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Review Article

A Review on Safety of Detoxified Kesari Dal New Variants for Daily Consumption

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Author's Contribution

Sunil Kumar Kadiri has drafted the manuscript. Golla Nikitha, Daram Devi Sri Satya, Rasapelly Ramesh Kumar has revised and finalized the manuscript. All authors read and approved the manuscript.

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ABSTRACT

In this review, the safety of new variants of Kesari dal for human consumption has been presented and discussed. Kesari dal consumption in India before 2016 known to cause a neurodegenerative disorder called as Lathyrism which causes severe muscle paralysis due to the presence of high amounts of Oxalyl-diamino-propionic acid (ODAP) in *Lathyrus sativus* (Kesari dal) seeds. However the currently available new variants of Kesari dal i.e Ratan and Prateek has low ODAP content and is safer for human consumption. Indian government is supporting the farmers for increased production of these two safer variants of *Lathyrus sativus* to overcome the financial needs of the farmers during drought and pandemic times.

Keywords: Kesari dal, lathyrism, Oxalyl-diamino-propionic acid, Ratan, Prateek.

INTRODUCTION

An attempt was made to break the myth of many farmers and poor villagers through this review article that the current varieties of *Lathyrus Sativus* seeds are safe for daily consumption. Till today in many rural parts of Uttar Pradesh and Bihar it is believed that kesari dal excess consumption leads to paralysis. Lathyrism is a neurodegenerative disorder manifested by spastic paraplegia following constant consumption of *Lathyrus Sativus* (LS) [1]. *Lathyrus Sativus* is a solid plant which develops quite easily [2]. Grains of LS are boiled in water to make a dal and its flour is utilized in the preparation of bread [3]. During times of shortage of food like floods or dry seasons or recent Covid-19 pandemic, LS is utilized as the staple food, particularly by poor villagers [4]. Three methods of presentation of neurolathyrism have been revealed, the commonest being an acute onset of leg weakness while going to sleep or when awakening from sleep [5,6]. It is usually found in Asia and East Africa and affects men, aged 25-40 years, more than females [7]. It influences generally people in Bangladesh, India, Nepal, Pakistan and Algeria

however then tracked down in Spain, France, Australia and Italy [8,9]. This illness influences ponies and cows including man. Beta-oxalyl-amino-L-alanine acid (BOAA), an stimulatory neurotoxin and glutamate activator was recognized as the ingredient of the chickling pea liable for sickness [10]. BOAA seems to elicit its effects through mitochondrial toxicity [11,12]. The primary data of sickness has been believed as a antiquated Hindu literature known as Bhavaprakasa but also depicted by Hippocrates all over 400 BC [13]. An overview in our country in 1833 revealed the infection in unfortunate people during a dry spell however it was only after 1873 that Cantani in Italy named the disorder as lathyrism [14]. Neurophysiologic findings propose foremost horn cell harm, and neuropathologic findings have shown myelin damage in the corticospinal tract alongside front horn cell contribution [15]. Kesari dal's manufacturing and trading was restricted in India in 1961 for possessing a neurotoxin (BOAA) that leads to lathyrism [16] (Figure 1). The prohibition was lifted in 2016 after reports from ICMR and FSSAI said its usage in more lesser amounts was safer. Bhojpur, Aurangand, Rohtash, Navada, Jahanabad, east Champaran and Nalanda districts are developing dal variations with lower content of the neurotoxin, Oxalyldiaminopropionic acid (ODAP), under an errand by the branch of biotechnology. Under the program, the two variations, Ratan and Prateek exhibited in 3 districts of Bihar achieved ODAP content within the acceptable limit of 0.1% and prompted more significant turn outs. Following two years under the task, the average yield in Patna, Gaya and Lakhisarai was 12.01 quintals per hectare for Ratan , 11.5 quintals per hectare for Prateek and for regional varieties 9.9 quintals, as shown by the venture's advancement report. The more prominent yield and low ODAP levels when appeared differently in relation to nearby variations, and low info required in general for grass pea, expanded ranch earnings, a normal financial benefit of 27,500/hectare per season through its development in rice fallows, according to the report. It further more watched out for the lack of pulses, gave protein-rich eating regimen to the farmers and feed for domesticated animals.

