor minerals were determined using Atomic Absorption Spectrophotometry (AAS), Flame Photometry, Inductively Coupled plasma Optical Emission Spectroscopy (ICP-OES), UN-Visible Spectrophotometry (for phosphorus).

Phytochemical Analysis

The anti-nutrients such as oxalates, phytates, saponins, tannins, glycosides, alkaloids and apigenin were also analysed. Similarly, some antioxidants compounds were also analysed: Vitamin E, Vitamin C β-Carotene, total phenolics, flavoniods and Glutathione, according to standard methods of (10), (11) and (12).

Results and Discussions

The proximate composition of Portulaca oleracea (purslane weed) yielded the following results in Table 1. The results indicate that Portulaca oleracea contains a high level of nitrogen-free extract (NFE) at 45.84%, suggesting a rich presence of soluble carbohydrates. The crude fibre content (12.8%), suggests potential benefits as a good source of dietary fibre. The protein content of 17.7%, shows that purslane can serve as a modest plant-based protein source (13) and aligns with

previous findings by (14), who reported that purslane contains significant levels of essential amino acids and protein. The ash content (9.72%) reflects high mineral composition, confirming the presence of micronutrients (such as potassium, calcium, magnesium, and iron) as reported by (15). The EE was found to be relatively low (4.19%), which is typical for leafy vegetables, but still valuable given purslane's known richness in omega-3 fatty acids (14). The Moisture content of 9.55%, indicates the sample was properly dried before analysis, which supports storage stability and accuracy in dry matter-based measurements (16).

Table 1: Proximate Analysis of Purslane Weed

Parameters	Value (%)
Moisture	9.55
Dry Matter	90.45
Crude Protein	17.70
Crude Fiber	12.80
Ash Content	9.72
Ether Extract	4.19
Nitrogen-free Extract	45.84
NDF	78.43
ADF	64.35
Ligni	18.81
Cellulose	45.54
Henicellulose	14.08
Organic Matter	57.08
ME (Kcal/Kg	2415.78

Table 2: Macro Minerals

Macro Minerals	Value (mg/kg)
Calcium	2620
Phosphorus	3731
Magnesium	3924
Potassium	5881

Table 3: Micro Minerals

Micro Minerals	Value (mg/kg)
Iron	82
Zinc	36
Copper	11
Manganese	43

The mineral analysis of purslane weed reveals a nutrient-rich profile, with significant levels of both macro and micro minerals. The high levels of calcium, phosphorus, magnesium, and potassium suggest its potential to support bone health, energy metabolism, and nerve function in ruminants (17), (13). The calcium content (2620 mg/kg) is particularly noteworthy, as it can support bone growth and development in young ruminants (18). The phosphorus content (3731 mg/kg) is also significant, as it plays a crucial role in energy metabolism and bone health (13). The micro minerals, including iron, zinc, copper, and manganese, can support various biological processes, such as oxygen transport, immune function, and antioxidant defense (18). The iron content (82 mg/kg) can support oxygen transport and erythropoiesis (19), while the zinc content (36 mg/kg) can support immune function and wound healing (20). Overall, the mineral profile of purslane weed suggests its potential as a valuable feed supplement for ruminants, providing essential nutrients for optimal health and productivity.

Table 4: Phytochemical Constituents of Aqeous Extract in Portulaca oleracea

Nutrients	Presence	Percentage (%)
Saponins	++	3.11
Tannin	+	1.43
Glycoside	+	0.31
Alkaloids	+	0.05
Flavonoid	+	
Steroid	+	
Apigenin	+	20.32
Oxalate	+	2.31
Phytates	+	0.96

The Qualitative Phytochemical screening of Portulaca oleracea revealed the presence of various bioactive compounds including saponins, tannins, glycosides, alkaloids, flavonoids and steroids. These compounds are associated with significant medicinal properties such as antioxidant, antimicrobial, anti-inflammatory, and cardioprotective effects. This supports the ethnomedicinal use of purslane and highlights its pharmacological potential for livestock.

Table 5: Antioxidant Evaluation of Portulanca oleracea

Parameter	Value	Unit
Vitamin C (Ascorbic Acid)	14.0	Mg/100g FW
Vitamin E (Tocopherol)	17.2	Mg/100g FW
β-Carotene	0.1	Mg/100g FW
Total Phenolics	420	Mg GAE/100g FW
Flavonoids	147	mgQE/100g FW
Glutathione	8.9	Mg/100g FW

The antioxidant profile of Portulaca oleracea is shown in Table 5, and indicates key bioactive compounds known for their health-promoting properties. Vitamin C (14.0mg/100g FW) acts as primary antioxidant in biological systems by donating electrons to neutralize reactive oxygen species. Vitamin E (17.2mg/100g FW) provides lipid-solution protection in cellular membranes, preventing oxidation of polyunsaturated fatty acids. The β-carotene content, through low (0.1mg/100g FW), adds value due to its provitamin A activity. Total phenolic and flavonoids were recorded at 420mg GAE and 147mg QE respectively, both of which indicates potent antioxidant activity. Phenolic scavenge free radicals and chelate metal ions, while flavonoids stabilize oxidative stress. Glutathione, at 8.9mg/100g FW, supports detoxification and boosts intracellular antioxidants defence systems.

The nutritional and antioxidants values obtained in this study are consistent with several previous studies on Portulace oleracea. (14) reported similar crude protein levels and emphasized the plant's richness in essential fatty acids and micronutrients. (15) also confirmed high antioxidant content across various plant parts, validating this study's findings on phonolic and flavonoid concentrations. (21) observed that purslane has comparable protein and ash levels, reinforcing its nutritional reliability. Moreover, (22) noted that environmental and soil conditions influence fibre content, which explains the slight variation in crude fibre compared to other regions. The overall profile aligns with the reported values for nutritionally beneficial forage alternatives in tropical regions.

