Biorefinery of Jatropha Seed Cake by Lactid Acid Bacteria and the Effects on Hematological Profile of Rex Rabbit

Titin Widiyastuti, Mohandas Indraji, Agung Wibowo, Roy Hendroko

Abstract

This research aimed: to increase the added value of Jatropha cultivation by using it as rabbit feed and to analyze the fermentation of Jatropha seed cake by lactic acid and the effect on blood profile of post weaned Rex rabbits. The range and analysis of variance of PCV, trombocyte, TPP and fibrinogen are presented in these documents. Conclusion, to increase the added value of Jatropha cultivation is by utilizing the seed cake as complete feed for rabbits up to 12% level without affecting the blood profile of post weaned Rex rabbits.

1. Introduction

High fuel oil consumption in Indonesia has led to the ever increasing biofuel exploration, resulting in by-product excess that is subject to utilize zero waste products. *Jatropha curcas* is one of biofuel sources that one ton dried Jatropha seeds produce 200-300 liter oil and 700-800 kg seed cake waste [1]. Shell less of seed cake contains 56.4% crude protein, higher than soybean meal 48%. Rich nutrition in Jatropha seed cake is a significantly potential feed utilization; the biological value however is not equally high because of antinutrients such as phorbolesters, tannins, phytates, saponins, trypsin inhibitor, and lectins that inhibit the utilization of Jatropha seed cake as feed. Detoxification methods have been administered to eliminate the negative effect of the antinutrients by heating and...
chemical treatments [2, 3, 4], acid base precipitation technique [5], fermentation with *Marasmius spp* [6], fermentation with lactic acid bacteria (*Lactobacillus spp dan Bifidobacter spp*) and saccharides addition [7] followed by FOS (Fructooligosaccharides) addition up to 1.5% in layer and broiler feeds [8]. Meat self-sufficiency still depends mostly on ruminant while non-ruminant commodity is well develop yet. Diversification in non-ruminant products can significantly contribute to meat self-sufficiency plan in 2014. One of meat producing commodity is rabbits, and Rex rabbits are protein source as nutrition fulfilment alternative in society. Rabbits are potential to produce meat and pelt and as decorative rabbits [9]. High quality feed will support a fast rabbit meat production concerned to a relatively short production period (meat and population) compared to ruminants. Providing high quality feed and no competition with other cattle are required as well as the importance of exploring non-conventional feed sources. Optimizing biorefinery of Jatropha seed cake therefore needs to accomplish. The study of its application as extensive feed to various poultry both ruminants and non-ruminants is of good possibility. It is therefore important to observe the effect of Jatropha seed cake on haematological profile of rabbits (packed cell volume, red blood cell, fibrinogen and total plasma protein). Protein-contained feed affects the blood profile of cattle, so blood profile in Rex rabbits is a significant indicator to determine whether feed containing Jatropha seed cake affects the rabbits health status.

2. Research methods

This research administered 21 post weaning Rex rabbits of 120 days old, fermented *Jatropha curcas* seed cake and feed (iso protein and iso energy) ration formula is presented in Table 1. Materials and utility used in the research: *J. curcas* seed cake, inoculation device and *Bifidobacterium spp* culture, MRS (de Man Rogosa Sharpe) broth media, molasses, pasteurized milk, sterilized aquades, bunsen, plastic covers, rubber band, glass bottle. Pellet machine, feed and water container, sensitive balance scale of 10 x 10⁻³ kg and 5 kg scale, cage thermometer, disinfectant, syringe and Na-EDTA (Natrium Ethylen Diamin Tetra Acetic Acid). Completely Randomized Design with three treatments and seven repetitions was applied. The treatments consist of R₀ (complete pellet without fermented *Jatropha curcas* seed cake/ control), R₁ (complete pellet with 6% fermented *J. curcas* seed cake), R₂ (complete pellet with 12% fermented *J. curcas* seed cake). Fermentation of *J.curcas* seed cake used *Bifidobacterium spp* culture for 15 days at 37°C, and the fermented product was used to compose complete pelleted feed. Rabbits were reared for 30 days, data of feed consumption and body weighing were taken once a week, and intracardiac blood collection was on the 30th day after the rabbits underwent 5 hour fasting. The measured variables were packed cell volume (%) and thrombocytecount (per mm³), total plasma protein, fibrinogen and feed consumption as supporting variable. Data collected were subject to variance analysis continued by orthogonal polynomials [10].

