

Research Article

Potential of Mango Peels and Kernels as Feedstuffs: Effect on Broiler Chicks Growth Performance

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Abstract

The increasing cost of conventional poultry feed ingredients has driven interest in alternative, sustainable feed resources. This study aims to evaluate the potential of mango (*Mangifera indica* L.) by-products, specifically mango peel and mango kernel flours as substitutes in broiler diets, and their effect on growth performance, feed efficiency, mortality rate and carcass yield. A total of 180 14-days-old broiler chicks (Cobb 500) were randomly assigned to four dietary treatments for a 45-day feeding trial: (1) control RC (standard commercial diet), (2) R1 diet with 15% mango peel flour (MPF), (3) R2 diet with 15% mango kernel flour (MKF), and (4) R3 diet with a combination of 7.5% MPF and 7.5% MKF. Performance indicators including body weight (BW), body weight gain (BWG) and feed conversion ratio (FCR) were monitored weekly, while carcass characteristics were assessed at the end of the trial. Results showed that formulated diets maintained adequate crude protein levels (18.43–21.60%), suggesting that partial substitution of maize or oil with MPF or MKF does not compromise protein supply. After 45 days of age, the weight and weight gain of the animals were significantly different ($p < 0.05$) with each type of diet. An average weight of 2086, 2489, 2516, and 2887 g were recorded for diets R1, R2, R3 and RC, respectively. Feed conversion ratio (FCR) had the highest value (1.44 ± 0.10) in the R1 diet ($p < 0.05$) compared to R2 (1.21 ± 0.10), R3 (1.20 ± 0.15) and RC (1.07 ± 0.10) after 45 days of age. Mortality rates across the RC and R3 groups were within acceptable limits ($<5\%$) for broiler production, showing that no adverse health effects resulted from the inclusion of mango by-products. These findings highlight the potential of agro-industrial mango by-products in poultry nutrition, contributing to cost reduction and sustainability in the poultry industry.

Keywords

Mango Peel Flour, Mango Kernel Flour, Broiler Performance, Feed Conversion Ratio, Alternative Feedstuffs, Poultry Nutrition

1. Introduction

Mango (*Mangifera indica* L.) is one of the most important fruit cultivated in tropical and subtropical regions, ranking fifth in global production after citrus fruits, grapes,

bananas, and apples [1]. There are approximately one thousand varieties cultivated worldwide, which differ in size, color, texture, and nutritional properties [2]. Man-

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goes are also appreciated for their sweet taste and high vitamin content, especially vitamins A and C, and minerals such as calcium, potassium, phosphorus, and iron [3]. The annual production of mango fruit reached about 52 million tons according to FAO in 2020 with India, Indonesia and China as the third major producing countries with more than 50% of the total production. In Côte d'Ivoire, mango fruit plays an important economic role as the third major exported fruit after banana and pineapple. The main producing regions (Korhogo, Ferkessedougou, Sinematiali, Boundiali, Odienné) of mango fruits are located in Northern part of Côte d'Ivoire and the most cultivated varieties are Kent (80%), Keitt (7%) and Amelie (3%) [4, 5]. Despite its economic and nutritional importance, mango is a highly perishable fruit that faces post-harvest losses estimated to 30-60% of national production [4]. In order to reduce post-harvest losses, the perishable fruit can be processed into shelf-stable products such as juice, puree, nectar, slices in syrup, pickles, canned slices, chutney and dried products [6]. The major by-products from mango processing are peels and seeds which represent 35–60% of the total weight of the fruit [7]. The peels accounts approximately for 7–24% of the total weight of mango fruit and these by-products have been reported as source of dietary fibre, cellulose, hemicellulose, lipids, protein, enzymes and pectin [8]. Regarding the seeds, more than one million tons are annually produced as wastes, and these are often underutilized [9, 10]. The seed kernels represent 45–85% of the seed and approximately 20% of the whole fruit [11]. Some studies have reported mango seeds as biowastes with high content of bioactive compounds (phenolic compounds, carotenoids, vitamin C, and dietary fibre) [12]. Mango seeds are also good source of carbohydrates (58–80%), protein (6–13%) and fats (6–16%) [13]. Therefore, the proper use of mango peels and kernels as raw material for animal feed may generate economic benefit for livestock sector and reduce environmental pollution. This study was undertaken in order to evaluate the effects of a poultry diet containing mango peels and kernels on the growth of Cobb-500 broiler chicks.

