

Use of biodiesel co-product from *Jatropha curcas* as ingredient for animal feed

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Introduction Studies about new sources of renewed energy have been intensified in recent years, motivated especially for the high prices and the scarcity of the petroleum as well as the concerns on global climatic changes. One of these sources is *Jatropha curcas*, Euphorbiaceae family, widely distributed in all continents (Cano-Asseleih *et al.*, 1989) as well in Brazil. Different research with *Jatropha* seeds found some toxic or irritant compounds including curcin, flavonoids, vitexine, isovitexine and the major toxic principle 12-deoxyl-16-hydroxyphorbol, a phorbol ester which caused clinical signs such as diarrhoea, dyspnoea and dehydration (Aregheore *et al.* 2003) in different species of animals. Despite this, seeds are an excellent oil source (60% of oil in the kernels) and after the full removed of its oil, it provides a meal with a highly nutritious and economic protein supplement (53-58% of crude protein) for animal diets if the toxins are removed (Becker and Makkar, 1998). This is the first of a full study about the utilization of *Jatropha curcas* meal in swine diets. So, the purpose of this work was to evaluate the utilization of detoxified *Jatropha curcas* meal from Brazilian sources in animal diets.

Material and methods Twenty-four Wistar rats (*Rattus norvegicus*), 21 to 25-day-old and 69.9 g \pm 5.40 initial live weight (LW), were kept for a 28 day experimental period and housed in 24 metabolism cages according to initial weight in a randomized complete block (LW) design with six replications per treatment. The *Jatropha curcas* seeds were collected from different producers of biodiesel from different toxic sources in the southern part of Brazil. The detoxified meal was produced by LABORE Ind. The animals were divided in four isoproteic and isoenergetic diets (treatments), T1) Basal casein diet described by Reeves *et al.* (1993); T2) Basal casein diet with replacement of casein with 5% of detoxified *Jatropha curcas* meal; T3) Basal casein diet with replacement of casein with 10% of detoxified *Jatropha curcas* meal. All animals received water and diets *ad libitum* throughout the experimental period. At the beginning and at the end of the experiment all rats were weighed for initial and final body weight (IBW and FBD) (g), respectively. The average daily gain (ADG) (g/day) and the average feed intake (AFI) (g/day) were measured three times per week and the mortality was checked daily. To calculate the feed conversion (FC) the ADG were divided by AFI. After 28 days, after fasting for 12 hours, all animals were slaughtered in a halothane saturated chamber. After this, blood samples were collected and analyzed for complete blood assay: red blood cells count (RBC) ($\times 10^6/\text{mm}^3$), haemoglobin (HB) (g/dl), packed cell volume (PCV) (%), mean cell volume (MCV) (fl), mean corpuscular haemoglobin concentration (MCHC) (%), total plasma (TP) (g/dl), white blood cells count (WBC) ($\times 10^3/\text{mm}^3$) and the hepatic transaminases enzymes (alanine aminotransferase (ALT) (IU/l) and aspartate aminotransferase (AST) (IU/l)). The data were analyzed using GLM of SAS package (SAS Institute, 2001) and the analysis of variance and treatment means were compared by Tukey test ($P < 0.05$). This study was carried under the accordance of the Commission for Ethics in Experimentation with Animals of Center of Nuclear Energy in Agriculture, University of Sao Paulo.

Results The performance, blood parameters and hepatic transaminases enzymes were not affected ($P > 0.05$) by the level of inclusion of detoxified *Jatropha curcas* meal.

Table 1 Performance, blood count and hepatic enzymes of rats fed with dietary levels of detoxicated *Jatropha curcas* meal

	Performance					Blood parameters								
	IBW	FBW	ADG	AFI	FC	RBC	HB	PCV	MCV	MCHC	TP	WBC	ALT	AST
Control	69.4	214.2	5.4	16.0	3.0	6.1	12.9	39.8	66.0	32.7	6.6	7.0	18.9	139.5
5% DJCM	71.4	217.0	5.4	15.6	2.9	6.8	13.9	41.2	60.	34.6	6.4	7.9	17.8	107.8
10% DJCM	68.9	217.3	5.5	16.0	2.9	6.2	12.7	38.8	62.1	33.3	6.3	6.6	20.4	141.3
s.e.d	5.4	9.6	0.4	0.8	0.2	1.1	1.9	9.0	5.0	3.8	0.2	2.9	3.8	33.34
P	-	0.71	0.70	0.52	0.24	0.55	0.61	0.91	0.28	0.77	0.28	0.64	0.57	0.11

Conclusions The results showed that the detoxified *Jatropha curcas* meal may be a promising protein source, but more investigations are necessary to check the efficacy of detoxification in different animal species and higher level of inclusion.

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