

PP-01

Nutritional and Chemical Characterization of Currently Unutilized Aquatic Plants from Nepal as Potential Sustainable Feed Ingredients for Future Aquaculture

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Nepal is rich in various aquatic bioresources, including plants and algae. In the water bodies of sub-tropical geographical regions of Nepal, *Pontederia hastata* (Arrow pondweed), *Nelumbo nucifera* (Lotus), and *Pistia stratiotes* (Water Lettuce) are major aquatic plants that play important ecological roles. However, these plants are often considered nuisances due to their rapid growth and tendency to overpopulate water bodies. Despite this, their potential utilization for various commercial applications has not been explored yet. This research examines their proximate, mineral, and heavy metal content to assess their feasibility for inclusion in sustainable fish feed.

On August 4, 2023, leaf samples of Arrow leaf pondweed, Lotus, and Water lettuce were collected from Chitwan, Nepal using a random sampling method in selected areas. Arrow pondweed was collected from a small creek in Sardanagar (27°37'22" N 84°19'11" E). Lotus samples were taken from RaniPokhari Pond, Sardanagar (27°37'57" N 84°19'50" E), and Water lettuce samples were obtained from the Fisheries Reservoir at the Agriculture and Forestry University (AFU), Rampur (27°39'26" N 84°21'00" E), all lying within a 5 km radius. Post-collection, the samples were meticulously cleaned, air-dried at 60°C for 48 hours, finely ground to a powder (<1 mm), and vacuum-sealed. Subsequent analyses were conducted at FBA, Nord University, Norway. Proximate composition analyses were performed using standard AOAC methods. Mineral content and heavy metals were quantified using ICP-OES and ICP-MS respectively.

Results revealed that the dry matter contents of all three aquatic plants were below 15%. *Pontederia hastata* had the highest crude protein content (23.8 ± 0.08%), followed by *Nelumbo nucifera* (20.4 ± 0.55%) and *Pistia stratiotes* (12.0 ± 0.14%). The crude fat content was highest in *Nelumbo nucifera* (6.2 ± 0.16%).

Pistia stratiotes exhibited significant ash content (17.2 ± 0.03%), indicating a rich mineral profile, particularly in potassium (37.5 ± 0.50 g/kg), calcium (36.1 ± 0.28 g/kg), and magnesium (5.5 ± 0.07 g/kg). *Pontederia hastata* stood out for micronutrients like manganese (0.85 ± 0.01 g/kg), zinc (41.1 ± 1.95 mg/kg), and iodine (7.8 ± 0.15 mg/kg), while *Nelumbo nucifera* showed notable phosphorus levels (5.5 ± 0.17 g/kg). Heavy metal concentrations across all three species fell within safety limits set by FAO/WHO; lead maximum (1.08 ± 0.09 mg/kg), cadmium (0.05 ± 0.001 mg/kg), mercury (0.02 ± 0.001 mg/kg), arsenic (1.40 ± 0.03 mg/kg), copper (11.57 ± 0.66 mg/kg), and chromium (4.24 ± 0.76 mg/kg). These findings underscore the potential of these aquatic plants as sustainable alternatives in aquaculture feed. In particular, *Pontederia hastata*, *Nelumbo nucifera*, and *Pistia stratiotes*, could be utilized as an alternative source of protein for future aquaculture production, contributing towards establishing a circular economy within aquaculture.

Table: Nutritional Composition of Three Freshwater Aquatic Plants collected from Chitwan, Nepal

Aquatic Plants		DM (%)	Ash (%DM)	Protein (%DM)	Fat (%DM)	Energy (MJ/kg)
<i>P. hastata</i>	Mean	91.1	12.9	23.8	5.9	17.9
	S.D	0.34	0.08	0.08	0.08	0.12
<i>N. nucifera</i>	Mean	87.3	11.3	20.4	6.2	18.5
	S.D	0.21	0.06	0.55	0.16	0.07
<i>P. stratiotes</i>	Mean	87.2	17.2	12.0	3.9	15.6
	S.D	0.27	0.03	0.14	0.08	0.05