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Full Length Research Paper

Nutritional potential of *Alysicarpus* species: an underexploited legume from North Western Ghats of Maharashtra, India

Mayur Patil[1*], Sanjay Auti[2]

[1] KKHA Arts SMGL Commerce and SPHJ Science College, Chandwad, Nashik India

[2]HPT Arts and RYK Science College, Nashik, India.

Correspondence email: mayurpatil49@gmail.com

Abstract

Grain legumes or pulses are significant sources of proteins and other nutrients for the majority of the population in the world. Wild relatives of grain legumes relatively remain under explored for their nutritive value. With this backdrop, three species of Alysicarpus were analyzed for their protein contents and other nutritional and anti-nutritional components. Results showed significant content of proteins and carbohydrates whereas lower free amino acids and lipid ranging from 13.80 ± 0.40 to16.05 ± 0.86, 31.86 ± 1.10 to 51.15 ± 0.52, 1.97 ± 0.52 to 4.4 ± 1 and 2.47 ± 0.32 to 8.37 ± 0.35 g/100g respectively. Antinutrients phenols, tannins and Phytic acids were also analyzed and showed a range of 0.57 ± 0.76-0.64 ± 0.28; 0.50 ± 0.40-1.11 ± 0.11 % respectively. Results showed that Alysicarpus species might be used as alternative sources of proteins and other nutrients especially in rural peoples of developing countries.

Keywords: *Alysicarpus* species, Proteins, Nutritional analysis, Antinutrients.

INTRODUCTION

Good health is the midst of all for humans considering the present scenario of over affection toward fast food and sedentary lifestyle. Changing lifestyle has compromised the health leading to various diseases and disorders. Proper nutrition is key to all and should be viewedseriously. Proteins are the important component of nutrients and required to carry out many vital functions of the body. Animal sources of proteins are costly and not affordable to the bulk of the population all over the globe. Grain legumes or pulses are a significant source of proteins and other nutrients and are comparatively cheaper than animal sources. Legumes are acknowledged as the second most important plant sources for human and animal nutrition (Vietmeyer, 1986). Legumes belong to the family leguminosae which is the third largest family among flowering plants, consisting of about 650 genera and 20000 species (Doyle, 1994).Wild relatives of plants are the reservoir of genetic diversity and do possess unique characters. Wild and underutilized legumes might have high potential to be used as human food for overcoming the malnutrition-associated problems and may also be used for future commercial exploitation such as a source of nutraceuticals, for new food formulations and biofortification (Bhat and Karim, 2009).Certain Indian tribal pulses have been investigated to trace their biochemical composition and to evaluate their nutritional potential (Rajaram & Janardhanan, 1991). Some of wild relatives of grain legumes are relatively unexplored for their nutritive values. With this backdrop, three species of Indian tribal pulse *Alysicarpus* were investigated for its nutritive value and their probability to be used as potent sources of proteins to eliminate malnutrition related problems especially among the rural peoples.

MATERIALS AND METHODS

Three species of *Alysicarpus* viz. *Alysicarpus vaginalis, Alysicarpus monilifer, Alysicarpus tetragonolobus* var *tetragonolobus* were collected from North Western Ghats of Nashik district, Maharashtra. Identification of species was made with the help of flora of the presidency of Bombay, Flora of Maharashtra and Flora of Kolhapur (Cooke, 1967; Almeida, 1996; Yadav and Sardesai, 2002). Pods of collected species were sun dried for two days. Seeds were separated from pods and screened for any damage or infection. Only matured seeds were selected and powdered for further analysis. Nutritional analysis included total true proteins, total carbohydrates, total free amino acids and total lipids