<table>
<thead>
<tr>
<th>Feed</th>
<th>R₀ (0%)</th>
<th>R₁ (6%)</th>
<th>R₂ (12%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>11.45</td>
<td>9.70</td>
<td>8.04</td>
</tr>
<tr>
<td>Ash content</td>
<td>7.78</td>
<td>8.52</td>
<td>8.38</td>
</tr>
<tr>
<td>Crude protein</td>
<td>19.30</td>
<td>18.42</td>
<td>18.66</td>
</tr>
<tr>
<td>Crude fat</td>
<td>7.89</td>
<td>8.41</td>
<td>9.48</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>18.27</td>
<td>18.08</td>
<td>18.16</td>
</tr>
<tr>
<td>BETN</td>
<td>46.76</td>
<td>46.57</td>
<td>45.32</td>
</tr>
<tr>
<td>Ca</td>
<td>1.31</td>
<td>1.26</td>
<td>1.36</td>
</tr>
<tr>
<td>P</td>
<td>0.87</td>
<td>0.91</td>
<td>1.03</td>
</tr>
<tr>
<td>GE (kkal/kg)</td>
<td>2,873.690</td>
<td>2,757.234</td>
<td>2,740.679</td>
</tr>
</tbody>
</table>

Note:
R₀= Complete pelleted feed without fermented Jatropha seed cake (control)
R₁= Complete pelleted feed with 6% fermented Jatropha seed cake
R₂= Complete pelleted feed with 12% fermented Jatropha seed cake
3. Result and discussion

3.1. Consumption

Result showed daily feed consumption of Rex rabbits was 61.47 to 85.01 g/head/day with declining consumption tendency in every increasing level of fermented Jatropha seed cake in complete pelleted feed. Variance analysis result performed treatments significant effect (P < 0.01) on feed consumption. The declining feed consumption of treatment R2 in Rex rabbits was assumed as the result of flavour of fermented Jatropha seed cake that dominated the flavour of complete feed pellet composition if compared to control feed that was consumed more. But, the rabbit consumption is on normal level (65 – 85g kg⁻¹ body weight) [11]. Rabbits palatability was expected to improve by eliminating the flavour and providing longer adaptation period [12].

Fig. 1. Feed consumption of rabbits that received feed fermented Jatropha seed cake.

3.2. Packed cell volume (PCV)

PCV is a measurement used to detect anaemia or polycyttemia and to predict the change of hemodilution or homo concentration. PCV is used with red blood cell in calculation of mean cell volume (MCV) and with haemoglobin and corpuscular (MCHC). The result showed the average packed volume cell of R₀, R₁ and R₂ was 31%, 32.28 % and 28.42%, respectively, indicating the highest average of packed cell volume in treatment R₁ and the lowest in treatment R₂. Estimated PCV in rabbits was 36% to 48% [13], and 37.67% in local rabbits [14]. Low PCV average in research result was due to the low feed consumption. Variance analysis result indicated feed treatment containing fermented Jatropha seed cake did not significantly affect Packed Volume Cell (P > 0.05). No significant difference of PVC in treatments indicated that fermented Jatropha seed cake could be utilized to rabbits feed up to 12%. The factors influencing PVC were age, race, sex, and long duration of transporting sample from storage to testing site during which the blood cells lysis took place [15]. Low PVC in this research did not induce anaemia in experimental rabbits because 12% fermented Jatropha seed cake did not cause illness to the rabbits. It was likely because the Jatropha seed cake fermented using Bifidobacterium spp. could lower hemagglutinin in Jatropha seed cake as the main factor of red blood cell damage leading to anemia in rabbits.