2. Materials and Methods

2.1. Samples Collection and Treatment

Cultivars of ripe mangoes (Kent, Keitt, Amelie) were collected in two orchards in the city of Korhogo (9°27'41" North, 5°38'19" West, Côte d'Ivoire), during 2020-2021 harvest season. The production of flours from mango peels and kernels was carried out by using a processing method [14]. Mangoes were washed with potable water, peeled, and the pulp was removed from the seeds using a stainless-steel knife. Kernels were extracted and soaked overnight in potable water in order to reduce anti-nutrients (tannins, phytates) contents [15]. The peels and pre-treated kernels were cut into small pieces (1-3 mm thickness) and dried in an oven (Venticell, Germany) at 50 °C/48 h. The dried samples were ground using an electric blender (Moulinex, France) and flours from each cultivar were mixed (1:1:1, w/w/w) in order to obtain MPF and MKF flours used for incorporation in layer chicken diets. These flours were stored in airtight, opaque plastic containers at -18 °C for further analysis.

2.2. Determination of Proximate Composition of Mango Peels and Kernels Flours

The proximate composition of mango peels and kernels flours was assessed by determining the moisture, ash, fat, crude fibres and proteins according to AOAC methods [16]. Moisture content was determined according to AOAC 925.10 by drying the sample (5 g) in an oven at 105 °C until constant weight was obtained. The percentage moisture was calculated from the weight loss. Ash content was determined following AOAC 923.03 by incinerating the sample in a muffle furnace at 550–600 °C until complete combustion of organic matter. The result was expressed as percentage of initial weight. Fat content was measured using the AOAC 920.39 Soxhlet extraction method using hexane as solvent. The solvent was removed by evaporation, and the residue weighed to determine fat percentage. Crude fibre was analyzed according to AOAC 962.09 by sequential digestion with dilute acid and alkali to express crude fibre as percentage of the sample. Protein content was determined using the AOAC 979.09 Kjeldahl method, whereby nitrogen in the sample was converted to ammonium sulfate by acid digestion, distilled, titrated, and multiplied by the factor 6.25 to estimate crude protein content. Nitrogen Free Extract (NFE) was calculated by using the following formula:

$$NFE \text{ (\%)} = 100 - [\text{moisture} + \text{ash} + \text{proteins} + \text{fat} + \text{crude fibre}] \quad (1)$$

2.3. Formulation of Experimental Diets and Proximate Composition Analysis

Three (3) iso-nitrogenous and iso-caloric experimental diets (starter-finishing) were formulated based on the NRC [17]

nutrient requirements for layer chickens (Table 1). The diets contained 3500 kcal/kg DM and 20% crude protein. The control diet RC was provided by a livestock Enterprise (Abidjan, Côte d'Ivoire) while other experimental diets (R1, R2, R3) were formulated by using mango peels and kernels

flours (MPF and MKF) from 0 to 15% contents based on previous research studies [18]. Additionally, diets R1, R2 and R3 contained soybean meal, cashew nut cake, corn bran, rice bran and oyster shells. All the ingredients were mixed ho-

mogenously in order to obtain experimental diets. The proximate composition of experimental diets was determined as previously described [16].

Table 1. Experimental diets and calculated nutritive composition.

