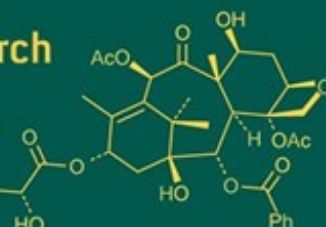
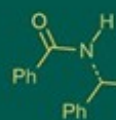


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
Indexing: Embase
IJABR 2026; SP-10(10): 366-370
www.biochemjournal.com
Received: 25-07-2026
Accepted: 20-09-2026
Published: 03-10-2026

The names and affiliations of all authors are provided below, following the references.

Effect of processing methods on β -ODAP content in Grasspea

Shivam G Navale¹, Vandana S Madke², Shanti R Patil³, Sapana B Baviskar⁴, PV Shende⁵, Santosh B Bankar⁶, SA Patil⁷, Bhushan R Pawar⁸, Saurabh D Shinde⁹, Vandana B Kalamkar¹⁰

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i10Se.10301>

ABSTRACT

Grass pea (*Lathyrus sativus* L.) is an important pulse crop adapted to marginal environments, but the presence of the neurotoxic non-protein amino acid β -N-oxalyl-L- α , β -diaminopropionic acid (β -ODAP) limits its wider utilization as food. Processing methods can play an important role in reducing β -ODAP concentration and improving the safety of grass pea for consumption. The present investigation was conducted during Rabi 2024–25 at the Research Farm of the Agricultural Botany Section, College of Agriculture, Nagpur, to evaluate the effect of different processing methods on β -ODAP content in *Lathyrus* mutants. Twenty-four mutant lines along with NLK-73 as parent and Ratan as check were evaluated for β -ODAP content under unprocessed and four processing treatments, namely, boiling, soaking, roasting and sun-drying. β -ODAP content was estimated using the method suggested by Briggs *et al.* (1983). Considerable variation was observed among mutant lines and processing treatments. Under unprocessed conditions, β -ODAP content ranged from 0.146 to 0.247 per cent. NLM-1 recorded the lowest β -ODAP content (0.146%), followed by NLM-7 (0.147%), NLM-13 (0.148%) and NLM-5 (0.151%). Among processing treatments, boiling resulted in the greatest reduction, with values ranging from 0.118 to 0.207 per cent, followed by soaking (0.122–0.222%), roasting (0.136–0.232%) and sun-drying (0.144–0.246%). NLM-1 consistently recorded low β -ODAP content under all processing treatments and showed the lowest value after boiling (0.118%). The overall effectiveness of the processing methods in reducing β -ODAP followed the order boiling > soaking > roasting > sun-drying. The findings indicate that selection of low-ODAP mutant genotypes combined with appropriate processing, particularly boiling, can contribute to improving the nutritional safety and utilization of *Lathyrus*.

Keywords: *Lathyrus sativus*, grass pea, β -ODAP, mutants, boiling, soaking, roasting, sun-drying

Introduction

Grass pea (*Lathyrus sativus* L.), commonly known as lathyrus or khesari, is an important pulse crop cultivated particularly under marginal and stress-prone environments. The crop possesses considerable adaptability to drought and other adverse environmental conditions and therefore serves as an important food and fodder resource in areas where other pulse crops may perform poorly. Its seeds are nutritionally valuable and contain substantial amounts of protein and carbohydrates.

Despite its agronomic importance, the presence of β -N-oxalyl-L- α , β -diaminopropionic acid (β -ODAP), also known as BOAA, is a major limitation to the wider utilization of grass pea as a food crop. β -ODAP is a neurotoxic non-protein amino acid associated with neurolathyrism when grass pea is consumed excessively over prolonged periods. Traditional grass pea types may contain relatively high concentrations of β -ODAP, and therefore development of low-ODAP genotypes has become an important objective of grass pea improvement programmes.

Genetic variability for β -ODAP content provides an opportunity for developing safer grass pea cultivars. Mutation breeding is particularly useful for generating novel genetic variability and identifying mutant lines possessing desirable traits, including reduced β -ODAP content. The thesis material used in the present study consisted of 24 mutant lines along with the parent NLK-73 and check Ratan, and considerable variability for β -ODAP was observed among the genotypes.