3.3. Platelet/ thrombocyte count

Research result showed the average platelet count in control (R₀), R₁ and R₂ was 69,428.6 (/mm³), 73,000 (/mm³) and 61,285.7 (/mm³), respectively. Analysis of variance indicated 12% fermented Jatropha seed cake did not significantly affect platelet count in post weaned Rex rabbits (P > 0.05). Normal platelet count in rabbits is less than
150,000/mm³. Thrombocytopenia is one of side effects of sulfonylurea because it prevents megakaryocyte—the giant cell in bone marrow. This cell forms platelet and exert a small amount of cytoplasm into bloodstream. One megakaryocyte can form 4,000 platelets [16]. Treatment R₁ had higher platelet than that of R₀ and R₂ and was still considered normal since subnormal platelets was proven that lectineantinutrient in Jatropha seed cake could be neutralized through Bifidobacterium spp. fermentation as observed from zero mortality and sickness in rabbits. Antinutrient in Jatropha seed cake belongs to the group of lectin, antitrypsin (trypsin inhibitor), saponin and porpholester. Porpholester, if consumed can cause death in cattle [17]. Protease inhibitor and lectin can disturb enzymatic digestion digestive system; moreover, lectin can attach to and damage intestinal epithelial cell receptor that eventually causes digestion and nutrient absorption disorders [18]. [8] further reported lectin in Jatropha seed cake can be the host of lactic acid in chicken intestine.

3.4. Total plasma protein (TPP)

The average total plasma protein of Rex rabbits ranged from 4.92 – 5.09 g/dL, with increasing tendency linear to the increase of fermented Jatropha seed cake in complete feed. Analysis of variance showed no treatment effect on total plasma protein (P>0.05), indicating complete feed pellet R₀, R₁, and R₂ did not result in different plasma protein of post weaned Rex rabbits. Rabbits with R₀ treatment in fact performed a slightly subnormal TPP compared to that of R₁ and R₂. Higher feed consumption in R₀ than that of R₁ and R₂ suggested higher biological value in protein content of R₁ and R₂, and protein in Jatropha seed cake could substitute protein in copra meal or soybean meal. In accordance with [19], plasma protein content was affected by protein content in feed, sex and growth rate. Result showed linear increase of total plasma protein to that of Jatropha seed cake (not statistically significantly different). During experiment however, no ill rabbits biologically indicated that R₂, complete pellet feed containing 12% fermented Jatropha seed cake, was still tolerable because it was within standard total plasma protein count: 5.0 – 8.0 g/dL [20]. Plasma protein increases when body resists infection through immunoglobulin system. Plasma protein concentration will increase to respond hypergammaglobulinemia symptom-disease [21].

3.5. Fibrinogen

The average fibrinogen in Rex rabbits was 0.74 – 1.52 g/dL, with tendency of linear increase to that of fermented Jatropha seed cake level in complete pelleted feed. Analysis of variance indicated treatments did not affect fibrinogen. (P>0.05). Fibrinogen of Rex rabbits in treatment R₂ was beyond normal – 1.52 g/dL although it was not statistically significantly different while [22] stated that standard fibrinogen level was 0.3 – 0.9 g/dL. It indicated the lectin content in fermented Jatropha seed cake given at 12% level, accordingly homeostatis was absent in Rex rabbits’ physiology but did not cause illness or death in rabbits. Theoretically, fibrinogen increase indicates general health disorder, trauma and infection. Fibrinogen is the essential component in blood clotting (coagulation). Coagulation takes place when cattle suffer from suppurating sore and acute or chronic disease. Fibrinogen level declines in liver disease.

Table 2. Hematological profile of Rex rabbits with Jatropha seed cake treatment.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>PCV (%)</th>
<th>Thrombocyte (/mm³)</th>
<th>Total Plasma Protein (g/dl)</th>
<th>Fibrinogen (g/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R₀</td>
<td>31.00 ± 6.85</td>
<td>69428.6 ± 0.128</td>
<td>4.92</td>
<td>0.74</td>
</tr>
<tr>
<td>R₁</td>
<td>32.28 ± 5.02</td>
<td>73000.0 ± 0.094</td>
<td>5.02</td>
<td>0.98</td>
</tr>
<tr>
<td>R₂</td>
<td>28.42 ± 3.30</td>
<td>61285.7 ± 0.144</td>
<td>5.09</td>
<td>1.52</td>
</tr>
</tbody>
</table>
4. Conclusion

The added value of Jatropha cultivation can be increased by optimizing Jatropha seed cake as complete feed. Composition up to 12% fermented jatropha seed cake in the rabbit feed, has no effect on the blood profile (packet cell volume, platelet count, total plasma protein and fibrinogen) of post weaned Rex rabbits.

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References


