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Feeding Kitchen Leftovers to Fattening Pigs Effects on Health and Production Performance

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Abstract: The use of kitchen leftovers as a feeding source in pigs has quality limitations as well as health and sanitary restrictions; nevertheless, it is still the only affordable food for some artisan pig farms. Production performance in hybrid pigs at an artisan farm in the State of Mexico, was studied. Four treatments (T1-T4) were administered to 50 hybrid pigs distributed at random as follows: T1 had 15 sows and T2, 15 castrated male pigs, both groups were fed with kitchen leftovers; T3 had 10 sows and T4, 10 castrated male pigs; these latter groups were fed with a commercial balanced feed. In order to analyse the differences between the means of the treatments a Tukey test was used. Proximal analysis showed the low nutritional quality of the leftovers. Animals fed with kitchen waste showed a higher percentage of respiratory and enteric signs that affected the muscular tissue development. Furthermore, leftovers increased feed conversion compared to the balanced diet. Treating the kitchen waste is recommended in order to diminish the pathogen incidence, and adding protein to the diet which will guarantee the fulfillment of animal nutritional needs. It is true that feeding with leftovers is cheap but it is convenient to take into account the cost involved which includes growth delay and both respiratory and digestive problems in animals.

Key words: Pig, kitchen leftovers, health, gowth rate.

INTRODUCTION

According to one of the Mexican regulation norms (Norma Oficial Mexicana NOM-037-200-1995), the word kitchen leftover includes any waste of feed or food leftovers which are used to feeding pigs.

Empirical use of human consumption organic residues in feeding pigs started at the beginning of swine production during the Colonial period in Mexico, and was the main nutritional source[1]. At present, its usage is still being reported in urban swine production in the State of Mexico and Mexico City [2]. With the industrialization of the sector, this feeding practice was relegated to the level of self-sufficiency, which has not transcended due, among other factors, to the lack of knowledge on its appropriate use[3]. Some of the main constrains for its use are the great variability in its chemical composition [3,5] furthermore, the sanitary-health aspect is another important issue to dealt with, as one needs to consider risks of disease transmission [6].

According to Restrepo and [7] more than 90 tons of *'tortillas'*, and more than 75 tons of bread are wasted every day in Mexico city. Furthermore, these authors also estimate that the total waste of other feed such as beans and rice result in equally enormous amounts; it has been calculated that around 10% of all the food bought for home usage in Mexico City is wasted. This issue is an indicator of generated volumes of resources, and the importance of them if they were to be taken into account as animal feed.

At present the usage of kitchen leftovers is being revalued in some countries due to its very low cost in the market (USD 0.019/kg). In the US it has been used as a dehydrated product to feed pigs in their finalizing period [8]. Cuba is one of the most advanced countries using this technology in Latin America [5] this is also true for Mexico [3] and Colombia [9]. Evaluations about the exploitation of human consumption waste as swine feed have also been conducted.

The objective of the present study was to evaluate the production performance in pigs fed with kitchen leftovers and commercial feed, and its effect on some animal health parameters.

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MATERIAL AND METHODS

This study was conducted in a family swine production farm located in the Municipality of Amecameca in the State of Mexico.

The collection of kitchen leftovers was obtained from a military camp (CABIR) located in the Municipality of Temamatla, also in the State of Mexico, about 24 km. from the Municipality of Amecameca. Waste was collected on a daily basis and was transported in plastic barrel containers of 200 kg. capacity.

The 50 pigs included in this study were hybrid crosses of Landrace x Hampshire sows with a Duroc boar. Animals were weighed, and experiments started as soon as animals were 90 days old (initial weight).

Ten pens with 5 pigs each were monitored. Males had been castrated during their first week of age. All animals within this study were distributed by sex at random:

- Treatment 1: 15 females fed with kitchen leftovers (FL)
- Treatment 2: 15 males fed with kitchen leftovers (ML)
- Treatment 3: 10 females fed with a commercial balanced food (FC)
- Treatment 4: 10 males fed with a commercial balanced food (MC)

A daily clinical evaluation was followed in order to determine the influence of the leftovers on disease development during the study period (150 days), taking into account the identification of pneumonic and diarrheic problems in all animals of all 4 treatments. A health protocol, which included the daily monitoring of number of animals coughing and sneezing per pen per minute, was recorded in order to identify pneumonic pigs.

Daily floor diagrams of wet areas were done daily in order to identify diarrhea, its amount on the floor and the delimitation of dry and humid areas according to Baxter's (1982) methodology. Clinical evaluations were performed daily in the morning from 7:00 to 8:00 hr.

At slaughter a pneumonic lesion identification was done at the abattoir by means of the 'flotation' clinical field test described by [10].

