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EVALUATION OF ACUTE TOXICITY STUDIES OF DRAGON FRUIT (*Hylocereus undatus*) FLESH IN FINGERLINGS (*Labeo rohita*)

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Recently, the fruits of *Hylocereus undatus*, known as dragon fruit, have received much attention from growers worldwide. However, there is little toxicological information regarding the safety of repeated exposure to these fruits. The present study evaluated the toxicity of *H. undatus* fruit flesh after acute administration in fish. In the acute toxicity study, Fingerling were not fed during the experimental period. Various concentrations (100, 250, 500, 1000 and 2000mg/L) of the test solutions were prepared from *Hylocereus undatus* stock solutions. A group of 10 laboratory acclimatized fingerling of a particular species having the same weight, size and age were introduced into each test concentration of *Hylocereus undatus*. After 24, 48, 72 and 96hrs monitor the mortality of fish. LC_{50} values were 48, 72 and 96hrs were more than 371.53mg/l, 3.46mg/l and 1.41mg/l observed respectively. The toxicity study which is essential for an adaptation of the traditional medicine was conducted to identify the tolerance limits of *Hylocereus undatus* fruit extract. According the obtained LD_{50} (446.68mg/L) values. These findings support the common practice of administration of *Hylocereus undatus* fruit as a medicinal decoction in herbal medicine.

Keywords: *Hylocereus undatus*; acute toxicity study; various concentrations.

1. INTRODUCTION

Hylocereus undatus is also known as Dragon Fruit and Pitaya belonging to family Cactaceae. *Hylocereus undatus* fruit is commonly used as a food. It is a native fruit originating from Mexico and Central and South America.1 It has been cultivated in Vietnam for at least 100 years, following by the French.

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Hylocereus undatus dragon fruit is a pink skin with white flesh [1]. Plants synthesize a variety of metabolites, some of which may be beneficial or potentially toxic to mankind [2]. Also, it has been true that pharmaceutical drugs may be therapeutic at one dose and toxic at another [3]. In order to ensure safety, there must be a study to show safety profiles of herbs claimed to be beneficial to humans and the animals before deciding to use them [4]. The selective uptake or accumulation of a particular xenobiotic in a specific tissue or cell, the inhibition of the normal export of a potentially toxic metabolite from a cell to the outside, and the activation of cellular receptors could lead to toxicity [5,6].

In modern drug development, about one-third of the drug candidates required high cost for its toxicity studies [7]. Despite its widespread use, little toxicological data is available regarding the safety of repeated exposure to *H. undatus* fruit. As part of a safety evaluation of *H. undatus* fruit, a toxicological study was thus carried out to investigate its acute toxicity (Mortality) in fingerlings of *Labeo rohita* after exposure of different time intervals.

2. MATERIALS ANDM METHODS

2.1 Collection and Acclimation of Experimental Fishes

Fingerlings of *Labeo rohita* (Average weight 4.70 ± 1.10 g) were procured from Fish farm, Thittai, Thanjavur District, Tamil Nadu, India, using cast net and maintained in the laboratory in a glass aquarium tank and acclimated in aerated tap water with continuous aeration for two weeks prior to experimentation.

2.2 Collection of *Hylocereus undatus* (Dragon Fruit)

The *Hylocereus undatus* or white-flesh with red peel dragon fruit purchased in Nilgiris fruit shop, Thanjavur, Tamil Nadu. The collected fruits were washed in water, cleaned well to remove all traces of insects, dust and other kinds of pollution. Cut off the crown of the dragon fruit and collected the white flesh. The collected flesh was used it in the next experiments.

2.3 Experimental Design

After acclimation healthy fish of *Labeo rohita* fingerling were chosen for the LC_{50} determination of *Hylocereus undatus* (Dragon fruit) flesh by static renewable bioassay. Fingerling were not fed during the experimental period. Various concentrations (100, 250, 500, 1000 and 2000mg/L) of the test solutions were prepared from *Hylocereus undatus* stock solutions. A group of 10 laboratory acclimatized fingerling of a particular species having the same weight, size and age were introduced into each test concentration of *Hylocereus undatus*. Triplicates and appropriate controls were maintained for each concentration. LC_{50} values were calculated, toxicity tests were conducted in accordance with the method recommended by Sprague [8]. Median lethal concentrations of 96 hrs were calculated by Finney's [9] probit analysis using SPSS Ver.20 Log10 Base calculation.