while antinutritional analysis involved total free phenol and tannins and Phytic acid. Proteins were estimated by the reported method (Lowery et al., 1951). Carbohydrates were measured by the Anthrone reagent method (Hedge and Hofreiter, 1962).Total free amino acids were estimated by the known method (Moore and Stein, 1948).Total lipids were estimated by reported method (Folch et al.,1957) Among the antinutrients, Phenols were measured by the established method (Malick and Singh,1980).Tannins were estimated by Folin Denis method (Schanderl, 1970). Phytic acid were estimated by reported method (Wheeler et al.,1971).Triplicate set of experiments were set up and data collected was subjected to statistical analysis using GraphPad Prism 8 Version 8.4.1(676) software and values were expressed as mean ± standard deviation (n=3).Data was subjected to one way ANOVA and Tukeys Multiple Comparison test to compare the means and to trace any significant difference between them at significance level,0.05.

RESULT AND DISCUSSION

The true protein content was ranged from 13.80±0.40 to16.05±0.86 g100g^{-1} dry wt. Maximum amount was recorded in *Alysicarpus monilifer* while *Alysicarpus tetragonolobus var tetragonolobus* showed the lowest among the species. It can be approximately comparable with other wild legumes *Rhynchosia hirta* (16.75 g100g^{-1}) (KSR Murthy and V B Kandimalla 2007). *Dolichos lablab* var. *vulgaris* (18.44 g 100 g-1) (V Kalpanadevi and V R Mohan, 2013). It was a bit lesser than commonly consumed pulses *Vigna mungo* (22.91 g 100 g-1) (Mohan V R et al., 2010). Overall protein content was in momentous amount to be considered as nutritionally rich. Total carbohydrate estimated was highest in *Alysicarpus tetragonolobus var tetragonolobus* (51.15 ± 0.52 g 100 g^{-1}) whereas least was recorded in *Alysicarpus monilifer* (31.86 ±1.10 g 100g$^{-1)}$. Overall carbohydrate content was in proximity to the commonly consumed cultivars mung bean *Vigna radiata* L (85 ±0.1 g100g^{-1}) (Kataria and Chavan 1988).Total free amino acids were highest in *Alysicarpus tetragonolobus var tetragonolobus* (4.4±1 g100g^{-1}) whereas minimum in *Alysicarpus vaginalis* (1.97±0.52 g100g^{-1}). Highest amount is nearly comparable with domesticated legumes such as beans (4.8 g100g^{-1}) whereas it is sufficiently more that other cultivated legumes lentils (0.52 g100g^{-1}) and peas (1.01 g100g^{-1}) (Kuo et al., 2004). Total lipid content was maximum in *Alysicarpus vaginalis* (8.37±0.35 g100g^{-1}) whereas *Alysicarpus monilifer* showed minimum (2.47± 0.32 g100g^{-1}).It was much lesser than the *Alysicarpus rugosus* (14±1 g100g^{-1}) (P.Sidhhuraju et al., 1992) and can be comparable to other wild legumes such as *Vigna sinensis* (3.10 g100g$^{-1)}$ (Rajaram and Janardhanan, 1990), *Indigofera linifolia* (4.72±0.65g100g^{-1}), *Sesbania bispinosa* (6.42±0.47g100g^{-1}) (P.Sidhhuraju et al., 1995). *Rhynchosia cana* (4.38 ± 0.01 g100g $^{-1}$) (Kalidass and Mohan, 2012). It is well comparable to the cultivated legume *Vigna mungo* L. Hepper (2.94 ± 0.03 g100g $^{-1}$) (V R Mohan *et al.,* 2010). Overall, Value of lipid content was in correspondence with earlier reported values (Table 1).

