



Effect of light and duration of exposure in counteracting aflatoxin B1 in broken rice

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Received: 9 December 2009; Accepted: 27 December 2010

ABSTRACT

Effect of exposure of aflatoxin (AF) for its reduction was studied under sunlight or UV light. The broken rice was artificially contaminated with aflatoxin B1 (209.99±4.39 ppb) and was exposed to either sunlight or UV light for different periods, viz. 0, 1, 2, 4, 8 and 16 h. The reduction in aflatoxin content in feedstuff was recorded with TLC method. It was revealed that both the type of exposure reduced the AF content and the reduction was proportion to the exposure period. After 16 h of exposure the per cent reduction in AF content was recorded to be 74.85 and 53.63 in sunlight and UV light, respectively. It could be concluded that the sunlight can be efficiently used in counteracting aflatoxin B1 in broken rice.

Key words: Aflatoxin, Counteraction, Sunlight, UV light

Aflatoxin (AF) is a major mycotoxin, contamination of which causes major economic losses in poultry production. It is estimated that as much as 25% of world's food grains are contaminated with several harmful mycotoxins (FAO 1979). Various methods to diminish the aflatoxin in the feed have been tried, including physical, chemical and herbal approaches. Ultra-violet rays and ionizing radiations are reported to be effective in destroying certain mycotoxins such as aflatoxin (Mohiuddin 2000) but the method has not been popular among the users probably, due to lack of simplicity. Therefore, there is a need to identify a simple, practical and economic method to detoxify aflatoxin in the feed adaptable in the field practice. With these facts in view, the present study was planned to evaluate the efficacy of sunlight or ultra-violet light in reducing aflatoxin in a common feedstuff, broken rice (BR).

MATERIALS AND METHODS

Toxin-free broken rice (900 g) was taken and was contaminated by mixing with known quantity of aflatoxin B1 (209.99±4.39 ppb) having a moisture content of 8.3%. The aflatoxin used in this study was previously produced in the laboratory by culturing *Aspergillus parasiticus* 'NRRL 2999' on broken rice (Shotwell *et al.* 1966). The whole broken rice was divided into 2 equal parts, one-half was used for sunlight exposure and another half for U.V light exposure. A

total of 18 aluminium trays were taken each containing 25 g of BR, six samples in triplicates (25 g each) for each treatment (sunlight or UV light). Each sample in triplicates was analyzed at different duration of exposure, viz. 0, 1, 2, 4, 8 and 16 hours. The contaminated BR (broken rice) was spread in thin layers (2–3 mm) under UV light. The aluminum trays containing BR were exposed to sunlight during the month of Jan/Feb in morning hours. The samples were analyzed quantitatively for the presence of aflatoxin B1 by adopting the method of TLC (Romer 1975). The mean values were compared and statistical analyses were done by Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

The mean aflatoxin B1 contents in the broken rice samples with two treatments i.e. sunlight or UV light and six durations of exposure are presented in the Table 1. The AFB1 content in the contaminated BR started declining significantly after 2 h of exposure under sunlight or UV light. It was observed that the toxin quantity gradually decreased as the duration of exposure was extended to 16 h. The highest % of reduction (74.85%) was recorded, when the contaminated rice was exposed to sunlight for 16 h of duration. Gowda *et al.* (2007) found hot air oven drying at 80°C for 6 h of aflatoxin B1 contaminated feed, which resulted in an average reduction of 57.60% in the toxin content. Whereas, Sun drying for 14 h (2 days exposure at 25–37°C ambient temperature) reduced the AFB1 content by 83.70%. Mani *et al.* (1987) reported that when AFB1 contaminated rice was exposed to sunlight at 40–45°C for 9 h, its aflatoxin content was reduced up to

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Table 1. Effect of sunlight and UV light treatment on the AFB1 content of broken rice

Duration (h)	Sunlight (ppb)	U/V light (ppb)	Reduction (%) UV light	Reduction (%) sun light
0	209.99 ^d ±4.39	209.99 ^d ±4.39	0.00	0.00
1	192.50 ^d ±3.16	209.99 ^d ±2.84	0.00	8.33
2	121.09 ^c ±3.02	172.08 ^c ±2.18	18.05	42.33
4	89.70 ^b ±4.03	151.66 ^{bc} ±2.05	27.78	57.28
8	77.58 ^b ±1.89	131.25 ^{ab} ±2.02	37.50	63.06
16	52.81 ^a ±1.26	97.37 ^a ±1.64	53.63	74.85

Means bearing at least one common superscript, column wise, do not differ significantly ($P < 0.05$).

