

*White Star apple and Physic nut as feed ingredients*

**THE POTENTIAL USE OF WHITE STAR APPLE SEEDS (*CHRYSOPHYLLUM ALBIDUM*) AND PHYSIC NUT (*JATROPHA CURCAS*) AS FEED INGREDIENTS FOR RATS**

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**ABSTRACT**

Forty-two (42) young male and female albino rats (*Rattus norvegicus*) were used in a preliminary study to assess the potential of non-conventional local materials, white star apple (*Chrysophyllum albidum*) 'udara' seeds and physic nut (*Jatropha curcas*) as feed ingredients for livestock. 'Udara' seed or physic nut meal were added to 14% crude protein basal corn soya bean diets at the rates of 0,5,10, or 15 percent to replace some of the dietary maize and soya bean. All measured parameters: (average daily weight gain (ADG), feed/gain ratio, total feed intake and average daily feed intake) differed between rats and levels of treatment. The rats fed control diets (0% 'udara' seed or physic nut) and those fed diets containing 10 and 15% levels of 'udara' and 5, 10 and 15% levels of physic nut had negative ADG values. Feed/gain ratio of the rats on control diets (9.92) was similar to that of rats fed 5% udara, but was significantly ( $P < 0.05$ ) superior to those of rats fed diets containing 10 and 15% of physic nut. Total feed and average daily intakes followed the same pattern. The rats fed control diets consumed significantly ( $P < 0.05$ ) more feed than those rats fed diets containing 10 or 15% "udara", or 5,10, 15% levels of physic nut. However, rats fed diets containing the 5% 'udara' seeds had similar ( $P > 0.05$ ) total feed and ADF with the rats on control diets. The rats fed diet containing 15% physic nut, had the least total feed and average daily feed intakes. The rats fed diet containing 15% physic nut, had the least total feed and average daily feed intakes. The results revealed that 'udara' seed could be incorporated into the diets of rats up to 5% level without deleterious effects while physic nut even at (5%) level could not be tolerated by the rats. The study points to the possibility of utilizing abundantly available and cheap 'udara' seeds in the diet of rats, a strategy that possesses the potential to reduce the high cost of livestock diets.

**KEY WORDS:** Albino Rats, White Star Apple, Physic Nut, Average Daily Weight Gain, Feed/Gain Ratio.

**INTRODUCTION**

Generally feeds and feeding have been shown to account for 55-85% of the total cost of commercial livestock production (Madubuike, 1988). In the present biting global inflation, the livestock producer appears most hit in terms of scarcity and high cost of feed (Babatunde *et al.*, 1975, Madubuike 1994, Madubuike *et al.*, 2003).

With the present trend of rising prices of animal feed stuffs all over the world, greater attention is unavoidably being paid to the search for safe and cheap local feed-stuffs (including unexplored feed-stuffs, by-products of agriculture and industry), especially in the developing countries that can ill afford the luxury of feeding milk-based and expensive diets to livestock.

Madubuike (1994) had proposed that as the world population continues to grow at alarming rates, the competition between humans and non-ruminant animals for existing protein sources becomes more severe. Consequently, the search for alternative feed ingredients for the non-ruminants becomes rather imperative to save both man and his livestock.

Furthermore, feeding of livestock in many developing countries continues to pose many problems because of lack of understanding both of the nutritional requirements of these animals under the local conditions and the nutritive value of locally available feeding stuff. Hence Fetuga *et al.*, (1974) had opined that lack of information on the composition and utilization rather than a real shortage of sources of protein as widely believed. However, Tegbe *et al.*, (1984), Madubuike (1993, 1994) had suggested the use of cheap and readily available agro-industrial by products in the diet of our livestock, as a means of increasing animal protein production in developing countries.

Consequently, there is intensified research on the value and use of certain unorthodox materials as livestock feed, such as cane molasses (Babatunde *et al.*, 1974), conophor seed *Tegracarpidium conophorum* Welio (Oyenuga and Fetuga, 1974), *Anarcodium occidentale*, L, cashew nuts scrap kernel meal (Fetuga *et al.*, 1974) palm kernel meal (Nwokolo, 1986), Brewers dried grains (Madubuike, 1988) palm oil sludge (Madubuike *et al.*, 1994) rubber seed cake (Madubuike *et al.*, 2003) for feeding non-ruminant livestock.