Ingredients (%)	RC	R1	R2	R3
Soybean meal	-	15	15	15
Cashew nut cake	-	28	28	28
Corn bran	-	20	20	20
Rice bran	-	20	20	20
Mango peel flour (MPF)	-	15	0	7.5
Mango kernel flour (MKF)	-	0	15	7.5
Oyster shells	-	2	2	2
Calculated nutritive composition				
Proteins (%)	20	20.10	20.43	20.27
Lipids (%)	4.5	4.58	4.98	4.78
Ash (%)	6.1	3.79	3.65	3.72
Crude Fibres (%)	4	9.88	7.83	8.86
NFE (%)	-	56.65	56.65	56.65
Metabolizable Energy (kcal/kg)	2944	3482	3531	3507

2.4. Animals and Experimental Design

2.4.1. Study Area, Housing and Management

Experiments were conducted on agro-pastoral farm located in Bonoua (5° 16' 17" North, 3° 35' 40" West) in the South part of Côte d'Ivoire. This area is characterized by high rainfall (average 1,265 mm³/year) and average annual temperature of 26.5 °C. Day-old broiler chicks (Cobb 500) were housed in a well-ventilated deep-litter poultry house of 16 m² partitioned into pens in accordance with standard broiler management guidelines. The floor of each pen was covered with a 5–7 cm layer of clean, dry wood shavings as bedding material. Litter was stirred daily to prevent caking and replaced as needed to maintain dryness. Prior to chick arrival, the poultry house and all equipment were cleaned, disinfected, and fumigated. A standard vaccination schedule for broilers was followed, and birds were daily monitored for symptoms of disease or abnormal behavior.

2.4.2. Environmental Conditions and Equipment

Brooding temperature was maintained at 32–34 °C during the first week using gas heating system and gradually reduced

by 2–3 °C per week until reaching 22–24 °C at the end of the study. Cross ventilation was ensured through open sides fitted with wire mesh to maintain air quality and reduce heat stress. Continuous lighting (23 h light: 1 h dark) was provided during the first week for feed and water intake, after which a 20 h light: 4 h dark cycle was adopted for the experiment. Artificial lighting was supplied using rechargeable light bulbs (50 W) distributed throughout the poultry house. Each pen was equipped with a round plastic feeder and a bell-type drinker, both disinfected before chick management. Feeders were adjusted in height as birds grew and feed was provided ad libitum. Fresh and clean water was also provided ad libitum through bell-type drinkers, which were washed and refilled twice a day.

2.4.3. Experimental Design

The study was conducted over a period of forty-five (45) days from April 8 to May 23, 2023, including two (2) weeks for the start-up phase and four (4) weeks of growth and finishing. Upon arrival, the chicks were quickly and gently placed in starter area [19]. For this study, 180 Cobb 500 broiler chicks (*Gallus gallus domesticus*) of both sexes with an average weight of 191.16 g were randomly assigned to 4

dietary treatments. After two (02) weeks of heating and starting, the animals were divided into four (04) groups of 45 chicks each group with 3 replicates of 15 birds per replicate in a completely randomized design (CRD) as follow: RC group (commercial control diet without mango peel and kernel flour); R1 group (diet with 15% mango peel flour and 0% mango kernel flour); R2 group (diet with 0% mango peel flour and 15% mango kernel flour) and R3 group (diet with 7.5% mango peel flour and 7.5% mango kernel flour).

2.5. Determination of Growth Performance Parameters

A total of four (4) diets were formulated to evaluate their effects on the zootechnical parameters of the chickens. The zootechnical parameters evaluated were: body weight (BW), body weight gain (BWG), feed conversion ratio (FCR), carcass yield and mortality rate.

