COMPARISON THE EFFECTS OF CLINOPTILOLITE SUPPLEMENTATION ON THE NUTRITIVE VALUE OF RICE BRAN AND RICE HUSK

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ABSTRACT

In this paper, the effects of clinoptilolite with and without supplementation on the nutritive value werecomparedbetweenrice bran (RB) and rice husk (RH). Five different levels of clinoptilolite (0-5%) were supplemented on RB and RH and the effects on the nutritive values were determined; dry matter (DM), total nitrogen (N), crude protein (CP), crude fat (EE), crude fibre (CF), total ash (Ash), calcium (Ca) and phosphorus (P) using the AOAC standard methods. Nitrogen free extract (NFE), total digestible nutrient (TDN) and metabolizable energy (ME) were calculated by differences. Increasing levels of clinoptilolite resulted in some changes in the nutritive values of RB and RH were not affected of EE and P content in RB, while affecting EE and P content in RH sample. Supplementation of clinoptilolite to RB and RH samples had increased DM, Ash, Ca and NFE contents, while decreasing total N, CP, EE, CF, P, TDN and ME in both samples but only P in RH is remain constant.

*Keywords:*clinoptilolite, rice bran (RB), rice husk (RH), nutritive value

1.0 INTRODUCTION

Rice husk and rice bran are agricultural crop residue which relatively high cellulose content and its potential prospect for alternative renewable resources in livestock industries [1]. This waste can be transformed either via chemical and/or biological treatments (aerobically or anaerobically, depending on the availability of oxygen) [2-3]. The rice husk mostly feed to the cattle, but in a small quantity because the husk contains arsenic that will accumulate the animal tissues and cause a disease (Bovine Spongiform Encephalopathy) [4-5]. However, rice bran successfully formulated diet for catfish [6], fowl and ducklings [7]. Therefore, it is our aim to study the comparison between RB and RH based on the nutritive values effect when clinoptilolite are supplemented or not in the sample based on chemical analysis for animal diet formulation.

2.0 EXPERIMENTAL

2.1 Analytical and Statistical Analysis

Nutritive values of RB and RH were analysed based on the Association of Official Analytical Chemists (AOAC) [8]. The analyses were done at the Animal Feed Laboratory, InstitutVeterinar Malaysia, Kluang Johor. The clinoptilolite was imported from Indonesia and it was supplied by Provet Group of Companies Sdn. Bhd., Selangor.

Both samples were collected from Cooperative UTM Alumni Feedmill, Pagoh, Johor, Malaysia. Five levels of clinoptilolite supplementation were evaluated (1 – 5%), apart from one without supplementation (0%).

The data were analysed by using one-way ANOVA and pairwise comparison technique in SPSS 20.0 (SPSS Inc. Chicago, IL, USA). The differences among treatments were evaluated by the least significant difference post hoc multiple comparison test. The significance level was set at 0.05.

Table 1: Analysis used for determining nutritive value of RB and RH

Parameter	Abbrev.	Method
Dry matter	DM	AOAC Official Method 2001.12
Total nitrogen	N	AOAC Official Method 2001.11
Crude protein	CP	AOAC Official Method 2001.11
Crude fat	EE	AOAC Official Method 991.36
Crude fibre	CF	AOAC Official Method 950.02
Total ash	Ash	AOAC Official Method 942.05
Calcium	Ca	AOAC Official Method 927.02
Phosphorus	P	AOAC Official Method 964.06
Nitrogen free extract	NFE	Calculation [11]
Total digestible nutrient	TDN	Calculation [11]
Metabolism energy	ME	Calculation [12]

3.0 RESULTS AND DISCUSSION

Table 2-3 shows the proximate analysis of RB and RH supplemented with varying levels of clinoptilolite (1-5%).

Table 2: Nutritive value of RB

Samples	T_0	T_1	T_2	T_3	T_4	T_5	ANOVA
DM, %	94.20^{a}	94.77^{ab}	94.97^{ab}	94.90^{ab}	96.13^{b}	95.33^{ab}	0.143
N, %	0.50^{ab}	0.43^{c}	0.51^{b}	0.45^{d}	0.47^{e}	0.49^{ae}	0.000
CP, %	3.10^{a}	2.70^{ab}	3.17^{b}	2.83^{ab}	2.97^{b}	3.03^{b}	0.073
EE, %	0.13^{a}	0.00^{b}	0.00^{b}	0.00^{b}	0.00^{b}	0.03^{b}	0.002
CF, %	58.97^{a}	55.73^{b}	57.67^{c}	54.13^{d}	52.57^{e}	52.13^{e}	0.000
Ash, %	13.90^{a}	13.80^{b}	14.93^{c}	16.17^{d}	16.67^{d}	16.60^{d}	0.000
Ca, %	0.16^{a}	0.12^{b}	0.20^{c}	0.16^{a}	0.37^{d}	0.28^{e}	0.000
P, %	0.04	0.04	0.04	0.05	0.04	0.04	0.000
NFE, %	23.93^{a}	27.77^{b}	24.23^{ab}	26.83^{ab}	27.73^{bc}	28.17^{bd}	0.146
TDN, %	39.17^{abc}	40.23^{a}	38.37^{abc}	37.53^{abc}	37.30^{bc}	37.43^{c}	0.215
ME, MJ/Kg	5.56^{abc}	5.73^{a}	5.43^{abc}	5.29^{abc}	5.25^{bc}	5.27^{c}	0.219

