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Giving of Concentrate based on Fermented Chicken Livestock Waste and its Effect on Carcase Characteristics and Microbial Profile of Landrace Pork Meat (LD Muscle)

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carcass characteristics;
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microbial profile;

Abstract

This study was to determine the effect of concentrates based on fermented chicken farm waste (CCFW) on carcass characteristics and microbial profiles in crossbreed landrace pigs. The study used a completely randomized design (CRD) with three treatments and four replications (3 x 4). The treatments were, A: using 0% CCFW + 24% CP-152 concentrate, B: 12% CCFW + 12% CP_152 concentrate, and C: 24% CCFW + 0% CP-152 concentrate. The study used 12 finisher phase pigs with an average body weight of 63.42 ± 2.39 kg. The research parameters were carcass characteristics (SW, CW, %CC, LCC, REA), and microbial profiles in meat (TPC, Coliform, and E.coli) of landrace pigs. The results of the study were that in treatment groups A and B, almost the same results were obtained for all carcass characteristic parameters (P>0.05). By giving 24% CCFW (C) the carcass characteristic values were significantly lower than the control (P<0.05). The use of commercial concentrates of 12%-24% CCFW did not change the microbial profile of pork landrace pig (P>0.05). The conclusion of this study was that giving 24% CCFW + 0% commercial CP-152 (B) concentrate could reduce the carcass characteristic value and giving up to 24% CCFW to the ration did not affect the microbial profile of cross-breed landrace pigs.

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1 Introduction

Carcass characteristics and good meat quality are the main requirements for consumer acceptance of post-harvest products. In addition to the carcass as a post-harvest product, an assessment of the profile or microbial contamination of meat should also be considered, because the microbial profile of meat is a measure of the food safety of the meat (Oliveira et al., 2017; Sriyani et al., 2018). Pigs are very prospective as meat producers and continue to experience an increase in terms of population, meat production, and the number of slaughters (Pramudita et al., 2021). The good performance of pigs has great potential as meat producers, this can be seen in the response of farmers who are quite good at increasing the efficiency of production and reproduction of pigs (Sumardani et al., 2022). Factors of nutritional management, breed, and general condition of pigs before slaughter can affect carcass composition, and overall meat quality, such as the microbial profile of the meat (Lebret, 2008; Djordjević, 2016). Foodstuffs, especially those from livestock, are easily damaged. The damage is caused by changes that occur both in the material itself and damage and contamination from the outside. so that this meat can be sustainable for human life as consumers, it is necessary to safeguard meat products to produce food ingredients that are healthy, safe, whole, and acceptable to consumers according to their tastes. Consumers at home and abroad today are increasingly demanding quality requirements that are guaranteed to be good (Cameron et al., 1990; Zhou et al., 2016; Zhou et al., 2010). Requirements for products that are free of residue (residue free) both for biological materials, chemicals, and pesticides. heavy metals, antibiotics, hormones, and other drugs as well as against microbial contamination that can transmit disease and have good quality, will be fulfilled if there are strict supervision and maintenance techniques (SNI No. : 01-6366-2000) (Widyantara & Sukaatmadja, 2019; Rimawan et al., 2018).

Nutritional content, climate and cage environment, and stress during maintenance can affect post-mortem muscle metabolism, and carcass characteristics including meat quality (Ariana et al., 2018; Lawrie & Ledward (2014). The cost of feed in raising pigs is still quite high (70% -80%). This problem causes pig farmers to seek solutions by looking for alternative feed sources that are cheaper. Research on the utilization of agricultural production waste as an ingredient in animal feed to increase production, carcass characteristics, and meat quality as a whole (Bulkaini et al., 2022; Seiawan et al et al., 2022). Hammedand & Amao (2021), presented the results of their research, with the addition of 1% black seed to feed, significantly ($P<0.05$) the characteristics of rabbit carcasses. Provision of fermented broccoli stems and leaves (FBR), and supplementation of plant essential oils (PEO) can improve the appearance and quality of meat in the finishing phase of pigs, and the quality of growing pork (Wibawa & Sumadi, 2019; Huang et al., 2022; Sun et al., 2023). Broiler chicken farming, both closed house and open house systems can produce waste products in the form of culled chickens and litter scattered with leftover feed, these products have great potential as a source of protein in the preparation of other livestock rations (especially pigs), hereinafter referred to as Animal Farm Waste-based Protein Concentrate Chicken (Ariana et al., 2022).

