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# Dietary Utilization of Yeast-fermented Coconut Milk Residue on Productive Performance and Carcass Traits of Broilers

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## ABSTRACT

**Background**: The objective of this study was to study dietary utilization of yeast-fermented coconut milk residue on the productive performance and carcass traits of the broilers.

**Methods**: A total of 120-day old unsexed broilers chicks (Cobb 500) were used. The chicks were weighed individually and randomly divided into four groups with similar mean body weight as the initial weight, in each group having five replicates of twelve chickens. Four dietary treatments were as follows; treatment I: basal diet only (control group), treatment ii, iii and iv were dietary experiments consisted of yeast fermented coconut milk residue at the levels of 3, 6 and 9 per cent, respectively. Data of feed intake, weight gain and mortality rate were collected for calculation of ADG, FCR and mortality percentage. End of feeding trial, four chickens were randomized to determine the carcass traits.

**Result:** It was found that dietary utilization of yeast-fermented coconut milk residue had no effect on productive performance and carcass traits (P>0.05). Moreover, tenderloin was affected by the dietary using yeast-fermented coconut milk residue at nine percent. In conclusion, yeast-fermented coconut milk residue can be used in broiler's diet up to nine percent without impairing growth performance and carcass trait.

**Key words:** Broilers, Carcass traits, Productive performance, Yeast-fermented coconut milk residue.

## INTRODUCTION

Since the cost of many cereals grains and legumes used in feed market are increasing due to the many factors such as the oil price and market utilizing them as human food and fuel. To courter this, alternative feedstuffs from agriculture or industrial by-products such should be used to replace those grains (Barge and Divekar, 2018). Coconut is a crop that used for food, beverage, oil seed, fibers, medicines, *etc.* Its by-product are coconut meal or copra meal that has two types depending on the residue from the process; the first type is coconut meal from oil extraction which has 21.50 percent crude protein. Coconut meal has two physical characteristics which are high bulk density and water holding capacity (WHC) that can decrease the feed intake of the poultry such as chickens (Sundu *et al.,* 2020; Ayuti *et al.,* 2022). It is generally used as animal feed for poultry or ruminants. (Sundu *et al.,* 2006; Barge and Divekar, 2018; Taer *et al.,* 2022). The second type is coconut milk residue from coconut milk extraction process which has very low in crude protein range from 1.02 to 3.75 per cent, fiber content ranges from 10 to 26 per cent and approximately 43 to 45 percent of carbohydrates (Somkuna, 2012, Chupraphawan *et al.,* 2019, Sittiya *et al.,* 2023). Using the coconut milk residue in poultry diet is limited due to its nutritive quality, the process of extraction and storage condition. Since the coconut milk residue contains high fiber and some lipids that cause rancidity that limited the animal intake and digestibility.

With this restriction, researches on the application of fermentation technology to improve fibrous feedstuffs nutritive values by various kinds of microbes. Since, fermentation has been practiced in feed technology to bio-convert the inorganic minerals to organic compound. Microbes have been used in fermentation technology such as filamentous fungi such as *Aspergilus niger*, *Pleorotus ostreatu,* Rhizopus *sp.* and *Trichoderma* spp. are common fungi used for solid-state fermentation to enhance the feeding value of the substrate. It is also used for improvement the nutritive value of various feedstuffs, such as rice bran, maize (Koh *et al.,* 2002; Alam *et al.,* 2018; Ali, 2019; Ahmed *et al.,* 2017; Suphrap *et al.,* 2018; Phan *et al.,* 2020; Liza *et al.,* 2022; Nidhilangelo *et al.,* 2024), coconut meal from coconut oil extraction (Hatta *et al.,* 2021) and coconut milk residue (Somkuna *et al.,* 2014; Chupraphawan

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*et al.,* 2019; Somkuna, 2020; Kwiankhokkruad *et al.,* 2021; Sundu *et al.,* 2019; Sundu *et al.,* 2021).

Baker's yeast (*Saccharomyce cerevisiae) is a potential microbe that has been widely used in this process.* It is one that the most natural alternative growth promoter used in animal production (Ogbuewu *et al.,* 2019; Qui, 2023). It can improve the nutritive value of fibrous feedstuffs in terms of increasing protein and decreasing fiber content. Baker's yeast which is high in protein, amino acids, fatty acids and vitamins and minerals. It acts as an antibiotic alternative by acting as prebiotics and probiotics has received significant attention. Moreover, baker's yeast contains β-glucans and mannan-oligosaccharides as its main components. Recent studies have shown that baker's yeast, as an alternative protein source. It has detoxification effect that reduces the phytate and other anti-nutritional factors and also improves nutrient availability, promote growth, boost immune level in broilers (Sundu *et al.,* 2020; Liza *et al.,* 2022). Furthermore, the application of baker's yeast as a feed additive in fermentation process showed promising results for poultry production in terms of improving the morphological structure of gastrointestinal tract, thus increasing growth performance. When use live baker's yeast as probiotic or autolyzed yeast and its components as prebiotic could act as a growth promotor in healthy broiler chicken (Yasar and Yegen, 2017; Ahiwe *et al.,* 2021; Zeinali and Mohammadi, 2022; Qui, 2023). However, a limited number of studies reported the use of yeast-fermented coconut milk residue in broiler diet. Therefore, the main objective of this study was conducted to study dietary utilization of yeast-fermented coconut milk residue on the productive performance and carcass traits of the broilers.