Conclusion and Application

The results indicate that *Portulaca oleracea* is a nutrient-rich plant with significant levels of protein, minerals, fibre, lipid, and carbohydrates, making it a valuable dietary component. The results from this study show that purslane weed is a nutrient-rich feed supplement, with significant levels of macro and micro minerals. The high levels of fiber and minerals in purslane weed suggest its potential to support digestive health and provide essential nutrients for ruminants. Furthermore, its antioxidants compounds particularly phenolics, flavonoids, vitamin C and E and glutathione may help mitigate oxidative stress in animals, thus enhancing immunity, productivity and overall health. This makes purslane a sustainable, low-cost and functional feed option especially in regions where conventional forages are expensive or scares. Purslane can be applied in feeding both ruminants and monogastric animals as supplements because of its rich in nutritional status, low-cost and locally available. However, if the weed is going to be supplemented in fresh form it should be fed within twelve (12) hours otherwise it will start fermenting.

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References

1. McDonald, P., Edwards, R.A., Greenhalgh, J.F.D., Morgan, C.A., Sindair, L.A and Wilkinson, R.G. (2011), Animal Nutrition. Seven Edition. Pearson Education Limited, England.
2. Liu, L., Howe, P., Zhou, Y.f., Xu, Z.Q., Hocart, C. & Zhang, R. (2000). Fatty acids and β-Carotene in Australian Purslane (Portulaca Oleracea) varieties. Journal of Chromatgraphy A, 893 (1),207-213.
3. Uddin, G., Rauf, A. (2012). Phytochemical Screening, Antimicrobial and Antioxidant activities of aerial parts of Quercus Robur L. Middle-East Journal Med. Plants Research. 1.01.04.
4. Simopoulos, A. P., *et* al. (2012). Omega-3 fatty acids in wild plant. Biomedicine & pharmacotherapy.
5. Alam, M. A., Juraimi, A., Raifi, M.Y., Hamid, A.A., Aslani, F., Alam, M. Z. (2014). Effects of Salinity and Salinity-Induced Augmented Bioactive Compunds Purslane (Portulaca Oleracea L.) for Possible economical use. Elsevier.
6. Food and Agriculture Organization. (2012). Use of Lesser-know plants and plant parts as animal feed resources in tropical regions. Animal Production and Health Working Paper, No.8, Rome, 2012.

7. Kumar, V., Sinha, A.K., Makkar, H.P.S and Becker, K. (2010). Dietry Role of Phytates and Phytase in Human Nutrition: A review. Food Chemistry, 120:945-959.
8. Adebayo, A.A. and Tukur, A.L (1999). Adamawa State in Maps: Department of Geography, Federal of Technology, Yola. Incorporation with Paraclete Publisher, Yola. Nigeria. Pp. 20-26.
9. AOAC. (2019). Official Methods of Analysis. Association of Official Analytical Chemists.
10. Speckman, D. H., Stein, W.H. and Mare, S. (1958). Automatic Recording Apparatus for Use in the Chromatography of Amino Acids. Analytical Chemistry 301: 1185-1190.
11. Gurfinkel, D. M. and Rao, A.V (2002). Determination of Saponins in Legumes by Direct Densitory. Journal of Agriculture Food Chemistry. 50(3), 426-430.
12. Qayyum, M.M. N, Butt, M.S., Anjum, F.M. and Nawaz, H. (2012). Composition Analysis of some Selected Legumes for Protein Isolates Recovery. The Journal of Animal and Plant Sciences. 22 (4), 1156-1162.
13. N.R. C (2013). National Research Council, Nutrient requirement of sheep. 6th Edition. Washington, DC.
14. Liu, L., Howe, P., Zhou, Y.f., Xu, Z.Q., Hocart, C. & Zhang, R. (2000). Fatty acids and β-Carotene in Australian Purslane (*Portulaca oleracea*) varieties. Journal of Chromatgraphy A, 893 (1), 207-213.
15. Uddin, M.K., Juraimi, A.S., Hossain, M.S., Nahar, M.A., Ali, M.E & Rahman, M.M. (2014). Nutritional and Antioxidant Properties of Different Parts of Portulaca Oleracea. Food Chemistry, 161, 180-187.
16. Food and Agriculture Organization. (2013). The State of Food and Agriculture. Food Systems for Better Nutrition. The United Nations. Rome.
17. McDonald, P., Edwards, R.A., Greenhalgh, J.F.D., Morgan, C.A., Sindair, L.A and Wilkinson, R.G. (2018), Animal Nutrition. Seven Edition. Pearson Education Limited, England.
18. Underwood, E.J and Suttle, N.F (1999). The Mineral Nutrition of Livestock. 3rd Ed., CABI Publishing New York.
19. McDowell, L.R. (2003). Minerals in Animal and Human Nutrition. Second Edition. University of Florida. Elsevier Publishers.
20. Prasad, K. (2008). Hypocholesterolemic and Antiatherosclerotic effect of flax lignin complex isolated from flaxed. Atherosclerosis, 179:269-275.
21. Ezekwe, M. O., Omara-Alwala, T.R, & Membra, D.A. (1999). Nutritional Potential of Purslane (Portulaca Olerancea) Prepared as a vegetable. Journal of the American College of Nutrition, 186 (6), 603-610.
22. Sowbhagya, H.B and Bhattachary, S. (2000). Processing of Dietary Fibre-rich Fractions from Culinary Banana. Food Chemistry. 73(4), 431-438.