Effect of yeast supplementation in diets with early feed restriction on nutrient digestibility and carcass characteristics of broiler chickens

M Malahubban1*, N A N Adek2, N A Sani2, N S A Rahimi2 and F A A Zakry2,3

1 Department of Animal Science and Fisheries, Faculty of Agriculture, Science and Technology, Universiti Putra Malaysia Bintulu Sarawak Campus, Jalan Nyabau, 97008 Bintulu, Sarawak, Malaysia
2 Department of Crop Science, Faculty of Agriculture, Science and Technology, Universiti Putra Malaysia Bintulu Sarawak Campus, Jalan Nyabau, 97008 Bintulu, Sarawak, Malaysia
3 Institute of Ecosystem Science Borneo, Universiti Putra Malaysia Bintulu Sarawak Campus, Jalan Nyabau, 97008 Bintulu, Sarawak, Malaysia

Corresponding author: masnindah@upm.edu.my

Abstract. Present study aimed to determine the influence of yeast supplementation in diets with or without early feed restriction on nutrient digestibility and carcass characteristics of broiler chickens. Three dietary treatments each consisting of three replicates namely 1) control (commercial diet); 2) 0.3% yeast supplement; and 3) 0.3% yeast and early feed restriction at 7 to 14 days of age. Faeces were collected from five days before the end of experiment and later analysed for crude protein, fibre, and fat. At the end of the experiment (day-42), two broilers from each replicate were slaughtered. The present study found that crude protein and crude fat increased at 92.00 ± 1.46% and 96.33 ± 0.42%, respectively (P<0.05), over broilers fed commercial pellet only at 84.50 ± 0.56% and 94.17 ± 0.48%, respectively. However, when employing feed restriction on broilers fed on diets with 0.3% yeast, no further improvement (P>0.05) on nutrients digestibility was observed after yeast supplementation in diets. Dressing and abdominal fat of broiler chickens fed a diet with yeast supplement were different (P<0.05) with control. This study concludes that yeast supplementation improved digestibility of crude protein, crude fat, and dressing and abdominal fat but no improvement when early feed restriction imposed.

1. Introduction
The concept of “functional food”, “animal comfort” and “functional supplements” are increasingly present in the current livestock production. The base of this concept is that digestibility and good nutrient absorption are key factors to keep the animal health. Present-day research and practical on animal feed production, researchers and farmers are actively exploring new and natural technologies and compounds to increase and improve animal health and production [1]. Of various natural products, one of them is yeast which has been reported to improve feed intake, weight gain, carcass characteristic and nutrient digestibility in broilers through digestive enzymes excretion that help
gastrointestinal tract [2]. Feed restriction can be defined as method feeding that is time, duration and amount of feed are reduced [3]. Tesfaye et al. [4] reported that birds subjected to feed restriction for short periods during the early growth phase gave an economic advantage by enhancing feed utilization and able to attain complete live weight by 42 days of age. By employing this feeding method, it would possibly do much on feed cost improvement which has been found to range from 70% to 80% of total cost of broiler production. Thus, the aim of this study was to determine the influence of feed restriction and yeast supplementation on nutrient digestibility and carcass characteristics in broiler chickens.

2. Materials and methods

2.1. Chickens, treatments and experimental design

Experiment was conducted at a poultry house of Share Farm 2, Universiti Putra Malaysia Campus Bintulu Sarawak. The day-old broiler chicks (n=99) were used for this study. The day-old chicks were weighed and brooded (one week for adaptation) before putting them in their respective treatments. During brooding, the room temperature was maintained at 32 to 36°C. The broiler chicks were randomly assigned completely in three dietary treatments and replicated three times and each replicate contain 11 chicks. The broilers were fed commercial pellet (Gold Coin Feedmill Sdn. Bhd.) during starting and growing periods while during finisher period or one week prior to slaughtering, the broilers fed corn only. Feeding the broilers with the corn was enough for broiler growth requirement during one-week finishing period. Three treatments were as follow: (1) commercial pellet (control group), (2) commercial pellet supplemented with 0.3% yeast without feed restriction, and (3) commercial pellet supplemented with 0.3% yeast with feed restriction during 7 to 14 days of age. Early feed restriction was employed by offering 50% feed of total feeding requirement (50% reduction) for seven days old chicks or at second week of starting period and allow the chicks under feed restriction for another seven days or one week. The one-week period under feed restriction regime was enough to expect the variation among treatments and it was scheduled to demonstrate at 7 to 14 days of age to allow one week resting period in between starting and growing periods. The level of yeast supplementation at 0.3% was adapted from Eltazi et al. [5] work. Yeast for feed supplement was prepared using commercial instant yeast (Mauri-pan®).