The breed can affect meat quality and microbial profile in meat. Oliveira et al. (2017), reported that the physical quality of local and imported beef is of good quality and is in the normal range so it is suitable for consumption but the microbes of local and imported beef, especially the total microbes, E. coli, and Coliform, are above the standard except for E. coli. imported beef is still below the threshold standard SNI.3932:2008.

The problems and facts above inspired us to find out the description of carcass characteristics and total microbes in landrace cross-pig meat-fed concentrate based on chicken farm waste (CCFW) (Maharani et al., 2021; Sriyani et al., 2021; Joseph et al., 2012).

2 Materials and Methods

Animal ethics agreement

The research material (landrace cross) has been approved by the Ethics Committee of the Faculty of Veterinary Medicine-Udayana University, Bali, Indonesia with Number: B/272/UN14.2.9/PT.01.04/2022. Finisher fase of landrace pigs with an average body weight of 63.42 ± 2.39 kg were reared according to pig rearing management. Pigs as research material were kept in colony cages with a size of 3.0 x 3.0 x 1.0 m2 with four landrace pigs per cage. At the end of the study, the pigs were slaughtered according to the requirements for slaughtering pigs at the slaughterhouse to obtain research samples.

Meat microbial test

Microbial profiles (total microbes, E. coli, and Coliform) were analyzed according to the instructions (ISO 21528-1, SNI, 1992; Jackson et al., 1998). The method used to count the number of colonies growing in petri dishes was the plate count method (Swanson et al., 1992). Total Microbes (TPC). The total number of microbes can be calculated using the cup counting method and the calculation formula:

$$\text{BacteriaTotal (CFU/gr)} = \frac{\text{Number of Colonies}}{\text{(CupPetridis NA/PCA)}} \times \frac{1}{\text{DelutionFactor}} \times 10$$

Total Escherichia coli (E. coli). The total number of E. coli) can be calculated using the cup calculation method and the calculation formula:

$$\text{Bacteri Total (CFU/gr)} = \frac{\text{Number of Colonies}}{\text{Cup Petredis EMBA}} \times \frac{1}{\text{DellutionFactor}} \times 10$$

Total Coliforms. The total amount of Coliform can be calculated using the cup calculation method and the calculation formula:

$$\text{Bacteri Total (CFU/gr)} = \frac{\text{Number of Colonies}}{\text{(Cup PetredisEMBA)}} \times \frac{1}{\text{DellutionFactor}} \times 10$$

Research design

The research design was a completely randomized design (CRD) with 3 (three) treatments and 4 replications (3 X 4). The study used 12 finisher phase pigs with an average body weight of 63.42 ± 2.39 kg. During 70 days of maintenance in the study and slaughtered with a slaughter weight of: 103.92 ± 8.51 kg. The treatment in this study was the ration given as follows:

A: 24% commercial concentrate CP-152 + 0% CCFW. (Control)
B: 12% commercial concentrate CP-152 + 12% CCFW.
C: 0% commercial concentrate CP-152 + 24% CCFW

CCFW (Concentratbased on chicken farm waste)

Concentrate based on Chicken Farm Waste ("CCFW") is a protein source concentrate consisting of dead broiler chicken meal and litter flour mixed with leftover feed. The rejected and dead chickens were then chopped and baked in the oven at 70 0C for 2 x 24 hours. After drying, it is followed by grinding to make meat flour. Litter flour is obtained from litter collections in an area of 10 cm around the feed area, then mixed evenly, dried in the sun to air dry, followed by grinding to become litter flour. Fermentation is carried out with EM-4 to increase its nutritional value (Zollitsch et al., 1997; Isabel & Santos, 2009; Hanenberg et al., 2001).