## MATERIALS AND METHODS

### Preparation of yeast-fermented coconut milk residue

The coconut milk residue was purchased from local market in Buriram Province. It was dried in the hot air oven at 50°C until a constant weight was obtained and then used the baker's yeast, *Saccharomyces cerevisiae* which was also purchased from the market in the fermentation process. The mixture was then mixed by 0.2 per cent of ammonium sulfate (21-0-0) was added to the mixture according to the method of Hafsah *et al.,* (2020) and Kwiankhokkruad *et al.,* (2021) with some modifications. The fermentation duration was 0, 1, 7, 14 and 21 days to get the highest crude protein level. The fermented substrates were subjected to proximate analysis (AOAC, 1990). It was found that the fresh coconut milk residue showed crude protein as 5.55 per cent while yeast-fermented coconut milk residue for seven days of fermentation showed the highest crude protein level 13.88 per cent as shown in Table 1. Subsequently, it was used for dietary treatments.

### Animals and diets

The experiment was carried out following the guideline and rules for animal experiments of the Institute of Research and Development, Buriram Rajabhat University, Thailand. A total of one hundred and twenty-one-day old, unsexed broilers chicks (Cobb 500) were obtained from commercial hatchery driller. The chicks were weighed individually and randomly divided into four groups of chicks with similar mean body weight as initial weight, in each group having five replicates of twelve chickens. Chicks were fed on starter ration for three weeks of age (from 0 to 21 days of age) followed by finisher ration dietary treatment as shown in (Table 2) until the 6$^{th}$ week of age. The chickens were housed and raised on the litter-floored pens with rice hulls under the appropriate lighting and had *ad libitum* access to drinking water for 42 days. The experimental design was Completely Randomized Design (CRD); which consisted of four treatments. The treatments were as the following: The four dietary treatments included treatment i) basal diet only (control group), treatment ii to iv were dietary experiment consisted of yeast fermented coconut milk residue 3, 6 and 9 percent, respectively. All dietary diets were provided to the chickens in the mashes form.

### Data collection

The data of body weight gain, feed intake and mortality of the chickens were collected after 22 and 42 days. Whenever a bird was found dead, the feed and weight were collected immediately. The FI and BWG of the dead bird can be calculated and deducted from the final FI and BWG of its cage, respectively (Sittiya *et al.,* 2023). The parameters of average daily gain (ADG) and feed conversion ratio (FCR), mortality rate was also calculated. At the end of feeding trial, four chickens were randomized to determine the carcass traits.

### Statistical analysis

Data were statistically analyzed using one-way analysis in SPSS statistical software (version 20). Differences among treatments were determined using Duncan's new multiple range test (DUNCAN). A P-value of <0.05 was considered statistically significant.

## RESULTS AND DISCUSSION

### Growth performance

It has shown that the chicken received the control diet revealed the better growth performance when compared with the others. However, the use of yeast-fermented coconut milk residue in the diet had not negative effects on growth performance (P>0.05) by the treatments (as shown in Table 3. A possible reason to describe this result was

**Table 1:** Crude protein in yeast-fermented coconut milk residue.

| Day of fermentation | Crude protein (%) |
|---|---|
| 0 | 11.70 |
| 1 | 12.36 |
| 7 | 13.88 |
| 14 | 12.34 |
| 21 | 13.75 |