30.9%. Waghray and Reddy (1995) reported that exposure of artificially infected maize to sunlight for 7 h, reduced aflatoxin B1 by 80%. Shantha *et al.* (1986) also reported that 14 h exposure to sunlight destroyed about 90% and 77% aflatoxin B1 added to ground nut flakes with and without fat whereas, only about 50% of the toxin was destroyed when present as a natural contaminant.

Similarly, when the contaminated BR was exposed to U.V

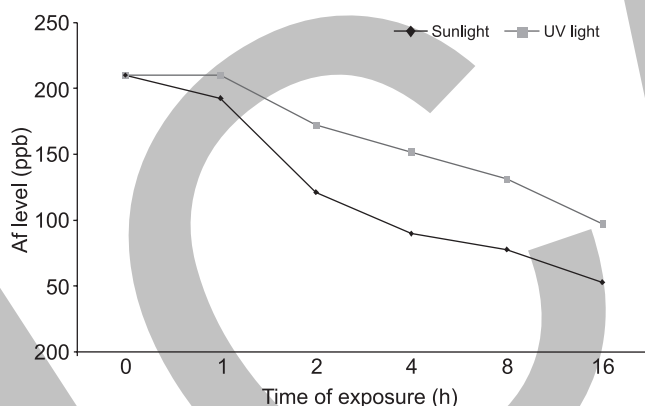


Fig. 1. Effect of light and duration of exposure on AFB1 content in broken rice.

light for various periods (0 to 16 h), the AFB1 content decreased significantly ($P < 0.05$). The toxin content gradually reduced as the duration of exposure increased, the highest reduction (53.63%) was recorded in 16 h of exposure.

When both the sources of light were compared the sunlight exposure was found to be more efficient in reducing the AF content in feed since under a given duration of exposure the

AF content in sunlight was always lower than that of UV light exposure. The effect of lights and duration of exposure in counteracting AF is depicted in Fig.1.

From the above experiment, it can be concluded that though both the sunlight and U V light are effective means of counteracting AFB1 in broken rice however, the former one is more effective. Looking into the application procedure, the sunlight treatment is also found to be simpler and thus, can be easily utilized in the field condition to counteract the AF.

ACKNOWLEDGEMENTS

The research investigation is part of the NATP Project 'ROPS-15'. Financial help received from the ICAR, New Delhi is greatly acknowledged. The authors also express their gratitude to the Director of Research (Veterinary), and Dean, Faculty of Veterinary Science, AAU for extending the facilities to carry out the experiment.

REFERENCES

- FAO. 1979. FAO Food and Nutrition paper 13. Food and Agricultural Organization, *FAO/FHO/UNEP Conference on Mycotoxins*, Nairobi, September, 19 - 21, 1977.
- Gowda N K S K, Suganthi R V, Malathi V and Raghavendra A. 2007. Efficacy of heat treatment and sun during of aflatoxin contaminated feed for reducing the harmful biological effects in sheep. *Animal Feed Science and Technology* **133**: 167-75.
- Mani K, Narahari D, Kumarraj R and Viswanathan K. 1997. Effect of sunlight exposed aflatoxin B1 contaminated feed on the performance of broiler chicks. *Indian Veterinary Journal* **74**: 768-71.
- Mohiuddin S M. 2000. Handling mycotoxin contaminated feedstuffs. *Poultry International* **6**: 46-52.
- Romer T R. 1975 Screening method for detection of aflatoxins in mixed feeds and other agricultural commodities with subsequent confirmative and quantitative measurement of aflatoxins in positive samples. *Journal of Association of Official Analytical Chemists* **58**: 500-06.
- Shantha T, Sreenivasa M, Rati E R and Verma V. 1986. Detoxification of ground nut seeds by urea and sunlight. *Journal of Food Safety* **7**: 225-31.
- Shotwell O L, Heseltine C W, Stubblefield R D and Sorenson W. 1966. Production of aflatoxin on rice. *Applied Microbiology* **14**: 425-28.
- Snedecor G W and Cochran W G. 1989. *Statistical Methods*. 8th edn. Iowa State University Press Ames. Iowa.
- Waghray K and Reddy U. 1995. Detoxification of aflatoxin B1 in maize and groundnut kernels by sunlight and dung cake fumes. *Indian Journal of Toxicology*: 37-41.