Table 1
Nutritional content of CCFW

NO	NUTRIENT	KLPA (%)*
1	Water content	11,3
2	Ash	10,4
3	Crude Protein	39,7
4	Crude Fat	4,8
5	Crude Fiber	8,4
6	Calcium	15,2
7	Fosfor	1,2
8	Gross Energi (k.cal/g)	5.110

Note : *) Proximate Analysis of Animal Feed and Nutrition Laboratory, Faculty of Animal Husbandry, Udayana University. (2021)

"CCFW" flour consists of two parts of litter flour and one part of rejected chicken meat flour. The nutritional content of KLPA is presented in Table 1. The commercial concentrate produced by PT. Charoen Pokphand Indonesia.Tbk with code: CP-152, is concentrated as a protein source for mixed pig rations in the grower phase to the finisher phase, the recommendation for its use is 24% of the total ration (PT. Charoen, 2022).

Table 2
The composition of the research rations

Material	Treatment (%)		
	A (Control)	B	C
Concentrate CP.152	24	12	0
CCFW	0	12	24
Polard	35	35	35
Corn miel	40	40	40
Pig Mix	1	1	1
Total	100	100	100

Note: A: 24% commercial concentrate CP-152 + 0% CCFW. (Control)
B: 12% commercial concentrate CP-152 + 12% CCFW.
C: 0% commercial concentrate CP-152 + 24% CCFW

Table 3
The nutritional content of feed according to treatment

No.	Analysis	Unit	Treatment*)		
			A	B	C
1	Dry Matter	%	86,7099	87,7276	85,5874
2	Water	%	13,2901	12,2724	14,4126
3	Ash	%	12,3087	15,3184	11,3000

4	Organic Matter	%	87,6913	84,6816	88,7000
5	Crude Protein	%	22,8568	21,7816	20,4079
6	Crude Fiber	%	4,0143	5,1731	7,1471
7	Crude Fat	%	4,6036	5,5244	5,9699
8	TDN	%	84,3244	71,6065	67,7626
9	BETN	%	32,9265	41,9301	45,7625
10	Gross energi	Kcal/g	3,7266	3,1487	3,3261

Note: A: 24% commercial concentrate CP-152 + 0% CCFW. (Control)
B: 12% commercial concentrate CP-152 + 12% CCFW.
C: 0% commercial concentrate CP-152 + 24% CCFW
*) Proximate Analysis of Animal Feed and Nutrition Laboratory,
Faculty of Animal Husbandry, Udayana University. (2022).

Research parameters

The research parameters were carcass characteristics such as: slaughter weight (SW), carcass weight (CW), carcass percentage (% CC), carcass length (CL), rib eye area (REA). Microbial profiles in pork such as: Total plate count (TPC), Coliform contamination, and Esceria coli contamination.

Data analysis

The research data were analyzed using analysis of variance (one-way ANOVA), and if there were significant differences between the treatments (P<0.05), it would be followed by Duncan's multiple range test. The analysis procedure uses SPSS version 22.0.

