Economics and Environmental Impact of Water Lentil Protein for Human Consumption

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Aim

Provide an estimate of the economics and environmental impact of water lentil protein for human consumption for three production routes:

1. Protein extraction
2. Direct consumption
3. Dried product (see Figure 1).

Materials and methods

Data from local practice, databases and assumptions were used to estimate fixed and variable costs, climate change, water use, land use and energy use. Life cycle assessment was used to compute the environmental impact. Outcomes were expressed per kg of protein in the end product and adjusted for protein digestibility.

Results

Production cost and environmental impact were in similar range as algal protein except for land use and water use that were lower (see Table). Outcomes depended mainly on energy use for production in greenhouses. Future effort will need to focus on reducing energy consumption, renewable energy use and whole nutrition sales routes.

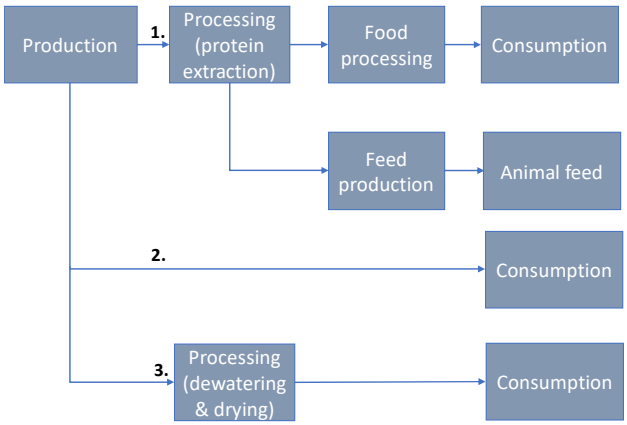

Figure 1. Production routes for using water lentil protein for human consumption: 1. protein extract, 2. direct consumption and 3. dried product.

Conclusion

Production of water lentil protein for human consumption was economically feasible, but depends strongly on the sales route in the business model. Further reduction in energy consumption is needed to improve the economics and reduce environmental impact of water lentil protein for human consumption.

Product	**Economics**	**Environmental impact**			
Per kg of protein	Estimated production cost ($ USD)	Climate Change (kg CO_2-eq)	Land use (m^2)	Water use (m^3)	Energy use (GJ)
1. Protein extract	50 – 82	151 – 179	-8.0 – -1.3	-2.8 – 0.4	-2.3
2. Direct consumption	38 – 47	133 – 163	1.4 – 1.7	1.2 – 1.5	1.7 – 2.1
3. Dried product	30 – 37	105 – 129	1.1 – 1.3	0.9 – 1.1	1.4 – 1.7
Chicken egg protein[#]	9 – 12	35 – 77[*]	45 – 58	-7.9	0.1 – 269
Algal protein[#]	27 – 144	16 – 263	1.8 – 5.8	0.3 – 4.2	2.3 – 3.6
Soy protein[#]	-2.19	1.7 – 2.2[*]	-3.6	-3.6	-0.01

[*] Including land use and land use change, [**] Own calculations based on production scales of 150 t/ha yr^{-1} and 1000 t/ha yr^{-1},[#] Williams et al. (2006); Baumgartner et al. (2008); Smetana et al. (2017).

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