Notes: $T_0 – T_5$ = 0 – 5 % clinoptilolite supplementation.
a, b, c, d, e = means in a row with different letters differ (p<0.05)

Table 3: Nutritive value of RH

Samples	T_0	T_1	T_2	T_3	T_4	T_5	ANOVA
DM, %	94.83^{a}	94.77^{a}	95.17^{a}	95.37^{a}	95.37^{a}	95.30^{a}	0.709
N, %	0.71^{a}	0.67^{b}	0.65^{c}	0.61^{d}	0.61^{de}	0.65^{bc}	0.000
CP, %	4.43^{a}	4.17^{b}	4.03^{c}	3.83^{d}	3.83^{de}	4.07^{bc}	0.000
EE, %	0.33^{a}	0.27^{ab}	1.67^{b}	0.37^{a}	0.33^{a}	0.27^{ab}	0.174
CF, %	55.13^{a}	55.17^{a}	54.30^{a}	52.03^{b}	51.37^{b}	51.43^{b}	0.000
Ash, %	13.50^{a}	14.07^{ab}	14.73^{b}	16.07^{c}	15.93^{c}	16.77^{c}	0.000

Ca, %	0.29[ac]	0.33[b]	0.28[a]	0.32[bc]	0.31[bc]	0.40[d]	0.000
P, %	0.06[a]	0.03[be]	0.04[c]	0.04[d]	0.03[de]	0.02[bf]	0.000
NFE, %	26.60[ab]	26.33[a]	26.80[ab]	27.77[bc]	28.50[c]	27.43[abc]	0.048
TDN, %	39.77[a]	39.20[a]	38.90[ac]	37.50[bcd]	37.80[cd]	37.00[d]	0.002
ME, MJ/Kg	5.66[a]	5.57[a]	5.52[ac]	5.28[b]	5.34[bc]	5.20[bd]	0.002

Notes: $T_0 - T_5$ = 0 – 5 % clinoptilolite supplementation.
a, b, c, d, e,f = means in a row with different letters differ ($p<0.05$)

Table 2 shows that supplementation of clinoptilolite resulted in increased DM, Ash, Ca and NFE percentage in the RB, while decreased N, CP, EE, CF, TDN, and ME. However in Table 3 shows the increase of DM, Ash and NFE percentage of RH, while N, CP, EE, CF, Ca, P, TDN and ME were decreased with increasing the clinoptilolite supplementation. An analysis of one-way ANOVA by Pairwise Comparison using LSD technique shows all the nutritive valuesin Table 2 were significantly different ($p<0.05$) except for DM, CP, NFE, TDN and ME in RB, while in Table 3 all pairs were significantly different ($p<0.05$), but DM and EE were not significant for all pairs in the RH.