3. RESULTS

Table 1 shows the acute toxicity studies of *Hylocereus undatus* (Dragon fruit) extract on *Labeo rohita* fingerling. In 24hrs, there is no mortality was observed on treatment with different concertation ((100, 250, 500, 1000 and 2000mg/L) of *Hylocereus undatus* while 48hrs treatment showed 10% and 20% mortality were observed in 1000 and 2000mg/L respectively. Similarly, 72hrs treatment with different concertation ((100, 250, 500, 1000 and 2000mg/L) of *Hylocereus undatus* showed 30% and 50% mortality were observed in 1000 and 2000mg/L respectively while 96hrs treatment showed 10, 40 and 70% mortality were observed in 500, 000 and 2000 mg/L respectively.

3.1 Lethal Dose (LD_{50})

The animals having received *Hylocereus undatus* did not exhibit marked behavioral changes but showed weak and less active movement followed by gradual death. After 24, 48, 72 and 96hrs monitor the mortality of fish. LC50 values were 48, 72 and 96hrs were more than 371.53mg/l, 3.46mg/l and 1.41mg/l observed respectively. The LD_{50}, calculated from equation of probit-log dose (Figs. 1 and 2) of *Hylocereus undatus* was found to be 446.68 mg/L.

4. DISCUSSION

There is increasing concern about the safety of use of the medicinal plants. There are general and herb specific concern regarding medicinal plants and their ability to produce toxicity and adverse effects [10]. Toxicity of medicinal plants may be related to the mixture of active compounds that they contain and stability of active ingredients in tissues. Phytotherapy having its pervasive use is substantiated by the affordability, its medicinal value and the belief of their harmlessness [11].

Table 1. Acute toxicity studies of *Hylocereus undatus* (Dragon fruit) extract on *Labeo rohita* fingerling

Concentration (mg/L)	Log10 Concentration (mg/L)	Exposed fish	24 hours		48 hours		72 hours		96 hours	
			# of mortality	% of mortality	# of mortality	% of mortality	# of mortality	% of mortality	# of mortality	% of mortality
100	2.00	10	0	0	0	0	0	0	0	0
250	2.39	10	0	0	0	0	0	0	0	0
500	2.69	10	0	0	0	0	0	0	1	10
1000	3.00	10	0	0	1	10	3	30	4	40
2000	3.30	10	0	0	2	20	5	50	7	70

Table 2. Determination of LD_{50} values (96hrs) by Finney method of the aqueous extract of *Hylocereus undatus* in fish

Oral dose (mg/kg)	Log10 Concentration (mg/L)	Dead/Total	% of Death	Probit
100	2.00	0/10	0	0
250	2.39	0/10	0	0
500	2.69	1/10	10	3.72
1000	3.00	4/10	40	4.75
2000	3.30	7/10	70	5.52

Table 3. Determination of LC_{50} of *Hylocereus undatus* (Dragon fruit) extract on *Labeo rohita* fingerling

Hours	LC_{50} (mg/L)	Regression equation	R^2 value
24	Nil	Nil	Nil
48	5.57	y = 15.172x - 34.654	0.7412
72	3.54	y = 39.484x - 89.802	0.7577
96	3.15	y = 54.844x - 122.96	0.8331