In addition to genetic improvement, appropriate food-processing techniques can contribute to reducing β -ODAP concentration in grass pea seeds. Traditional methods such as soaking, boiling, roasting and drying are commonly used during preparation of pulses. Previous studies have reported that processing can reduce β -ODAP concentration, with the extent of reduction depending on the processing technique. Soaking facilitates leaching of water-soluble compounds, whereas boiling combines heat treatment and leaching and may

Corresponding Author:
Shivam G Navale
PG Scholar, Genetics and Plant Breeding, College of Agriculture, Nagpur, Maharashtra, India

therefore result in greater reduction. Roasting involves dry heat and generally produces comparatively lower reduction, while drying mainly removes moisture and may have limited effect on β -ODAP.

Akalu *et al.* (1998) [1] reported substantial reductions in β -ODAP following roasting and frying treatments. Girma *et al.* (2011) [2] also reported that combinations of soaking, heating, roasting and autoclaving could considerably reduce β -ODAP concentration. More recent studies have further emphasized the importance of processing and pretreatment techniques for reducing β -ODAP and other antinutritional factors in grass pea.

Although genetic improvement for low β -ODAP is important, information on the response of individual mutant genotypes to commonly used processing methods is also useful for developing safer food products. Therefore, the present investigation was undertaken to evaluate the effect of different processing methods on β -ODAP content in *Lathyrus* mutants and to identify mutant lines maintaining low β -ODAP concentration following processing.

Materials and Methods

The experiment was conducted during Rabi 2024–25 at the Research Farm of the Agricultural Botany Section, College of Agriculture, Nagpur. The experimental material comprised 24 mutant lines of *Lathyrus sativus* L., along with NLK-73 as parent and Ratan as the check variety. The objective was to evaluate variation in β -ODAP content among mutant lines and to determine the effect of different processing methods on its concentration.

Four processing treatments were used along with an unprocessed control, viz., unprocessed, soaking, boiling, roasting and sun-drying. For the soaking treatment, seeds were soaked in water for 8 hours. For boiling, 100 grains of each genotype were cooked in water at 100 °C for 30 minutes on a hot plate. For roasting, 100 grains of each genotype were roasted in a metal frying pan until the seeds became brown. For sun-drying, water-soaked seeds were removed and dried under sunlight for approximately 7–8 hours per day for 2–3 days until the moisture content reached approximately 8–10 per cent on dry basis.

For estimation of β -ODAP, the seeds were oven-dried and ground into a fine powder. A 0.5 g sample was extracted with 10 ml of 60% ethanol for 45 minutes followed by centrifugation at 3000 rpm for 15 minutes. Two millilitres of the supernatant were hydrolysed using 4 ml of 3N KOH for 30 minutes. An aliquot of the hydrolysed extract was reacted with OPT reagent and incubated until colour development. Absorbance was recorded at 425 nm using a Systronics spectrophotometer. β -ODAP content was estimated following Briggs *et al.* (1983) [3].

The β -ODAP content was expressed as percentage. The observations obtained under different processing treatments were compared to determine the magnitude of reduction in β -ODAP content among mutant lines.

Results and Discussion

The results demonstrated considerable variation in β -ODAP content among the *Lathyrus* mutant lines and also showed clear differences in the response of the genotypes to different processing methods. The variation observed among the mutant lines indicates the presence of genetic variability for β -ODAP content, which provides opportunities for identifying low-ODAP genotypes. The thesis also recorded high genetic variability for ODAP content and high heritability coupled with high genetic advance, suggesting the usefulness of selection for improvement of this quality trait.

Under unprocessed conditions, β -ODAP content ranged from 0.146 to 0.247 per cent. The lowest β -ODAP concentration was recorded in NLM-1 (0.146%), followed by NLM-7 (0.147%), NLM-13 (0.148%) and NLM-5 (0.151%). NLM-18 also recorded comparatively low β -ODAP content (0.162%). In contrast, the parent NLK-73 recorded 0.247 per cent, while the check Ratan recorded 0.212 per cent. These results demonstrate substantial differences among the mutant genotypes for β -ODAP concentration.