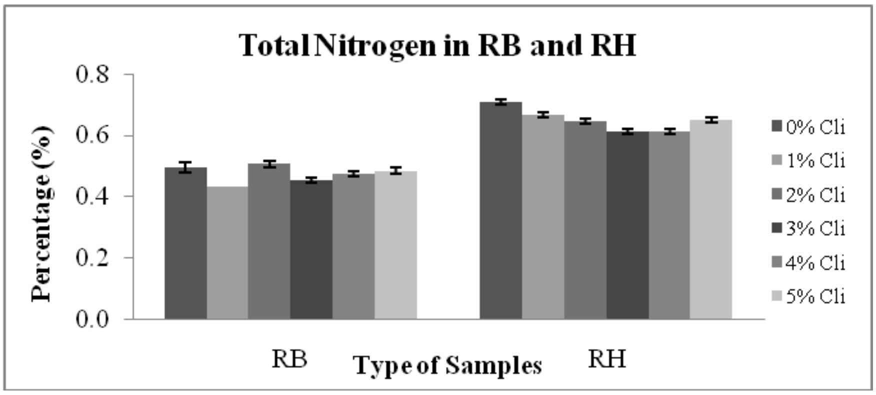

Figure 1: Total nitrogen in RB and RH

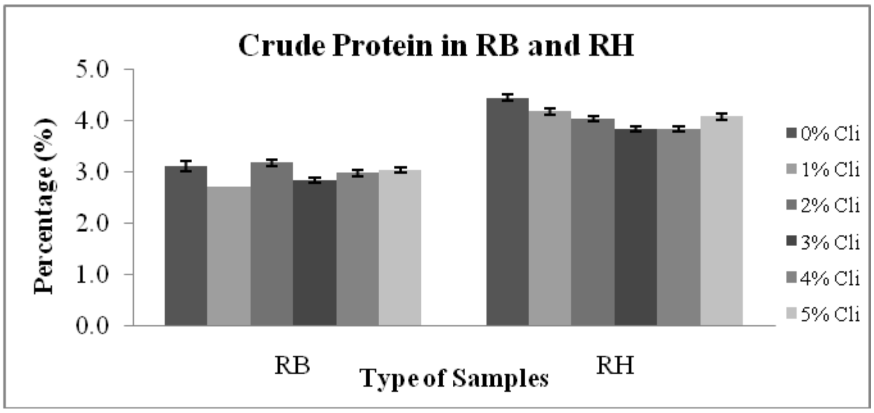

Figure 2: Crude protein in RB and RH

Figure 1 and 2 show the representative percentage of total N and CP in RB and RH based on Kjeldahl method [9]. It is evident that increasing levels of clinoptilolite resulted in decreased percentage of total N and CP. This might be associated to the adsorption of ammonium (NH_4^+) by clinoptilolite during the Kjeldahl analysis which has high cation exchange capacity [10-12]. Based on one-way ANOVA, all total N were found to be significantly different ($p<0.05$) for all pairs in both samples, but all CP were not significantly difference in RB sample ($p>0.05$).

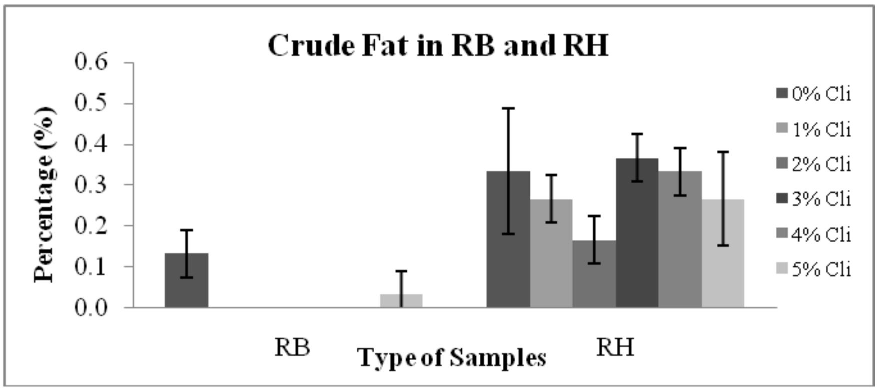

Figure 3: Crude fat in RB and RH

Figure 3 shows nothing would be affected of crude fat when RB is supplemented with clinoptilolite. However, increasing levels of clinoptilolite in the RH, did not significantly affecting EE contents in the sample as prove by one-way ANOVA (EE in OPF were not significantly different for all pairs (p>0.05)).

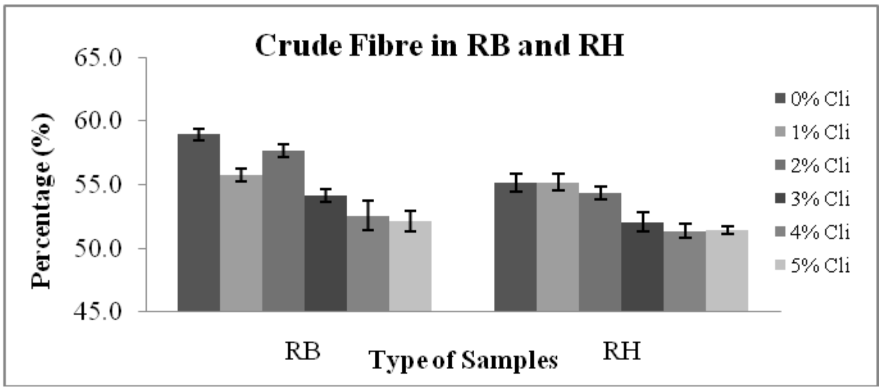

Figure 4: Crude fibre in RB and RH

Figure 4 shows decline ofCF when RB and RHare supplemented with clinoptilolite. Increasing levels of clinoptilolite in the RB and RH, significantly affecting CF contents in the both sample as prove by one-way ANOVA (CF in RB and RH were significantly different for all pairs (p<0.05)).