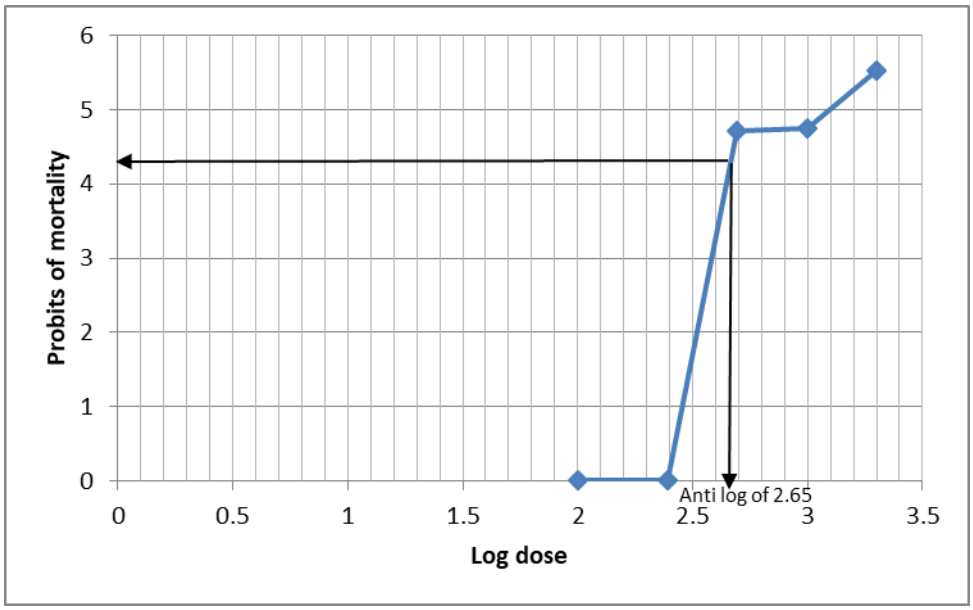
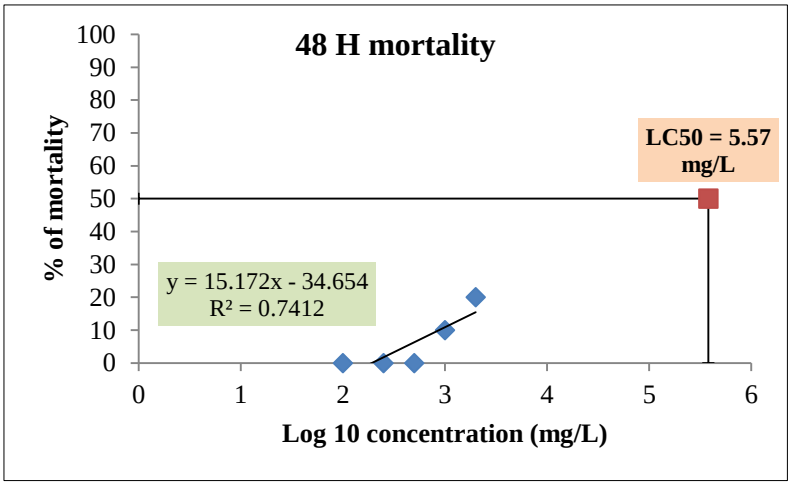
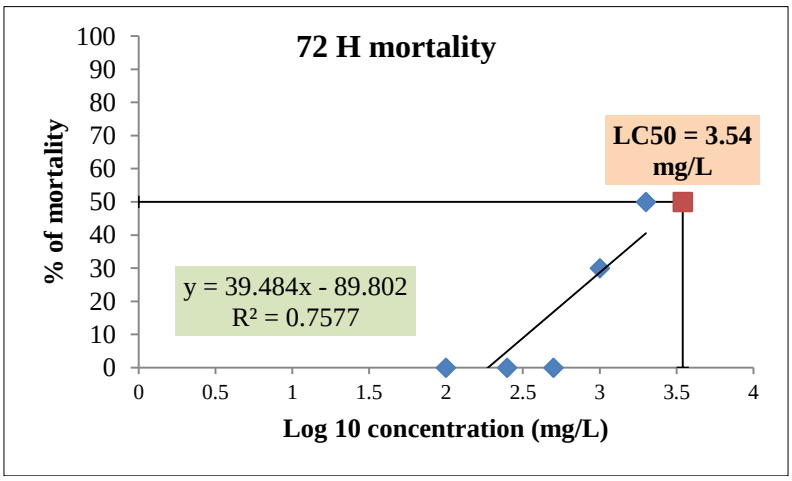