2.2. Digestibility trial

A digestion trial was conducted at day 37 of the feeding trial. Feed intake and excreta were recorded during the last 5 days of the feeding trial. Excreta was collected for each 24-hour period from day 37 until day 41 on aluminium tray, which were covered with aluminium foil. Contamination, such as feathers, scales and feed particles were carefully removed from the tray. Total faeces were collected and maintained in hot air oven (60°C), following this, excreta could equilibrate in moisture with the air before being weighed and stored until chemical analysis for determination of nutrients content [6].

2.3. Carcass characteristics

At the end of the experiment, the broilers were fasted overnight and weighed. Two broilers (male and female) of 42 days old were randomly taken from each treatment replicate were slaughtered following Halal method [7]. Immediately after complete bleeding, the slaughtered birds were transferred to rotating machine with warming water (50 to 60°C) for about 20s to aid the removal of feathers and then transferred to defeathering machine for cleaning it up with running tap water for about 10s. The organs of broilers were removed and weighed for calculations. The carcasses (meat, fat, skin and bone) were separated and weighed to obtain dress weight.
2.4. Sample analysis

Feeds and excreta were analysed for crude protein, crude fat, and crude fibre according to Association of Official Analytical (AOAC) procedures [8]. Digestibility percentage of crude protein, crude fat, and crude fibre were calculated as:

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\% \text{ Digestibility} = \frac{\text{Nutrient intake (g)} - \text{Nutrient in excreta (g)}}{\text{Nutrient intake (g)}} \times 100
\]

2.5. Statistical analysis

Data were analysed for variance and means of crude protein, crude fat and crude fibre digestibility, and carcasses were compared by Duncan’s test at 5% level of significance. This statistical analysis was conducted by using Statistical Analysis System (SAS) version 9.4.

3. Results and discussion

Supplementing diet of broiler chickens with yeast was seen to have dramatic impact on digestibility of nutrients as demonstrated in the present study where broilers fed commercial pellets supplemented with 0.3% yeast improved nutrients digestibility over broilers fed commercial pellets except, crude fibre (Table 1).

Table 1. Nutrients digestibility of broilers fed diets supplemented with yeast with and without feed restriction (mean ± SE)

| Nutrient digestibility (%) | Dietary treatment¹ |        |        |
|---------------------------|---------------------|--------|--------|
|                           | T1ᵃ                 | T2     | T3     |
| Crude protein             | 84.50 ± 0.56ᵇ       | 92.00 ± 1.46ᵃ | 89.67 ± 1.68ᵃ |
| Crude fat                 | 94.17 ± 0.48ᵇ       | 96.33 ± 0.42ᵃ | 97.50 ± 0.50ᵃ |
| Crude fibre               | 59.83 ± 3.60ᵃ       | 63.33 ± 2.63ᵃ | 62.83 ± 3.07ᵃ |

Different letters within the same row differ significantly (P<0.05)

ᵃTreatment 1 (T1) = Control (Commercial pellet); Treatment 2 (T2) = Commercial pellet + 0.3% yeast without feed restriction; Treatment 3 (T3) = Commercial pellet + 0.3% yeast with feed restriction.

Crude protein and crude fat were significantly (P<0.05) increased at 92.00 ± 1.46% and 96.33 ± 0.42%, respectively, over broilers fed commercial pellet only at 84.50 ± 0.56% and 94.17 ± 0.48%, respectively. However, when employing feed restriction on broilers fed on diets with 0.3% yeast (T3), no further improvement significantly (P>0.05) on nutrients digestibility was observed when compared with broilers fed diet-yeast supplement (T2). Even though no improvement observed, this feed restriction had the potential to lowering the feed consumption thus lowering the feed cost without deleterious effect to nutrient digestibility. The phenomenon in this study agreed with Tesfaye et al. [4]. Moreover, metabolic disorders such as sudden death syndrome and ascites could be prevented by feed restriction [9].