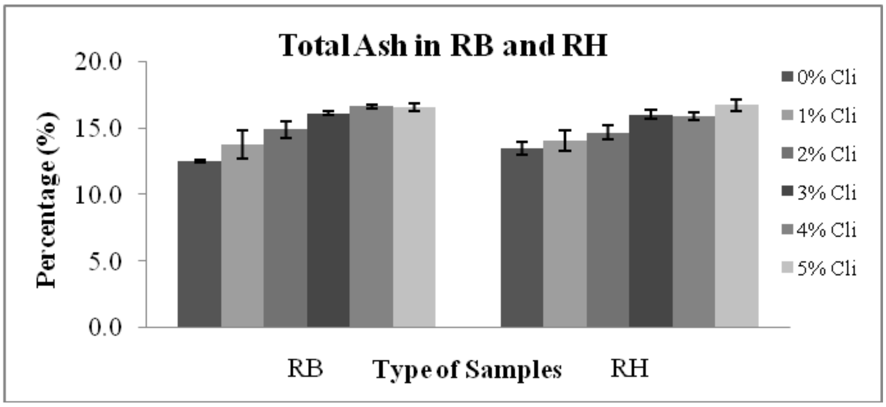

Figure 5: Total ash in RB and RH

Figure 5 shows the increasing levels of clinoptilolite in the RB and RH were gradually increased the total ash in the samples. It is evident that the increasing levels of clinoptilolite resulted in significantly affecting total ash contents in the both sample as prove by one-way ANOVA (Total ash in RB and RH were significantly different for all pairs (p<0.05)).

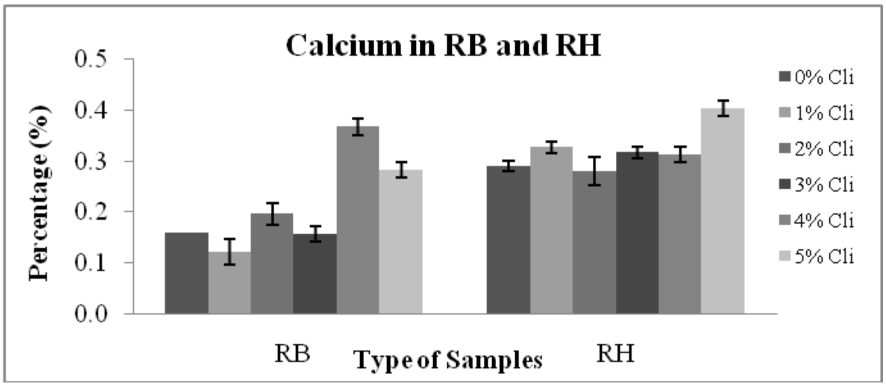

Figure 6: Calcium content in RB and RH

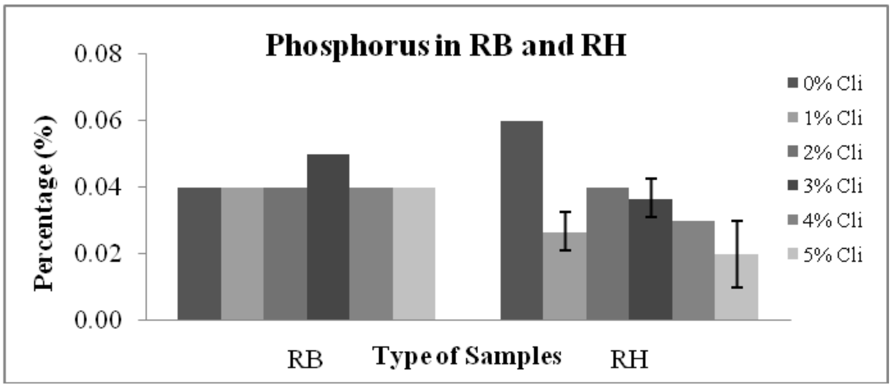

Figure 7: Phosphorus content in RB and RH

Figures 6 and 7 show Ca content was increase for both samples while P content was remains constant in RB but decreased in RH with increasing the percentage of clinoptilolite in the RB and RH samples, and one–way ANOVA shows significantly different ($p<0.05$) for all pairs. Since clinoptilolite is one of natural zeolite, it has high impurities of mineral (inorganic) substances which directly can increase Ca and P content in the RB and RH [12-13].

4.0 CONCLUSIONS

Supplementing varying levels of clinoptilolite resulted in significant differences in the nutritive value of RB and RH. The comparison of RB and RH were EE and P content in the samples. It is evident that the increasing level of clinoptilolite supplementation, resulting in not affected of EE and P content in RB, while affecting EE and P content in RH sample and the clinoptilolite is a non-fat source. Addition of clinoptilolite to RB and RH samples had increased DM, Ash, Ca and NFE contents, while decreasing total N, CP, EE, CF, P, TDN and ME in both samples but only P in RH is remain constant.

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