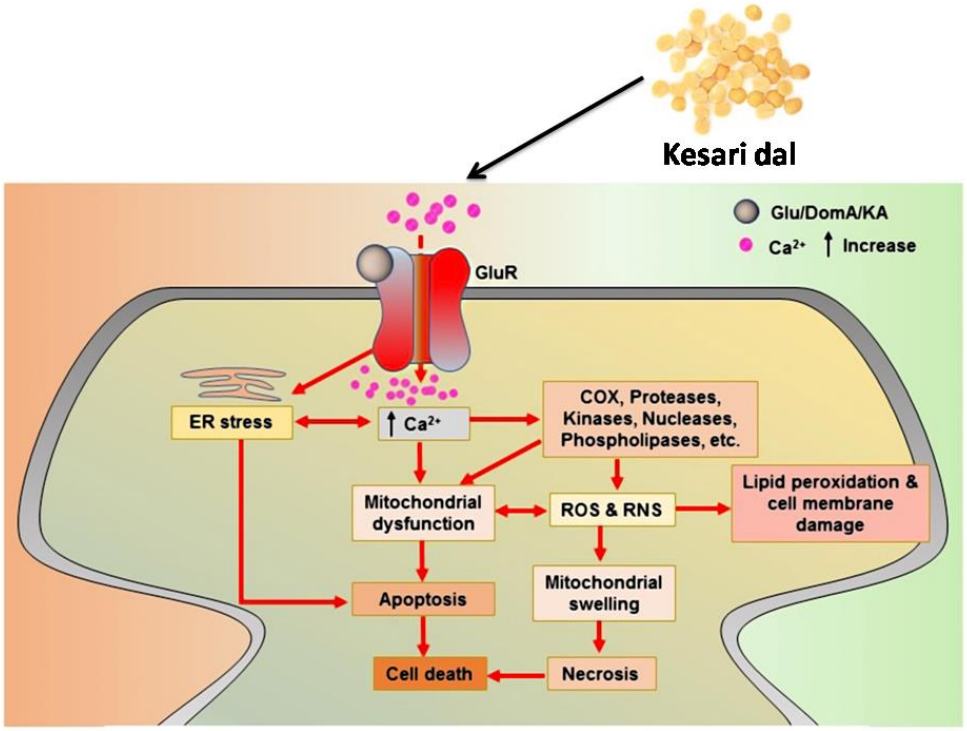

Figure 1: Mechanism of Mitochondrial dysfunction and free radical generation with excess consumption of Kesari dal subsequently damaging the cells.

INCEPTION OF LATHYRUS

Grass pea or Lathyrus sativus is found in North America, Eurasia, East Africa and South America. The inception of Lathyrus is dark, in any case, its accepted focus of beginning is Southwest and Central Asia. Being a colder time of year season crop it inclines toward a quiet climate with brilliant reception under climatic furthest points. By and large, the yield requires 15°C to 25 °C temperatures during planting to gathering of this reap. The yield is created as a rain fed crop on remaining dampness. Anyway, under high dampness stresses water system at 60 to 70 days subsequent to planting may be compensated concerning production. For regular planted crops one hand-weeding at 30 to 35 days right after planting (expecting soil conditions grant). Weeds can moreover be managed capably by fluchloralin (Basalin) 45 EC spray @ 0.75-1 kg a.i./ha in 750 to 1000 liters of water as pre-plant joining. Lathyrus sativus or Grass pea

seeds are used in Ethiopia, India and other arising countries as a component of the eating routine of the poor amidst starvation.

FIELD CULTIVATION OF KESARI DAL

Lathyrus sativus is widely developed in Afghanistan, Iraq, Syria, Iran, and Lebanon in Middle East, France and Ethiopia, Algeria, Libya, Egypt and Morocco in Africa Spain in Europe [17]. *Lathyrus sativus* is proliferated by seed. Few say inoculation is fundamental prior to planting, especially in virgin soil; others pronounce it seems superfluous. In a few temperate districts, Lathyrus is planted after rye, or on neglected land. Cultivating rates differ from 45 to 90 kg for every hectare relying upon the strategy for development, whether in the unadulterated stand or intercropped, the motive behind cropping (food or feed), and seed size. The yield comes up as a thick mass over the whole surface and under ideal natural circumstances can suppress out weeds. Aside from lime on corrosive soils, other nutrients are scarcely at any point required. Phosphorus application is suggested in India, Nepal ,Pakistan and Bangladesh, the Lathyrus yield might be planted as unadulterated or in a blended stand frequently into a standing rice crop one to about fourteen days before the rice is prepared to harvest. *Lathyrus sativus* is accounted for to add 67 kg for every hectare of nitrogen to the dirt from beneficial interaction (symbiosis) with Rhizobium species. Lathyrus develops best where the typical temperature is 10 to 25 °C and the typical rainfall is 400-650 mm (16-26 in) each year. The harvest can endure dry spell or floods however grows in moist soils (Figure 2). It endures an assortment of soil types from light sandy through loamy to weighty mud, and acid, neutral, or alkaline soils.