In general, broiler chickens fed diets supplemented with yeast has significantly changed some carcass characteristics over broiler chickens fed on commercial control diets such as on dressing and abdominal fat, but no significant changes observed on gizzard, liver, and intestine (Table 2).

Dressing of broiler chickens fed diet with yeast supplement has increased significantly (P<0.05) at 71.74 ± 3.00% over commercial diet at 64.51 ± 2.20%. However, the abdominal fat of broiler chickens on diet with yeast supplement has significantly decreased at 0.79 ± 0.07% over commercial control diet at 1.58 ± 0.18%. When comparing the broiler chickens fed diet with yeast and with broiler chickens that fed restricted during early stage, day-7 to day-14 of age. No significant improvement was observed except abdominal fat carcass, where the abdominal fat of broiler chickens with feed restriction (1.36 ± 0.22%) was increased significantly (P<0.05) over fat carcass of broiler chickens fed on diet supplemented with yeast (0.79 ± 0.07%).
Table 2. Carcass characteristics of broiler fed with feed restricted and yeast supplementation (mean ± SE)

| Carcass characteristics (%) | Dietary treatment¹ |   |   |
|-----------------------------|-------------------|---|---|
|                             | T1                | T2 | T3 |
| Dressing                    | 64.51 ± 2.20b     | 71.74 ± 3.00a | 69.19 ± 1.57ab |
| Abdominal fat               | 1.58 ± 0.18a      | 0.79 ± 0.07b  | 1.36 ± 0.22a   |
| Gizzard                     | 1.37 ± 0.07a      | 1.67 ± 0.12a  | 1.70 ± 0.07a   |
| Liver                       | 2.74 ± 0.18a      | 3.37 ± 0.47a  | 2.51 ± 0.37a   |
| Intestine                   | 5.51 ± 1.26a      | 3.90 ± 0.82a  | 3.58 ± 0.05a   |

Different letters within the same row differ significantly (P<0.05)

¹: Treatment 1 (T1) = Control (Commercial pellet); Treatment 2 (T2) = Commercial pellet + 0.3% yeast without feed restriction; Treatment 3 (T3) = Commercial pellet + 0.3% yeast with feed restriction.

Lower fat carcass in broiler chickens fed diet with yeast might be due to the effectiveness of digestive enzymes that improving nutrient uptake in gastrointestinal tract [2-10]. However, when early restriction imposed on broiler chickens fed diet with yeast supplement, the fat carcass was increased and similar with those fed commercial diet. The activity of yeast to excrete digestive enzymes in the gastrointestinal tract during feed restriction was interrupted causing increased fat accumulation is plausible explanation. Source of nutrients or additional nutrients might be necessary or beneficial for yeast to multiply which eventually excreting more digestive enzymes and thus affecting positively on general activity in gastrointestinal tract of broiler chicken. Present study suggests that applying interval restricted feeding such as one-day interval restriction may be beneficial instead of continuous restricted feeding for one week as demonstrated in this study or possibly increasing the present amount of feeding in restricted regime to more than 50% thus allow more supply of nutrients to support yeast growth and activity. Besides that, present study demonstrates that the gizzard, liver, and intestine of broilers were not significantly affected (P>0.05) by any treatments thus consuming yeast and/or with early feed restriction did not negatively impact the internal organs broiler chickens concomitantly the health status of broiler chicken in this study might be in good condition. This agrees with Mousa [11] who found that the gizzard and liver were not altered when adding live yeast into diet of broiler chickens but could promote growth performance. In contrast, Kaushal et al. [12] reported that the liver and gizzard weights of broiler chickens were higher than control and even higher than enzyme inclusion. Further studies need to be conducted in future to unravel the benefits or the effects of adding yeast in broiler chicken feed and adopting feed restriction in broiler feeding programme.

4. Conclusion
This study concludes that the yeast supplementation in diets has promoted crude protein and crude fat digestibility. It has also increased dressing and skin carcasses and lowers fat carcass of broiler chickens. By employing early feed restriction to broiler chickens that fed diet supplemented with yeast, present study suggests that the feed consumption in broiler chicken production would be cost effective without deleterious impact to nutrient digestibility and carcass performance.

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