The white star apple (udara), (*Chrysophyllum albidum*) is a popular tropical fruit tree widely distributed in the low land rain forest zones and frequently found in villages. The fruit, pale orange, edible when ripe, is a large berry containing five large flattened black or brown seeds in yellowish pulp. The transverse section of the fruit shows the seeds arranged in star-like fashion. According to Nwoboshi (1982), the white star apple fruit (*Chrysophyllum albidum*) which is greenish grey, turns yellow with copiously milky juice and soft pulp when ripe. Opeke (1982) also described white star apple fruit as a fleshy and juicy edible fruit, and postulated that the juice from the fruit is a potential source of soft drinks, and can be fermented for production of wine and alcohol. It has also been proposed as a raw material for jam production without additional pectin, as there is indication that its original pectin content is high. Inoh *et al* (1977) has earlier believed that white star apple fruit has no other use other than consumption in its fresh form. While little work has been done on the use of the white star apple fruit, no work has been done on the possible use of the seeds as potential livestock feed.

According to a 1992 report from the Centre for Technical Agriculture (CTA) Spore, physic nut tree, (*Jatropha curcas*) grows abundantly in the Sahel, producing a globular fruit (about 3cm in diameter), changing from green to yellow on maturation and finally forming a dark brown capsule containing 3 black seeds. However, according to Griffin (1993), the main commercial importance of physic nut lies in its content of 50-60 percent of a slow-drying oil used as an illuminant and in soap manufacture. Godin and Spensley (1971) had earlier reported that physic nut cake cannot be fed to cattle because of its toxicity, but can be used as fertilizer, while the protein extracted from the cake is utilized in plastic and synthetic fibre manufacture. Besides the attempt to feed cattle with physic nut cake, some additional work has been done on livestock feed potential of physic nut.

The objective of this study was to assess the potential use of locally abundant and cheap white star apple seeds (*chrysophyllum albidum*) and physic nut (*Jatropha curcas*) as feed ingredients for livestock, using rats as preliminary test animals.

#### **MATERIALS AND METHODS**

Forty two (42) six to seven weeks old male and female albino rats of Wister strain, with initial body weight of between 110 and 111 grams were used in a 2 x 3 factorial experiment (replicated thrice) to determine the performance of rats fed 14% crude protein maize-soya bean experimental diets containing various levels of white star apple seed cake and physic nut cake. The white star apple seeds (11.0% crude protein) and physic

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nuts (20% crude protein) were decorticated, heated to 110°C for 6 hours to destroy their anti-nutritional agents, and then milled into cake before incorporating in the experimental diets.

Diet (treatment) 1, the standard weaner diet for rats, contained 0% of both test materials and served as the common control diet. Diets (treatments) 2, 3, and 4 contained 5, 10 and 15% dietary levels of white star apple seeds respectively, while diets 5, 6 and 7 contained 5, 10 and 15% levels of physic nut cake respectively. Each inclusion level was used to replace part of the maize and soya-bean as shown in Table I.

Two rats were randomly assigned to each of the seven experimental treatment groups on the basis of closeness of body weight and sex balance, and housed in metal cages. Feed and drinking water were provided *ad libitum*. Body weights of rats were taken at the beginning of the trial and weekly thereafter, and daily feed consumption was recorded per experimental group (cage).

The left over feed was collected and weighted back every morning to determine actual daily feed intake, before a measured quantity of the fresh diet was supplied. The feeding trial lasted for 21 days. Other parameters recorded included weight gain per week and mortality. All data were subjected to the analysis of variance procedure according to the methods of Snedecor and Cochran (1974).

**TABLE 1: Percentage Composition of the Experimental Diets**

INGREDIENTS	WHOLE STARAPPLE		PHYSIC NUT		JATROPHA		
	(UDARA)		(UDARA)		(UDARA)		
	CHRYSOPHYLLUM	CURCAS	ALBIDUM				
	CONTROL	DIETS TREATMENTS					
	1	2	3	4	5	6	7
Maize 8.8% CP	81.0	77.0	73.0	67.0	79.0	75.5	72.0
Soya bean 45.0% CP	15.5	15.0	14.5	14.5	13.5	12.0	10.5
Udara 11.0% CP	-	5.0	10.0	15.0	-	-	-
Physic nut 20% CP	-	-	-	-	5.0	10.0	15.0
Vitamin Mix	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Common Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Bone meal	2.5	2.0	1.4	2.5	1.5	1.5	1.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Crude Protein (CP) (Calculated)	14.10	14.04	14.04	14.07	14.02	14.04	14.06

### **RESULTS AND DISCUSSION**

The results of the study are summarized in Table 2. All parameters measured differed significantly ( $P < 0.05$ ) between rats and levels of treatments. Average daily weight gain (ADG) of the rats fed control diet was significantly ( $P < 0.05$ ) higher than those of rats fed 10 and 15% dietary levels of white star apple “udara” seeds. Rats that consumed diets containing 5, 10 and 15% levels of physic nut had negative ADG values.