2.5.1. Determination of Body Weight (BW)

Body weights of the birds per pen were recorded on a weekly basis and average was taken as weight per pen using the formula:

$$BW \text{ (g)} = \frac{\text{Total weight per pen}}{\text{Number of birds per pen}} \quad (2)$$

2.5.2. Determination of Body Weight Gain (BWG)

The weight of chicks was taken at the beginning of each week. This was recorded as the initial body weight. The body weight for the ensuing week was recorded as the final body weight. The initial body weight was deducted from the final body weight to obtain the body weight gained for the week. The body weight gain was calculated using the formula:

$$BWG \text{ (g/day)} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Number of days}} \quad (3)$$

2.5.3. Determination of Feed Conversion Ratio (FCR)

Feed intake was recorded on a weekly basis. Diets were offered per replicates during the week and leftovers at the end of the week were weighed. Feed intake, on a dry matter basis, was calculated by subtracting feed leftovers from total feed offered. The feed conversion ratio of the birds was calculated as the ratio between feed intake and body weight as indicated by the formula:

$$FCR = \frac{\text{Feed intake}}{\text{Body weight}} \quad (4)$$

2.5.4. Determination of Carcass Yield

At the end of the feeding trial, birds were fasted for 12 hours with access to clean drinking water to allow gut clearance and reduce variability in live weight due to feed residue. After fasting, each bird was individually weighed to obtain the final live body weight. Birds were slaughtered following guidelines

for poultry research. The carcass was obtained after removing the feathers, head, feet, and visceral organs, leaving only the eviscerated body. The hot carcass weight was recorded immediately after processing using a digital balance. Carcass yield was expressed as a percentage by using the following formula:

$$C \text{ (\%)} = \frac{\text{Carcass weight}}{\text{Live body weight}} \times 100 \quad (5)$$

2.5.5. Determination of Mortality Rate

Mortality rate was recorded throughout the experimental period. Percentage mortality was calculated as indicated by the formula:

$$M \text{ (\%)} = \frac{\text{Number of dead birds}}{\text{Number of birds per treatment}} \times 100 \quad (6)$$

2.6. Statistical Analysis

All measurements were carried out in triplicate and the results expressed as mean $\pm$ standard deviation. Analysis of variance (1-way ANOVA) was performed to analyze significant differences of means among the diets at $p < 0.05$. All statistical analyses were performed by using XLSTAT software version 2024.

3. Results and Discussion

3.1. Proximate Composition of Mango Peels and Kernels Flours

The proximate composition of mango peels flour (MPF) and mango kernels flour (MKF) is presented in Table 2. These by-products were dried, milled, and analyzed for the following parameters: moisture, crude protein, lipids, crude fiber, ash, and nitrogen-free extract (NFE) on a dry matter basis.

Table 2. Proximate composition of MPF and MKF.

	MPF	MKF
Moisture (%)	7.36 $\pm$ 0.17 ^a	6.08 $\pm$ 0.28 ^b
Proteins (%)	3.73 $\pm$ 0.01 ^b	5.87 $\pm$ 0.02 ^a
Lipids (%)	3.16 $\pm$ 0.10 ^b	8.60 $\pm$ 0.41 ^a
Ash (%)	3.40 $\pm$ 0.09 ^a	2.60 $\pm$ 0.09 ^b
Crude fibres (%)	15.77 $\pm$ 0.50 ^a	2.19 $\pm$ 0.10 ^b
NFE (%)	66.58 $\pm$ 0.50 ^b	74.66 $\pm$ 0.80 ^a
Metabolizable Energy (kcal/kg)	3009.60 $\pm$ 7.60 ^b	3995.20 $\pm$ 7.20 ^a

Means in the same row with different superscripts differ significantly at $p < 0.05$. MPF: mango peels flour; MKF: mango kernel flour.

