

Effect of Processing Method on Phorbol Esters Concentration, Total Phenolics, Trypsin Inhibitor Activity and the Proximate Composition of the Zimbabwean *Jatropha curcas* Provenance: A Potential Livestock Feed

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Abstract

In a study to detoxify *Jatropha curcas* seed four potential detoxification methods were tested for their effectiveness. The first method entailed oil expulsion from unshelled *Jatropha curcas* seed using a Sunhdra industrial oil expeller. The second method involved laboratory-based petroleum-ether solvent extraction of shelled and minced kernels. Thirdly, shelled kernels were subjected to industrial detoxification that involved double solvent extraction with the hexane-ethanol system accompanied by moist-heat treatment at 90°C for 30 min. The fourth method was an extension of the third whereby the meal generated was wet extruded (126°C, 2 atmospheres, 10 min contact time) followed by re-extraction with hexane and moist heat treatment (121°C for 30 min). The detoxification methods had significant ($P < 0.0001$) effect on both the anti-nutritional factors (ANFs) and the proximate composition of the meals. Oil expulsion left the phorbol esters (PEs) of the unshelled seed at 0.70 mg g⁻¹, laboratory petroleum-ether extraction reduced the PEs content by 67.69% from 6.5 mg g⁻¹ in the raw shelled kernels to 2.10 mg g⁻¹, double solvent extraction followed by moist-heat treatment reduced PEs by 70.77% to 1.90 mg g⁻¹. Double solvent extraction accompanied with wet extrusion, re-extraction with hexane and moist-heat treatment reduced PEs content to 0.80 mg g⁻¹, an 87.69% decrease. All the methods except laboratory petroleum-ether solvent extraction managed to completely inactivate trypsin inhibitors in the meals. Total phenolics (TPs) content was lowest ($P < 0.0001$) in the oil-expulsion produced meal (8.50 g Kg⁻¹) while the laboratory petroleum-ether produced meal contained 64.57 g Kg⁻¹ TPs. Oil-expulsion and double solvent extraction accompanied with wet extrusion, re-extraction and moist-heat treatment completely inactivated lectins in the meals. The high chemical nutrient potential of *Jatropha curcas* seed (crude protein, calcium and phosphorus) is only realised with shelling and extraction of most of the oil. None of the tried methods managed to completely detoxify the *Jatropha curcas* seed. The two most ‘effective methods’ reduced the PEs to 0.70 and 0.80 mg g⁻¹, respectively compared to the non-toxic variety with 0.11 mg g⁻¹ PEs.

Keywords: detoxification, anti- nutritional factors, physic nut