Figure 2: **A**. *Lathyrus sativus* seeds **B**. Rabi Crop Sowing in Uttar Pradesh **C**. Banned Kesari Dal Sold and consumed in Uttar Pradesh.

THE MONETARY SIGNIFICANCE OF LATHYRUS CULTIVATION IN INDIA

Grass pea is the third most significant cool-season pulse crop of India, possessing an area of 0.58 million ha with a annual production of 0.43 million tones. It is developed mostly in Maharashtra ,Bihar, West Bengal, Madhya Pradesh and Chhattisgarh. Most of this acreage (~ 70%) is shared by Chhattisgarh and the Maharashtra (Vidarbha district), which is a rice-rising locale where supplemental water system is accessible just for rice. Thusly, water isn't open for resulting winter crops, making grass pea the main option for a yield following rice. Lathyrus or Grass pea really endure ominous circumstances, including unreasonable moisture at planting, which is frequently trailed by moisture stress at advanced development stages. As a matter of fact, lathyrus is liked for development in such regions attributable to its strong nature. In the mid 1990s, the financial effect of Lathyrus utilization was surveyed in an random sample of 100 farmers from Bilaspur, Raipur and Bastar. This study uncovered that very nearly 60% of the rice producers included grass pea in their cropping system. A large portion of the farmers experienced subsistence

farming with smaller landholdings (of under 5 ha). Appreciable awareness was found among the rural group about the harmful impacts of grass pea utilization.

ADVERSE EFFECTS AND SAFETY

Lathyrus or Grass pea is dangerous when taken by mouth. It is noxious to nerves. It can cause muscle inflexibility, muscle fits, paralysis of the leg muscles, feeble heartbeat, diminished breathing, seizures, and death (Figure 3). Lathyrus or Grass pea poisoning and its complications are uncommon in western nations, yet they have been reported for over 100 years in Europe, Africa, and Asia. Regardless of the effort to ban the sale of *Lathyrus sativus* in a few provinces of India, distribution continues. To deactivate the toxic substance, various strategies have been attempted. Typically they include soa**k**ing the seeds water, followed by steaming or sun drying. Roasting the seeds at extremely high temperatures for twenty minutes additionally helps with obliterating the toxic substance. However, these strategies are simply 80 to 85% effective.

Figure 3: **Neurolathyrism. A.** A patient with lathyrism unable to lie supine because of severe spasticity; **B.** Neurological manifestations of lathyrism; **C.** *Lathyrus sativus*; **D.** Banned Kesari dal; E. Kesari dal variant with low levels of neurotoxin. F. Kesari dal with low content of neurotoxin and safest for human consumption

Worried over decreased production of pulses, taking into account two successive years of rain deficit, the public authority promoted cultivation of three drought-resistant new varieties of khesari dal, with low neurotoxin ODAP content, in classical regions [18]. Beginning around 1961, the sale and stockpile of khesari dal has been prohibited because of higher presence of destructive substance called ODAP which causes an irreversible neuromotor disorder called neurolathyrism [19,20,21]. The food safety regulator FSSAI has sought Health Ministrys approval to hold public consultation on approval of three new kesari dal varieties Ratan, Prateek and Mahateara having low ODAP (Figure 2). These three varieties have been delivered for general development in traditional Kesari developing region of the country [22]. ICAR is attempting to replace the traditional high ODAP containing varieties of Kesari with improved varieties. Ratan, Prateek and Mahateara grades of kesari dal have been created by Indian Council of Agricultural Research (ICAR) in a joint effort with State Agricultural Universities between 1995 and 2008 [23]. These varieties have ODAP content in the scope of 0.07-0.1 percent, which is alright for human utilization. This yield is utilized as dal for human utilization and furthermore as green grub for domesticated animals [24,25].

FUTURE PERSPECTIVE

Because of the government ban, there was a pessimistic insight among individuals about the Kesari dal and solid efforts are required to generate awareness about the fact that the new variants had extremely low amounts of ODAP. The project developed gradually spread among farmers that the variants with low ODAP content (Ratan and Prateek) are probably going to have more acceptability among individuals. In addition, the Bihar agricultural university also started a seed buy-back policy to develop an effective production chain of quality seeds. This additionally made developing the variants lucrative for farmers with seeds being purchased at the cost of 4,200 for each quintal.

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Legends for Figures

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