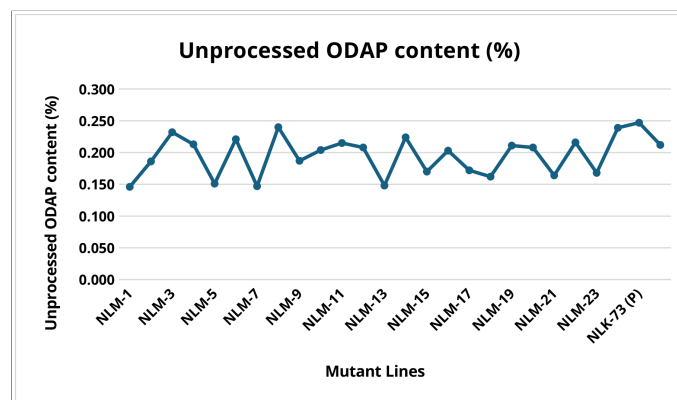


Figure 1. Unprocessed ODAP content (%)

The observed genetic variation is important because the development of low-ODAP genotypes represents one of the major approaches for improving the food safety of grass pea. Similar genetic variability in β -ODAP has been reported among grass pea accessions. Mekonen *et al.* (2024) [4], for example, reported considerable variation in β -ODAP content among grass pea accessions and emphasized the possibility of selecting low-ODAP genotypes.

Boiling resulted in the greatest reduction in β -ODAP content among all processing treatments. Following boiling, β -ODAP values ranged from 0.118 to 0.207 per cent. NLM-1 recorded the lowest value (0.118%), followed by NLM-7 and NLM-13 (0.120% each), NLM-5 (0.123%) and NLM-21 (0.128%). The check Ratan recorded 0.176 per cent after boiling, while NLK-73 recorded 0.207 per cent. Thus, boiling substantially reduced β -ODAP concentration across the mutant lines.

The greater reduction following boiling may be attributed to the combined effect of heat and water-mediated leaching of the water-soluble β -ODAP from the seeds into the cooking medium. The result is in agreement with earlier reports indicating that cooking treatments can substantially decrease β -ODAP concentration in grass pea. Barpete *et al.* (2021) [5] also reported an effect of cooking methods on β -ODAP concentration in grass pea grains.

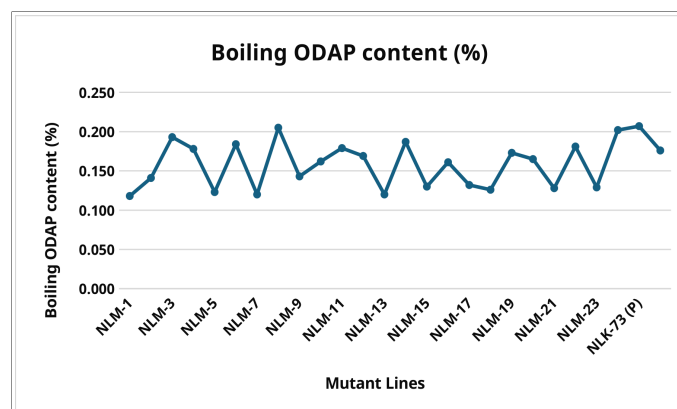


Figure 2. Boiling ODAP content (%)

Soaking resulted in the second-highest reduction in β -ODAP content. The β -ODAP concentration after soaking ranged from 0.122 to 0.222 per cent. NLM-1 recorded the lowest value (0.122%), followed by NLM-13 (0.129%), NLM-7 (0.129%) and NLM-5 (0.131%). Ratan recorded 0.192 per cent after soaking, whereas NLK-73 recorded 0.222 per cent. The reduction following soaking may be associated with diffusion and leaching of water-soluble β -ODAP into the soaking water. The magnitude of reduction was lower than that obtained with boiling, indicating that heat treatment in combination with water enhanced β -ODAP removal.