the effect of baker's yeast cell in the yeast-fermented coconut milk residue aid to increase the protein content. Increasing protein level in the yeast-fermented coconut milk residue was from yeast cell, nitrogen and sulfur that were found in ammonium sulfate. Yeast changes the inorganic minerals to be sulfur amino acids such as methionine and cysteines which the animals can utilize for growth (Hafsah *et al.,* 2020). Methionine is an amino acid which is important for growth, immune system, reproductive system. Moreover, methionine is the first amino acid used in the RNA synthesis and may affect myoblast differentiation and protein synthesis in breast muscle in broilers (Wen *et al.,* 2017). While the fiber content in yeast-fermented coconut milk residue would break down by the fermentation process which decreased the fiber contents and increased the crude protein, phosphorus and some amino acids such as methionine and lysine content (Arzinnahar *et al.,* 2021). This finding was in accordance with the report of Ahmed *et al.* (2017). As seen in Table 1; It is worth noting the level of fiber content increased when the level of yeast-fermented coconut milk residue was increased. However, the fiber content in the dietary treatment that used nine per cent of yeast-fermented coconut milk residue was 6.10 per cent without any negative consequences on growth performance of broilers. One of the nutrients for enhancing yeast growth is nitrogen source which increases the growth of yeast cells (Fadel *et al.,* 2013). In this study, 0.2 per cent of ammonium sulphate used in the mixture as nitrogen source for production the single cell protein. Supplementation of nitrogen source or non-protein nitrogen source from urea or ammonium sulfate in diet may improve the growth performance of broilers (Alam *et al.,* 2018). Similar to present results, Hafsah *et al.* (2020) reported the effects of the fermentation duration of coconut dregs by *S. cerevisiae* and the addition of ammonium sulfate on the growth performance and carcass trait of the broilers. In addition, Phan *et al.* (2020) reported the effect of feeding the fermented rice bran and maize with *S. cerevisiae* improved

**Table 2:** Dietary experiment compositions and calculated nutritive value for grower period (22-42 days old).

| Ingredients (%) | Level of yeast-fermented coconut milk residue used in the diet (per cent) | | | |
|---|---|---|---|---|
| | 0 | 3 | 6 | 9 |
| Corn | 40.00 | 45.00 | 38.30 | 40.00 |
| Rice bran | 31.00 | 22.00 | 20.00 | 15.00 |
| Soybean meal | 14.20 | 15.60 | 19.50 | 20.00 |
| Fish meal | 12.00 | 12.00 | 13.00 | 13.50 |
| Yeast-fermented coconut milk residue | 0.00 | 3.00 | 6.00 | 9.00 |
| DCP (Di-Calcium phosphate) | 0.60 | 0.50 | 0.50 | 0.50 |
| Soybean oil | 0.50 | 0.75 | 1.50 | 1.60 |
| Salt | 0.70 | 0.50 | 0.50 | 0.10 |
| Vit-mineral premix[1] | 0.50 | 0.25 | 0.20 | 0.10 |
| DL methionine | 0.50 | 0.50 | 0.50 | 0.20 |
| Total | 100 | 100 | 100 | 100 |
| **Analyzed composition (%)** | | | | |
| Dry matter | 89.30 | 89.00 | 89.60 | 88.70 |
| Crude protein | 20.02 | 20.04 | 20.17 | 20.24 |
| Crude fiber | 3.20 | 4.46 | 5.12 | 6.10 |
| Metabolizable energy (Kcal/kg) | 3,247.88 | 3,246.65 | 3,240.16 | 3,241.84 |
| Price per kilogram diet (Bath/kilogram) | 28.3 | 27.8 | 26.8 | 26.0 |

NB: [1]Premix included the following (per kg of diet): Premix (0.5%) provided the following (per kilogram of diet): vitamin A, 15,000 IU; vitamin D3, 3,000 IU; vitamin E, 25 IU; vitamin K3, 5 mg; vitamin B1, 2.5 mg; vitamin B2, 7 mg; vitamin B6, 4.5 mg; vitamin B12, 25 µg; pantothenic acid, 35 mg; folic acid, 0.5 mg; biotin, 25 ìg; nicotinic acid, 35 mg; choline chloride, 250 mg; Mn, 60 mg; Zn, 45 mg; Fe, 80 mg; Cu, 1.6 mg; I, 0.4 mg; Se, 0.15 mg.

**Table 3:** Growth performance in broilers fed dietary used with yeast-fermented coconut milk residue (21-42 days old).

| Items | Level of yeast-fermented coconut milk residue used in the diet (per cent) | | | | SEM | P-value |
|---|---|---|---|---|---|---|
| | 0 | 3 | 6 | 9 | | |
| Feed intake (grams) | 2,186.24 | 2,031.23 | 2,170.10 | 2,160.16 | 47.12 | 0.66 |
| Body weight gain (grams) | 1,008.67 | 890.33 | 875.33 | 976.00 | 45.87 | 0.08 |
| Feed conversion ratio | 2.16 | 2.28 | 2.47 | 2.21 | 0.28 | 0.24 |
| Mortality (%) | 3.33 | 6.67 | 10.00 | 6.67 | 5.00 | 0.83 |