Food was provided *ad libitum* in all pens, and was weighed every day before its supplementation. Pens 1 to 6 were supplied *ad libitum* with kitchen leftovers in a humid basis three times a day, at 6:00, 13:00 and 18:00 hours. Animals from pens 7 to 10 were supplied with the commercial diet in a dry matter basis two times a day, at 6:00 and 18:00 hours. All wasted feed by the animals was collected from each pen, and weighed in the morning following the next day of administration, so that the voluntary intake (VI) and feed conversion (FC) could be determined.

Three chemical proximal analyses were performed to the kitchen leftovers at three different times of the experiment (160, 190, and 220 days) in order to determine the feed's nutritional content, as we know it can vary day by day. The methodology used to follow the chemical proximal analyses was the one established by[11].

Animals were weighed at 240 days old (final weight) in order to determine both the final weight gain (FWG) and the daily weight gain (DWG).

Results were analyzed by a completely randomized design with a covariable and a 2^2 factorial arrangement; its model was as follows:

$$Y_{ijk} = \mu + A_i + B_j + (AB)_{ij} + \beta (Xi - \bar{x}) + Eijk$$
$$I = 1,2$$
$$j = 1,2$$

Where:

- Y_{ijk}=Variable response
- μ=General mean
- A_i=Effect of factor A at i level (type of food)
- B_j=Effect of factor B at j level (sex)
- $(AB)_{ij}$=Effect of the interaction AB at i,j level
- β=Regression coefficient
- X_i =Covariable (final weight, weight at slaughter)
- $\bar{x}$=Covariable's general mean
- E_{ijk}=Randomized error in the k repetition, level j of B, and level i of A

The Tukey test was used in order to determine significant differences between the means of the treatments. Significant level considered for all statistical test was $p<0.05$.

The SAS program, version 6.12 [12] was used to analyze the treatments' effects on the indicators.

RESULTS AND DISCUSSION

Table 1 shows the results of the three chemical proximal analyses used to evaluate the leftovers and their mean and standard error of the mean. According to [5] the high volume of humidity within the human consumption wasted food causes a dilution of the nutrients, and this produces low values of dry matter.

Table 1: Chemical proximal analyses of kitchen leftovers in humid basis

Nutrients	Humid basis, (%) Sample 1	Sample 2	Sample 3	Mean ± MSE
Dry matter	15.2	18.91	29.8	21.30 ± 4.38
Total protein	3.09	2.01	4.9	3.33 ± 0.84
Ethereal extract	2.78	1.7	12.5	5.66 ± 3.43
Crude fiber	0.91	0.87-	0.8	0.86 ± 0.03
Nitrogen free extracts	7.32	12.8	10.6	10.24 ± 1.59
Ashes	1.26	1.31	1.87	1.48 ± 0.19

MSE: Mean standard error.

Table 2: Commercial balanced feed nutritional content (According to Malta-Clayton)

Nutrient	Content, %
Maximum humidity	12
Maximum ashes	10
Maximum fiber	6
Minimum protein	11
Minimum fat	2
Minimum nitrogen free extracts	59.9

This effect was present in this study. Nevertheless, variability, which is reported in other studies[3,4,13,14,15] on food residues, was only found in small fractions of the analyzed source (dry matter, ethereal extract), and in the rest of it uniformity was prevalent. Seemingly, other authors[3,4] had found high levels of ethereous extract in kitchen leftovers, which indicates a high level of fat (oil) used preparing food for people. Table 2 shows the nutritional content of the balanced commercial product used during the experiment. If nutritional values of the two types of feed included in this experiment are compared, it is evident that all leftovers values are below the ones found in the commercial feed, even that regarding animal nutrition's importance, the observed ifferences of total protein content and nitrogen free extracts are outstanding. Table 3 shows the results obtained from the clinical evaluation for enteric and respiratory diseases for all treatments. It is notorious that in Group 2 (ML) the number of diarrheas was statistically different compared with the other treatments, which indicates that it is a preliminary indicator, which proves that in those animals the muscular tissue development was affected, and that the dorsal fat deposition was increased. Enteric diseases negatively affect these tissues (López, unpublished).

Group 1 (FL) also showed a high index of diarrheas; it is deducted that due to the waste's composition it gets fermented in a very accelerated form in both the transported barrels and feeders, and this causes digestive disorders.

The high humidity's percentage of the leftovers caused that the floor was permanently wet which

Table 3: Enteric and pneumonic clinical evaluation in pigs fed with kitchen leftovers and a commercial balanced feed

Variable	Treatment 1 FL (n = 15) Mean ± MSE	Treatment 2 ML (n = 15) Mean ± MSE	Treatment 3 FC (n = 10) Mean ± MSE	Treatment4 MC (n =10) Mean ±MSE
Number of diarrheas on the floor	66.33 ± 5.23^{B}	125 ± 7.37^{A}	10 ± 2^{C}	12 ± 3^{C}
Number of clinically sick animals with pneumonia	1.67 ± 0.33^{A}	4 ± 0.57^{A}	0.5 ± 0.5^{B}	$1 \pm 1^{BA,B,C}$

Means with different literals in the columns are different ($p<0.05$). MSE= Mean standard error.

produced animals to lose heat when resting or sleeping; humid floors probably favored respiratory system disorders.