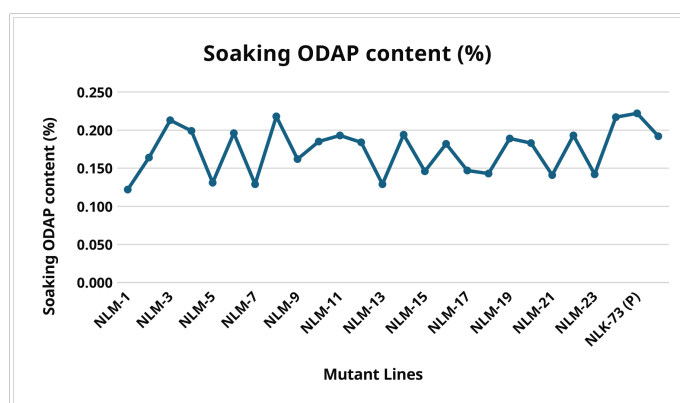


Figure 3. Soaking ODAP content (%)

Roasting resulted in a comparatively lower reduction in β -ODAP content. Values after roasting ranged from 0.136 to 0.232 per cent. NLM-7 recorded the lowest β -ODAP content (0.136%), followed by NLM-1 (0.137%), NLM-13 (0.139%), NLM-5 (0.144%) and NLM-18 (0.152%). Ratan recorded 0.203 per cent, while NLK-73 recorded 0.232 per cent. The lower reduction observed under roasting may be related to the absence of a water medium for leaching. Akalu *et al.* (1998) [1] reported reductions in β -ODAP following roasting and other thermal treatments, while Girma *et al.* (2011) [2] also demonstrated that processing combinations involving heating could reduce β -ODAP levels.

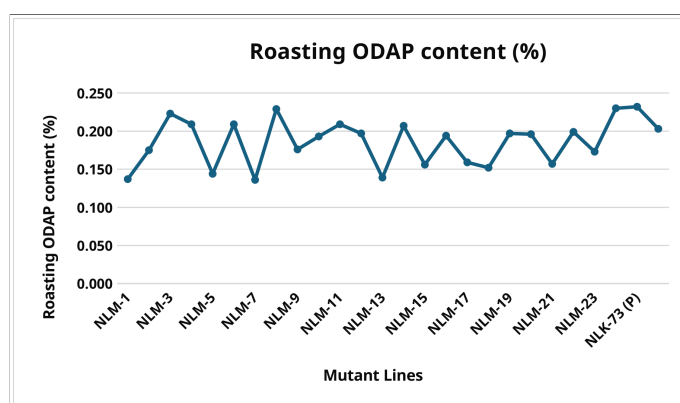


Figure 4. Soaking ODAP content (%)

Sun-drying showed the least reduction in β -ODAP concentration. Values after sun-drying ranged from 0.144 to 0.246 per cent. NLM-1 recorded the lowest value (0.144%), followed by NLM-7 (0.1469%), NLM-13 (0.147%), NLM-5 (0.150%) and NLM-18 (0.161%). The check Ratan recorded 0.211 per cent and NLK-73 recorded 0.246 per

cent. The values under sun-drying were generally close to those of unprocessed seeds, indicating that drying alone had limited influence on β -ODAP concentration. This may be because the treatment primarily removes moisture without providing sufficient opportunity for leaching of the water-soluble toxin.

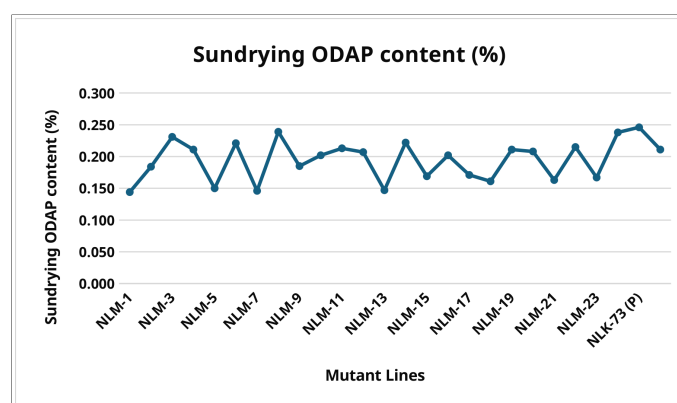


Figure 5. Sundrying ODAP content (%)

The mean β -ODAP concentration across the experimental material was 0.196 per cent under unprocessed conditions, which decreased to 0.160 per cent after boiling, 0.170 per cent after soaking, 0.180 per cent after roasting and 0.195 per cent after sun-drying. Thus, the overall effectiveness of the processing treatments in reducing β -ODAP followed the order boiling > soaking > roasting > sun-drying. The results clearly demonstrate that processing method strongly influences the final β -ODAP concentration of grass pea seeds.