Fig. 1. Shows the probits vs log concentration





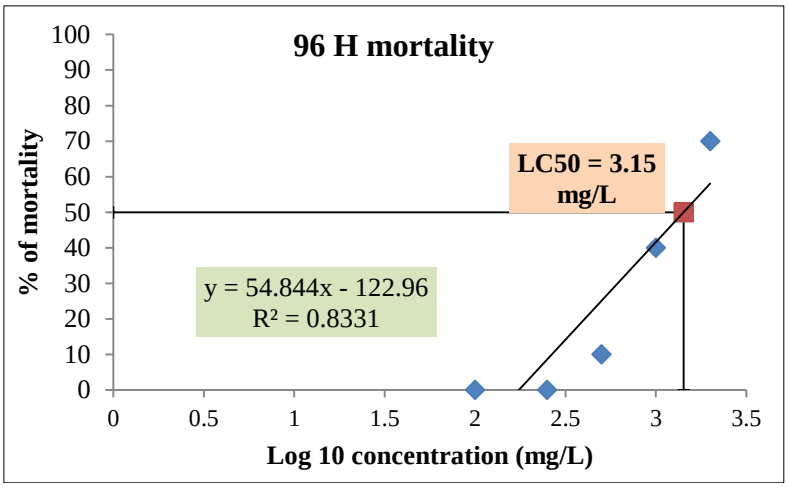


Fig. 2. Acute toxicity studies of *Hylocereus undatus* (Dragon fruit) extract on *Labeo rohita* fingerling

The toxic agent is mostly released from sources like leaf, fruits, and barks of plants, animals, and microorganisms. As a toxic agent, it will transmit the toxic substance through the various modes of transmission mainly via direct contact. A toxicology test is necessary, not only for allopathic medicine but also for complementary and alternative medicine to discover any adverse effects which are not known until the signs and symptoms develop upon high consumption [12]. The assessment of toxicity using acute toxicity bioassay can prove the safety of traditional medicine using *Hylocereus undatus* and promote its consumption.

Accordingly most of the herbal preparations do not have drug regulatory approval to demonstrate their safety and efficacy [13]. It is therefore pertinent to establish the safety of medicinal plant preparations through toxicological assessments. Liver, being the primary organ for the detoxification and distribution of drugs, and the kidney are the major excretory organ, could be assessed to establish the safety of a substance [14]. The result of the current study showed that the LD_{50} of the crude aqueous extract of the plant was found to be greater than 446.68mg/kg, which may be accepted as safe [15].

These results are similar to those of Ribeiro [16], who stated that the hydroethanolic extract of the jambu (*Spilanthes acmella*) roots in zebrafish can alter the behavior, and these behavioral changes begin with the increase of the swimming activity, which, according to Little et al. [17], is an indicator of the overall internal status of the animal. Exposure of the animal to a stress situation triggers its first defense mechanism, which most often is an escape behavior, to reduce the likelihood of death [18].

Everds et al. [19] state that in animal toxicity tests, animal stress is common and may lead to changes in body weight, food consumption, behavior, blood circulation, and reproductive functions. However, not all of these factors are usually evaluated in specific studies.

5. CONCLUSION

The findings of the present study demonstrated that LC_{50} values were 48, 72 and 96hrs were more than 371.53mg/l, 3.46mg/l and 1.41mg/l observed respectively. The toxicity study which is essential for an adaptation of the traditional medicine was conducted to identify the tolerance limits of *Hylocereus undatus* fruit extract. According the obtained LD_{50} (446.68mg/Kg) values. These findings support the common practice of administration of extract of *Hylocereus undatus* fruit as a medicinal decoction in herbal medicine. The minimal effective dose as 250mg/L may use for therapeutic dose. Based on the results from this study, it is therefore recommended that administration of up to 446.68mg/L of *Hylocereus undatus* are safe for human and animal use. The information obtained from this study can serve as a baseline for further pharmacological studies of these medicinal plants. Furthermore, phytochemical characterizations of *Hylocereus undatus* extracts would be beneficial.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of

knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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