**Table 4:** Carcass traits of broilers fed dietary yeast-fermented coconut milk residue.

| Items | Level of yeast-fermented coconut milk residue used in the diet (per cent) | | | | SEM | P-value |
|---|---|---|---|---|---|---|
| | 0 | 3 | 6 | 9 | | |
| Carcass percentage | 82.87 | 79.30 | 77.79 | 80.51 | 2.84 | 0.653 |
| **Carcass composition** | | | | | | |
| Thigh+drumstick (%) | 18.88 | 21.14 | 19.86 | 18.06 | 0.73 | 0.40 |
| Wing (%) | 7.49 | 7.82 | 7.11 | 7.32 | 0.20 | 0.56 |
| Breast (%) | 13.35 | 13.73 | 14.60 | 14.98 | 0.40 | 0.37 |
| Tenderloin (%) | 2.86[a] | 2.84[a] | 3.00[ab] | 3.35[b] | 0.06 | 0.04 |
| Abdominal fat (%) | 1.03 | 1.01 | 0.98 | 0.85 | 0.06 | 0.68 |
| Gizzard (%) | 1.61 | 1.68 | 1.73 | 1.73 | 0.04 | 0.68 |

[a, b]Mean within a row with different letters differ significantly at P<0.05.

protein supplement to crossbred chickens by there were no effects on growth and feed conversion. Moreover, the fermented feed supported increases in DM digestibility of 5.4 per cent, of protein by 10.1 per cent and the height of the villi in the duodenum by 17 per cent. Further, Ogbuewu *et al.* (2019) stated that yeast in feed reduce the gut pathogens and aids digestion *via* enzymatic action and produces lactic acid that makes the gastrointestinal tract to be acidic hence bringing the population of pathogenic microbes down. Moreover, yeast is an excellent source of protein and contains mannan oligosaccharides (MOS), a natural feed additive found in yeast cell wall (YCW) that encourages the growth of beneficial bacteria in the gastrointestinal tract (GIT). Moreover, it can improve feed intake and nutrient uptake from the GIT, lowering pH of the GIT through the production of wide range organic acids and decreasing bacteria enzyme activity and ammonia production. It was observed by many research that addition yeast in broiler diets enhances meat quality, better protein and fiber digestibility was observed in meat typed chickens fed a diet containing yeast probiotic (Zhang *et al.,* 2005; Ezema, 2012).

**Carcass traits**

Data on carcass traits was shown in Table 4. It was found that chickens received treatment diets had carcass percentage similarly to control group (P>0.05). Percent of thigh and drumstick, wing and breast weight of chickens of each group were not significantly different (P>0.05). It is worth noting that the tenderloin weight percentage of the chickens received nine per cent of yeast-fermented coconut milk residue showed the highest as 3.35 per cent (P<0.05). The breast weight percentage was also showed the highest value but there was not significantly different by the treatment (P>0.05). This might be the results of yeast content and other components in the yeast-fermented coconut milk residue that helped to increase protein and lipid uptake to the chicken meat cell, especially the tenderloin that are found either side of the breastbone, it is low in calories and high in protein as well as chicken breast. Liza *et al.* (2022) stated that fermentation produces enzymes, mainly amylase and protease which can break down complex carbohydrate and proteins to be use as source of energy. In terms of abdominal fat, even though it was not significantly different (P>0.05), the chickens received nine per cent of yeast-fermented coconut milk residue showed lowest percentage of abdominal fat. The possible reason might be that the coconut oil in the yeast-fermented coconut milk residue effected on the fat deposition in the chicken fat tissues. Since the coconut oil is a highly saturated oil (about 90 percent) and 60 per cent of its total fatty acid composition are medium-chain fatty acid (MCFA) with a chain length of 6 to 12 carbon atoms, which can be absorbed directly into the portal circulation without re-esterification in intestinal cell. The MCFAs are partly independent of the carnitine transport mechanism into the mitochondria of the liver and it is rapidly and exclusively oxidized for the production of energy. This is due to their faster metabolism and reduced storage in adipocytes, MCFAs have been reported to reduce fat deposition and improve serum lipid profiles in humans and rats (Wang *et al.,* 2015).

The results from this study indicate that coconut oil in yeast-fermented coconut milk residue may be more advantageous in abdominal and intermuscular fat reduction, which is in agreement with the work of Hafsah *et al.* (2020) who reported the effects of fermented coconut dregs on the growth performance and carcass trait of the broilers. It also had an effect on abdominal fat which slightly lower than control group (P>0.05).

## CONCLUSION

Yeast-fermented coconut milk residue can be used in broiler's diet up to nine percent without affecting growth performance and carcass trait. However, the using nine percent of yeast-fermented coconut milk residue in the diet showed the significantly highest per cent of chicken tenderloin weight. It is possible that yeast-fermented coconut milk residue can be used as an alternative feedstuff for broilers.

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### Conflict of interest

The authors declare that they have no conflicts of interest.

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