An important observation was the consistency of low β -ODAP performance in some mutant lines across processing treatments. NLM-1 showed the lowest β -ODAP content under unprocessed conditions (0.146%) and retained the lowest value after boiling (0.118%), soaking (0.122%), roasting (0.137%) and sun-drying (0.144%). Similarly, NLM-7, NLM-13 and NLM-5 consistently maintained comparatively low β -ODAP concentrations across the processing treatments. This indicates that genetic background and processing method both contribute to the final β -ODAP concentration.

The combination of naturally low β -ODAP genotypes with effective processing methods is therefore particularly relevant for improving the food quality of *Lathyrus*. Selection of mutant lines possessing inherently low β -ODAP concentration can reduce the initial toxin level, while appropriate household processing can further reduce the remaining β -ODAP. The present findings therefore support the use of low-ODAP mutants such as NLM-1, NLM-7, NLM-13 and NLM-5 as useful genetic resources for future *Lathyrus* improvement programmes.

Table 1. ODAP content in unprocessed and processed lathyrus mutant lines

Mutant Lines	Unprocessed ODAP content (%)	Processed ODAP content (%)			
		Boiling	Soaking	Roasting	Sundrying
NLM-1	0.146	0.118	0.122	0.137	0.144
NLM-2	0.186	0.141	0.164	0.175	0.184
NLM-3	0.232	0.193	0.213	0.223	0.231
NLM-4	0.213	0.178	0.199	0.209	0.211
NLM-5	0.151	0.123	0.131	0.144	0.150
NLM-6	0.221	0.184	0.196	0.209	0.221
NLM-7	0.147	0.120	0.129	0.136	0.146
NLM-8	0.240	0.205	0.218	0.229	0.239
NLM-9	0.187	0.143	0.162	0.176	0.185
NLM-10	0.204	0.162	0.185	0.193	0.202

(continued on next page)

Mutant Lines	Unprocessed ODAP content (%)	Processed ODAP content (%)			
		Boiling	Soaking	Roasting	Sundrying
NLM-11	0.215	0.179	0.193	0.209	0.213
NLM-12	0.208	0.169	0.184	0.197	0.207
NLM-13	0.148	0.120	0.129	0.139	0.147
NLM-14	0.224	0.187	0.194	0.207	0.222
NLM-15	0.170	0.130	0.146	0.156	0.169
NLM-16	0.203	0.161	0.182	0.194	0.202
NLM-17	0.172	0.132	0.147	0.159	0.171
NLM-18	0.162	0.126	0.143	0.152	0.161
NLM-19	0.211	0.173	0.189	0.197	0.211
NLM-20	0.208	0.165	0.183	0.196	0.208
NLM-21	0.164	0.128	0.141	0.157	0.163
NLM-22	0.216	0.181	0.193	0.199	0.215
NLM-23	0.168	0.129	0.142	0.173	0.167
NLM-24	0.239	0.202	0.217	0.23	0.238
NLK-73 (P)	0.247	0.207	0.222	0.232	0.246
Ratan (C)	0.212	0.176	0.192	0.203	0.211
mean	0.196	0.16	0.17	0.18	0.195
$SE_m \pm$	0.003	0.005	0.005	0.0007	0.001
CV (%)	3.10	4.96	4.64	0.65	1.49

Conclusion

The present investigation demonstrated considerable variation in β -ODAP content among *Lathyrus* mutant lines and confirmed that processing methods substantially influence the final β -ODAP concentration of seeds. Among the processing treatments evaluated, boiling resulted in the greatest reduction in β -ODAP content, followed by soaking, roasting and sun-drying. The mean β -ODAP content decreased from 0.196 per cent in unprocessed seeds to 0.160 per cent after boiling, 0.170 per cent after soaking, 0.180 per cent after roasting and 0.195 per cent after sun-drying.