Feed: gain ratio of the control rats (9.92) was similar to that of rats fed diets containing 5% “udara” seeds, but was significantly ( $P < 0.05$ ) superior to those of rats fed diets containing 10 and 15% “udara” seeds as well as

rats fed diets containing 5, 10 and 15% of physic nut. Total feed intake (TFI) and average daily feed intake (ADFI) showed the same trend. The rats fed control diets consumed significantly ( $P < 0.05$ ) more feed than those rats fed 10 or 15% udara, or 5, 10, 15% levels of physic nut.

However, rats fed diet containing the 5% “udara” had similar ( $P > 0.05$ ) total feed intake and ADFI with the rats on control diet. The rats fed the 15% physic nut had the most inferior total feed intake and the ADFI. The above results show that “udara” seed meal at low level of 5% was a better feed ingredient than physic nut meal even at trace quantity. Use of “udara” seed meal at low concentration possesses the potential to alleviate the problems of shortage of energy and protein component of livestock feed in Nigeria.

Increasing the level of “udara” in rat diets above 5% level appeared to produce an adverse effect on the growth of the rats. Physic nut on the other hand appears not to be suitable as a feed ingredient for the rats. The effects of physic nut meal observed on the rats in this study appear to suggest that physic nut, even after decortication and heating to 110°C for 6 hours still contained some toxic materials which adversely affected feed consumption, and caused diarrhea and loss of weight. Godin and Spensley (1971) had opined that the physic nut oil contains a substance curcassine which renders it toxic in large doses and strongly purgative in small doses. Clarke and Clarke (1978) also noted that *Jatropha curcas* (purging nut) contains a purgative agent (phytotoxin curcin).

Bhattara (1992) had also reported that mature seeds of physic nut in high doses (more than about 15g) can induce profuse vomiting. These factors may have resulted in the poor feed value of physic nut observed in this study. The results of this study therefore suggest that physic nut meal should not be used as feed ingredients, since decortication and heat treatment were unable to destroy the anti-nutritional agents in physic nut.

The results of this study therefore point to the feasibility of using abundantly available and cheap white star apple (udara) seeds (*Chrysophyllum albidum*) as feed ingredient for livestock following its utilization at 5% inclusion level by rats, thus contributing to reduce the ever increasing cost of livestock feeds.

**Table 2: Summary of Results**

TEST MATERIALS	DIETARY WEIGHT	INITIAL BODY WEIGHT	FINAL BODY WEIGHT	TOTAL WEIGHT GAIN	ADG (g)	TOTAL FEED INTAKE	ADF (g)	FEED/GAIN RATIO
WHITE	0	123.05	163.30	40.25	1.92 <sup>a</sup>	400.00 <sup>a</sup>	19.05 <sup>a</sup>	9.92 <sup>a</sup>
STAR	5	114.53	142.70	28.17	1.34 <sup>ab</sup>	361.50 <sup>a</sup>	17.21 <sup>a</sup>	12.84 <sup>a</sup>
APPLE	10	107.65	125.68	18.03	0.86 <sup>b</sup>	338.70 <sup>ab</sup>	16.13 <sup>ab</sup>	18.76 <sup>b</sup>
SEEDS	15	111.68	121.15	9.47	9.45 <sup>bc</sup>	335.80 <sup>b</sup>	15.99 <sup>b</sup>	35.53 <sup>c</sup>
PHYSIC	0	123.05	163.30	40.25	1.92 <sup>a</sup>	400.00 <sup>a</sup>	19.05 <sup>a</sup>	9.92 <sup>a</sup>
NUT	5	113.50	101.68	-11.82	-0.56 <sup>c</sup>	255.90 <sup>c</sup>	12.19 <sup>c</sup>	-21.77 <sup>d</sup>
	10	108.45	73.03	-36.42	-1.69 <sup>d</sup>	174.70 <sup>d</sup>	8.32 <sup>d</sup>	-4.92 <sup>a</sup>
	15	104.70	62.33	-2.37	-2.02 <sup>d</sup>	124.70 <sup>e</sup>	55.94 <sup>c</sup>	-2.94 <sup>c</sup>

<sup>abc</sup> Means followed by different superscripts differ significantly ( $P < 0.05$ )

## CONCLUSION

The results of this experiment showed that the rats fed control diets consumed significantly ( $P < 0.05$ ) more feed than those rats fed diets containing 10 or 15% “udara” seeds or 5, 10, 15% physic nuts, while total feed intake (TFI) and Average Daily Feed Intake (ADFI) of the rats were fed control diet were similar to those of rats fed the diet containing 5% “Udara” seeds.

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The observed possibility of utilizing udara seeds as feed ingredient at low dietary level (5%) will not only help to find good use for the otherwise wasted "udara" seeds (usually discarded after eating the edible part of the fruit), but may also help to alleviate the problems of shortage and high cost of feed ingredient for livestock in Nigeria.

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