3 Results and Discussions

Carcass characteristic

Effect of giving Concentrate based on Chicken Farm Waste (CCFW) on carcass characteristics of landrace cross pigs, as presented in Table 4. Feeding with 12% commercial concentrate CP-152 + 12% CCFW (B) obtained slaughter weight (SW) 108.1 ± 0.82 kg, but statistically, the weight was not significantly different from A (control) (P<0.05) (Lorenzo et al., 2014; Berrie et al., 1995; Realini et al., 2004). With an increase in the amount of CCFW given in treatment C (: Feed with 0% commercial CP-152 concentrate + 24% CCFW) a slaughter weight of 99.25 ± 4.17 kg, or 5.29% was obtained, which was significantly less than the control (P <0.05). The significant reduction in cutting weight in treatment C compared to the control could be due to differences in nutrient content in treatment C (Table.3). Protein content in C: 20.4079% (12% less than protein A/control). This could also be caused by the crude fiber content in C : 7.1471% (43.8% higher than A/control). The protein content in feed can affect feed palatability and feed intake. The high crude fiber in feed can reduce feed consumption, which in turn can reduce additional body weight and slaughter weight (SW). This opinion is in accordance with Oliveira et al. (2017), who state that the appearance and quality of meat are influenced by the nutritional content of the feed and other environmental factors during rearing. Hammedand & Amao (2021), also conveyed the results of their research that the addition of 1% black seed (Nigella sativa) to the ration mixture could improve the carcass characteristics of male rabbits (P<0.05). The addition of probiotics to feed can significantly improve the performance and quality of meat (Hasan et al., 2020).

Table 4
Carcass characteristics of crossed landrace pigs with given concentrate based on chicken farm waste (CCFW)

Treatment	SW(kg)	W.CC(kg)	% CC	CL (cm)	REA (cm^2)
A	104,5±3,51[a]	70,65±2,53[a]	67,61±1,37[a]	91±1,41[a]	68,3±4,57[a]
B	108,1±0,82[a]	71,65±1,84[a]	66,63±1,94[a]	95±4,24[a]	61,5±5,07[b]
C	99,25±4,17[b]	54,63±6,24[b]	55,35±4,61[b]	84±4,43[b]	53,5±5,44[c]

Note: Numbers with the same superscript in the same colume are not significantly different (P>0.05). SW: slaughter weight, CW: carcass weight, %KK: carcass percentage, CL: carcass length, REA: rib eye area.

Carcass weight (BKK) in treatment B: 71.65 ± 1.84 kg statistically the same as the carcass weight in treatment A (control) (P> 0.05). The use of 12% commercial concentrate CP-152 and 12% CCFW caused the protein content and gross energy in treatments A and B to be almost the same (Table.3). Energy-protein balance in almost the same rations can lead to carcass production or carcass characteristics that are the same. The results of this study are in accordance with the opinion of Dalle et al. (2022), substituting concentrate with 10 – 30% fermented chicken feather flour in pork rations causes almost the same performance (P> 0.05). Puger & Nuriyasa (2019), also informed the results of their research, by adding 2% - 15% of fermented wine waste to the rations did not significantly change the performance of male Bali ducks. In treatment group C, the weight of the catfish was significantly lower than that of the control (A) (P<0.05). This condition was caused by the crude fiber (CF) content in treatment C which was higher than in treatments A and C. In accordance with the opinion of Hammedand & Amao (2021), stated that the nutritional content of feed affects carcass production and quality. Assessment of pasca production of pigs is how much the percentage of the carcass (%CC) and the value of the rib eye area (REA) is produced. In treatment group C (0% commercial concentrate + 24% KLPA) it was found that the %CC: 55.35 ± 4.61 or 22.15% was significantly lower than the %CC of the control group (A). Rib eya area (REA) in treatment group C: 53.5 ± 5.44 cm2 or 27.66% significantly smaller than control (A) (P <0.05). The value obtained is in line with and directly proportional to the parameters of slaughter weight (SW) and carcass weight (CW). The carcass percentage value (%CC) is affected by the value of slaughter weight (SW) and the value of carcass weight (CW), (%CC = SW : CW) (Lawrie & Ledward (2014). It was also stated that the higher produced the REA value, the higher the carcass grade.