Among the mutant lines, NLM-1, NLM-7, NLM-13 and NLM-5 recorded consistently low β -ODAP content and maintained their comparatively low values after processing. NLM-1 recorded the lowest β -ODAP content under unprocessed conditions (0.146%) and after boiling (0.118%). The results indicate that the use of genetically low-ODAP mutants together with effective processing practices, particularly boiling, can contribute to reducing β -ODAP concentration and improving the food safety of *Lathyrus*. These low-ODAP mutants may also serve as useful genetic resources in breeding programmes aimed at developing nutritionally safer grass pea cultivars.

References

- Akalu G, Johansson G, Nair BM. Effect of processing on the content of β -N-oxalyl-L- α , β -diaminopropionic acid (β -ODAP) in grass pea (*Lathyrus sativus*) seeds and flour as determined by flow injection analysis. *Food Chemistry*. 1998;62(2):233–237.
- Girma A, Tefera B, Dadi L. Grasspea and neurolathyrism: Farmers' perception on its consumption and protective measure in North Shewa, Ethiopia. *Food and Chemical Toxicology*. 2011;49(3):668–672.
- Briggs CJ, Parreno N, Campbell CG. Phytochemical assessment of *Lathyrus* species for neurotoxic agent β -N-oxalyl-L- α , β -diaminopropionic acid. *Planta Medica*. 1983;47(3):188–190.

- Mekonen DA, Abraham A, Oselebe H, Afiukwa C, Abebe TD, Zemene A, Tesema AA. Estimation of ODAP contents and heritability of quantitative traits in grass pea (*Lathyrus sativus* L.) accessions from North-Western Ethiopia. *Cogent Food & Agriculture*. 2024;10(1):Article 2319174.
- Barpete S, Gupta P, Khawar KM, Kumar S. Effect of cooking methods on protein content and neurotoxin (β -ODAP) concentration in grass pea (*Lathyrus sativus* L.) grains. *CYTA – Journal of Food*. 2021;19(1):448–456.
- Kuma B, Shiferaw A. Review on pretreatment techniques of grass pea seeds for reduction of antinutritional factors and β -diaminopropionic (β -ODAP) contents from seeds. *American Journal of Plant Biology*. 2024;9(1):9–15.
- Kumar S, Bejiga G, Ahmed S, Nakkoul H, Sarkar A. Genetic improvement of grass pea for low neurotoxin (β -ODAP) content. *Food and Chemical Toxicology*. 2011;49(3):589–600.
- Lakra LP, Patel YK. Effect of soaking and drying on recovery of dhal (*Lathyrus sativus* variety Mahateora). *International Journal of Food and Nutritional Sciences*. 2022;11(8).
- Yerra S, Putta S, Kilari EK. The role of food processing techniques in the detoxification of ODAP in *Lathyrus sativus*. *International Journal of Information Research and Review*. 2016;3(8):2819–2823.

How to cite this article: Navale SG, Madke VS, Patil SR, Baviskar SB, Shende P, Bankar SB, et al. Effect of processing methods on β -ODAP content in Grasspea. *International Journal of Advanced Biochemistry Research*. 2026;SP-10(10):366-370. doi: <https://www.doi.org/10.33545/26174693.2026.v10.i10Se.10301>

Authors

Shivam G Navale

PG Scholar, Genetics and Plant Breeding, College of Agriculture, Nagpur, Maharashtra, India

Vandana S Madke

Assistant Professor, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

Shanti R Patil

Assistant Professor, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

Sapana B Baviskar

Assistant Professor, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

PV Shende

Professor, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

Santosh B Bankar

PG Scholar, Genetics and Plant Breeding, College of Agriculture, Nagpur, Maharashtra, India

SA Patil

Assistant Professor, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

Bhushan R Pawar

PG Scholar, Genetics and Plant Breeding, College of Agriculture, Nagpur, Maharashtra, India

Saurabh D Shinde

PG Scholar, Plant Pathology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, Ratnagiri, Maharashtra, India

Vandana B Kalamkar

Senior Research Assistant, Genetics and Plant Breeding, College of Agriculture, Nagpur, Maharashtra, India