The high percentage of enteric and respiratory signs in Group 2 (ML) is a consequence of the increased feed intake by animals (Table 3) when trying to satisfy their nutritional requirements. On the other hand, pigs fed with the commercial balanced diet (T3 and T4) showed an enteric and respiratory disease incidence similar to the permitted normal indicators.

At the beginning of this study animals did not show any statistical difference regarding their initial weight, nevertheless, when concluding the experiment significant differences in the final weights among types of feed and sex were observed, as shown in Table 4. Animals fed with leftovers (T1 and T2) had lesser weights compared with pigs fed with the commercial product (T3 and T4), and within these groups, males (T4) reached the highest weight gain. The co-variable, final weight resulted significant and therefore, values in some variables were corrected.

Pigs fed with waste had a higher feed intake, which logically affected their nutritional conversion; this happened mainly because leftovers are handled in a wet basis which diluted the nutrients and therefore, pigs had to eat more feed to satisfy their nutritional requirements at its maximum during both growing and finalizing periods.

The obtained results in pigs fed with the commercial balanced diet in this experiment are below the ones reported by [16] in which hybrid pigs with an average daily feed intake of 2.4 kg. showed a feed conversion of 3.12, and a daily weight gain of 780 g. On the other hand, [17] also demonstrated higher values compared with those reported; a conversion of 3.02, and a daily weight gain of 794 g.

Recently,[18] observed an approximate 2.38 kg. daily average intake on balanced diets in hybrid pigs, with a nutritional conversion of 3.07, and a daily weight gain of 820 g.; these values go beyond

Table 4: Accumulated weight gain of pigs fed with kitchen leftovers and a commercial balanced feed

Variable	Treatment 1 FH o FS?(n = 15) Mean ± MSE	Treatment 2 MH o MS?(n = 15) Mean ± MSE	Treatment 3 FC (n = 10) Mean ± MSE	Treatment 4 MC (n = 10) Mean±MSE
Initial weight (kg)	29.22 ± 0.27^{A}	29.52 ± 0.18^{A}	29.11 ± 0.45^{A}	29.75 ± 0.20^{A}
Final weight (kg)	95.6 ± 1.83^{C}	100.06 ± 1.74^{C}	121.1 ± 0.73^{B}	127.7 ± 1.14^{A}
DWG (gr) 5	26.36 ± 2.81*	525.01 ± 2.26*	530.14 ± 3.04*	526.57 ± 3.94*
Final WG (kg)	79.025 ± 0.42*	78.80 ± 0.33*	79.55 ± 0.45*	79.02 ± 0.59*
Covariable (CO) (kg)	6.67 ± 0.12^{B}	7.94 ± 0.11^{A}	2.38 ± 0.01^{C}	2.80 ± 0.01^{A}
Feed conversion (kg)	15.95 ± 0.04^{B}	17.78 ± 0.19^{A}	4.05 ± 0.04^{C}	4.47 ± 0.11^{A}

^{A,B,C} Means with different literals in the columns are different ($p<0.05$). Corrected values by the covariable (final weight). DWG= Daily weight gain; WG= Final weight gain; MSE= Mean standard error.

the ones reported in the present study. Furthermore, the same author observed a lower feed intake, better nutritional conversion and a higher daily weight gain in hybrid pigs under grazing conditions with a commercial balanced product supplementation.

CONCLUSIONS

The usage of leftovers for animal nutrition has the following disadvantages: the incidence of enteric and respiratory disorders is increased as a consequence of feed composition (sanitary aspect); the nutritional value of the leftovers can vary but generally its protein contribution is low, whereas its energetic content (mainly lipids) is very high (nutrient imbalance). In addition, voluntary feed intake and feed conversion are increased, lengthening the fattening period of the pigs, and sending older pigs to the slaughterhouse.

The main advantage of feeding pigs with leftovers is the positive economic impact, if we take into consideration its very low cost in the market (USD 0.019/kg); *e.g.*, pigs can be fatten having considerable savings; it is well known in the pig industry that 70 to 80% of the total production costs involves animals' feeding; although on the other hand, one has to bear in mind that other costs such as pharmaceutical expenses are generated, and that the fattening period is extended, prolonging the days to market.

The most recommendable way to use kitchen leftovers is to treat them previously by following a cooking procedure in order to diminish the quantity of pathological agents, and also by adding a protein concentrate which will guarantee satisfying animals' nutritional needs. If these steps are followed, we are not only assuring the securing of a quality product at slaughter (Becerril-Herrera *et al.*, 2005), but we are also collaborating towards ecological and economical issues of a locality as organic residues considered as waste, and lack of economic and/or nutritional value would be taken into advantageous ones.

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