Microbial profil

The effect of providing concentrate based on chicken farm waste (CCFW) on microbial profile (TPC/total plate count, Coliform, and E.coli), as shown in Table 5 and Figure.1. One aspect of assessing the physical condition of meat is through the microbial profile of the meat which includes total plate count (TPC), Coliform contamination, and Esceria coli contamination (Maharani et al., 2021; Oliveira et al., 2017). The results of this study (Table.5) microbial contamination in meat in general (TPC) ranged from $2.3x10^2$ - $2.7x10^3$ and were not statistically significantly different (P>0.05). The TPC contamination value in pork in this study was below the threshold and was declared safe and good (SNI-2000). The non-significant TPC values in the treatment group (A, B, and C) could be due to nutritional factors between the treatments which were quite good, the cutting conditions were the same and the other treatments were made the same. Because Lawrie & Ledward (2014); Illahi et al. (2021), informed Good nutrition and environmental factors where slaughtering greatly affects contamination and microbial growth in meat. The same thing also happened to Coliform and E.coli contamination (Table.5 and Figure.1). The administration of CCFW had no significant effect on the value of Coliform and E.coli contamination in treatment groups A, B, and C (P>0.05). This value is still at a safe threshold. Because according to SNI (2000), the maximum limit for microbial contamination in meat (in units of CFU/gr) is: the total number of germs/microbes : 1×10^4 , Coliform : 1×10^2 and E.coli : 5×10^1.

Table 5
Total microbes in pork (LD Muscle) landrace cross with given concentrate-based chicken farm waste (CCFW)

Total (Log cfu/cm^2)			
Treatment	TPC	Coliform	E.coli
A	$2,3x10^{2a}$	$1,5x10^{1a}$	$2.5x10^{1a}$
B	$3,4x10^{2a}$	$1,7x10^{1a}$	$3,4x10^{1a}$
C	$2,7x10^{3a}$	$1,9x10^{2a}$	$4,1x10^{1a}$
Standart*)	$1x10^{4}$	$1x10^{2}$	$5x10^{1}$
SEM	0,04	0,42	0,07

Note: Numbers with the same superscript in the same colume are not significantly different (P>0.05). SEM: Standard Error of the Treatment Means.*)Indonesian National Standard, SNI No.01-6366-2000

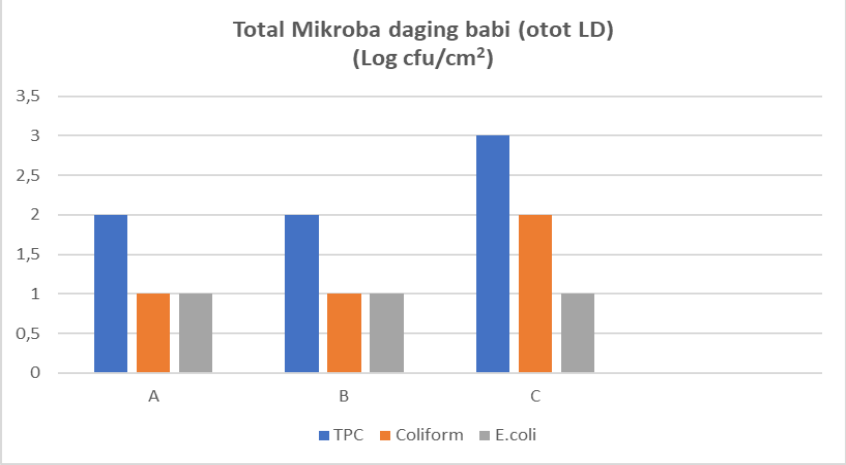

Figure 1. Microbial profile of meat (LD muscle) of landrace pigs

4 Conclusion

Giving up to 24% CCFW (concentrate-based chicken farm waste) in landrace crossbreed pig rations can reduce carcass characteristic values (carcass weight, carcass percentage, carcass length, and rib eye area). Administration of 0% - 24% CCFW did not affect the microbial profile of crossbreed landrace pork.

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Conflict of interest
The authors declare that there is no conflict of interest. Author contributions Tirta Ariana I N.T. is fully responsible for conducting research, writing papers, and correspondence. Bulkainiis in charge of processing research data and data in the laboratory. NLP.Sriyani, I Made Nuriyasa and I N. Sumerta Miwada are responsible for editing the manuscript/article.

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