Antinutrients are the compounds generated in natural feedstuff by normal metabolism and exert effect contrary to optimum nutrition (K E Akande *et al.,* 2010). In the current investigation three antinutrients were evaluated i.e. total free phenols, tannins and phytic acid. Total free phenol showed a range from 0.57±0.76 to 0.64±0.28 g100g^{-1} with lowest was recorded in *Alysicarpus vaginalis* whereas *Alysicarpus monilifer* showed the highest amount .The amount range is well below when compared with the other underutilized legume *Rhynchosia hirta* (2.25 g100g^{-1}) (KSR Murthy and V B Kandimalla 2007) *Mucuna pruriens* var pruriens (4.40 ±1.21 g100g^{-1}) (V R Mohan et al., 2010). Tannin content was minimum in *Alysicarpus tetragonolobus var tetragonolobus (*0.50± 0.40 g100g^{-1}) and highest was obtained in *Alysicarpus monilifer* (1.11±0.11 g100^{-1}g). It is less than the wild legumes *Rhynchosia hirta* (4.75 g100g^{-1}) (KSR Murthy and V B Kandimalla 2007) and is somewhat greater than underutilized legume *Mucuna pruriens* var *pruriens* (0.30 ± 0.03 g100g^{-1}) (V R Mohan et al., 2010). Phytic acid was ranged from 0.563±0.15 to 0.814 ± 0.29 g 100g^{-1} with maximum was recorded in *Alysicarpus vaginalis*where as *Alysicarpus monilifer* showed the minimum amount. It can be comparable to other wild legumes *Indigofera linifolia* (0.39 ± 0.12 g100g^{-1}), *Sesbania bispinosa* (0.46 ± 0.20 g100g^{-1}) (P.Sidhhuraju et al., 1995) and *Rhynchosia cana* (0.392 ± 0.99 g100g^{-1}) (Kalidass and Mohan, 2012). It was approximately equivalent to cultivated legume *Vigna mungo* L Hepper (0.338 ± 1.26 g 100 g$^{-1)}$ (V R Mohan et al., 2010).Observing the amount of antinutrients, it can be said that they are well within the tolerable limits and can also be eliminated by some processing techniques such as cooking, autoclaving, sprouting to a certain extent(Table 2).

Table 1: Nutritional profile

Sr.No	Species	Total proteins *	Total carbohydrates*	Total free amino acids*	Total lipids*
1	*Alysicarpus vaginalis*	14.19^{a}±0.65	41.91^{a}±0.76	1.97^{a} ±0.52	8.37 ^{a} ±0.35
2	*Alysicarpus monilifer*	16.05^{b}±0.86	31.86 ^{b}±1.10	2.01^{a}±1.44	2.47 ^{b} ± 0.32
3	*Alysicarpus tetragonolobus var tetragonolobus*	13.80^{a}±0.40	51.15^{C} ±0.52	4.4 ^{b}±1	5.57 ^{c} ± 0.06

* Values are expressed in g 100 g^{-1} dry weight.

[1] Values are expressed as means of triplicate determination ± Standard Deviation (n=3)

[2] Values in the same column with different alphabet superscript are significantly different from each other (P < 0.05) according to Tukeys multiple comparison test.

Table 2: Antinutritional profile

Sr.No	Species	Total free phenols*	Tannins*	Phytic acid*
1	*Alysicarpus vaginalis*	0.57[a]±0.76	0.55 [a] ± 0.60	0.814[a]±0.29
2	*Alysicarpus monilifer*	0.65[a]±0.36	1.11 [a] ± 0.11	0.563[a]±0.15
3	*Alysicarpus tetragonolobus var tetragonolobus*	0.64[a]±0.28	0.50 [a] ± 0.40	0.613[a]± 0.19

* Values are expressed in g100 g^{-1} dry weight.

[1] Values are expressed as means of triplicate determination ± Standard Deviation (n=3)

[2] Values in the same column with same alphabet superscript are not significantly different from each other (P>0.05) according to Tukeys multiple comparison test.

CONCLUSION

Species of *Alysicarpus* contains perceptible amount of proteins and other nutrients whereas antinutrients are well within the confines. In view of this fact, *Alysicarpus* species, being a wild underutilized legume, might be used as an alternative source of nutrients to the economically backward peoples and may solve a problem of nutrient deficiency to some extent.

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