Both MPF and MKF had moisture contents below 10%, meeting the safety threshold for storage and microbial stability in feed ingredients [20]. Such low moisture levels are advantageous for extending shelf life and preventing proliferation of fungi and mycotoxin-producing molds, thereby ensuring feed safety during prolonged storage. The crude protein content was $3.73 \pm 0.01\%$ for MPF and $5.87 \pm 0.02\%$ for MKF. While these values are lower than conventional protein sources like soybean meal (~44%), MKF may be used as protein fraction for partial replacement of energy feedstuffs [21]. Protein quality, however, also depends on amino acid profile, and MKF could provide supplementary amino acids that enhance the overall balance of the diet when combined with other protein sources. In addition, MKF had a notably high fat content ($8.60 \pm 0.41\%$), that makes a valuable energy-rich ingredient for broiler diets, providing dense calories necessary for rapid growth. However, MPF had significantly higher crude fiber ($15.77 \pm 0.50\%$) compared to MKF ($2.19 \pm 0.10\%$). The high crude fibre content in MPF may limit digestibility and feed conversion efficiency in monogastric animals like broilers if used at high concentration [22]. Nevertheless, moderate incorporation may promote gut health and modulate digestion when combined with fermentable carbohydrates. Regarding

NFE contents, both by-products had high NFE values, with MKF ($74.66 \pm 0.80\%$) and MPF ($66.58 \pm 0.50\%$), suggesting their potential as readily fermentable carbohydrate sources. This result aligns with mango kernel high starch content (58–65%), making it a suitable alternative energy feedstuff in poultry diets [23]. High NFE levels can provide rapid energy release for growth, and their contribution is particularly important in starter diets, where energy demand is high. Based on their proximate composition, MKF can serve as a partial replacement for maize or oil-rich ingredients, contributing both energy and essential fatty acids. As for MPF, although less energy-dense and may be used at low levels to improve gut motility and mineral supply. Importantly, incorporating these by-products into broiler diets could contribute to sustainable feeding strategies by reducing the use of conventional feedstuffs in order to promote agricultural wastes.

3.2. Nutritive Value of Formulated Mango Peels and Kernels Flours Based Diets

The chemical composition of the experimental diets incorporating mango peels flour (MPF) and mango kernel flour (MKF) is presented in Table 3.

Table 3. Chemical composition of formulated diets.

	RC	R1	R2	R3
Moisture (%)	4.32 ± 0.05^c	5.42 ± 0.90^b	4.69 ± 0.16^c	7.12 ± 0.34^a
Proteins (%)	21.60 ± 0.33^a	18.43 ± 3.76^b	18.65 ± 1.77^b	19.39 ± 1.42^b
Lipids (%)	4.80 ± 0.42^b	4.71 ± 0.89^b	6.93 ± 0.28^a	5.12 ± 0.96^b
Ash (%)	6.13 ± 0.96^a	4.54 ± 0.80^b	2.30 ± 0.14^d	3.72 ± 0.50^c
Crude fibres (%)	4.74 ± 0.05^d	9.69 ± 0.10^a	7.77 ± 0.50^c	8.44 ± 0.13^b
NFE (%)	58.41 ± 0.05^b	57.21 ± 1.12^b	59.66 ± 0.46^a	56.21 ± 0.09^b
Metabolizable Energy (kcal/kg)	3632.40 ± 5.40^b	3449.50 ± 6.20^c	3756.10 ± 6.70^a	3484.80 ± 7.30^c

Means in the same row with different superscripts differ significantly at $p < 0.05$. MPF: mango peels flour; MKF: mango kernel flour. RC: control diet; R1, R2, R3: formulated diets incorporating MPF and MKF.

All the formulated diets maintained adequate crude protein levels (18.43–21.60%), suggesting that partial substitution of maize or oil with MPF or MKF does not compromise protein supply. Adequate protein levels are crucial in broiler nutrition, especially during the starter and grower phases, where protein is a primary driver of muscle formation and growth performance. Previous studies indicated that MKF, though lower in protein than soybean meal, can support broiler chicks' growth when properly balanced with lysine and methionine [21]. This highlights the importance of amino acid supplementation when integrating unconventional feed ingredients into

poultry diets. The R2 diet showed the highest fat content ($6.93 \pm 0.28\%$), due to the lipid-rich nature of mango kernels (10–12%). This enhances the energy density of the diet and supports better feed efficiency and weight gain in broilers [24]. MPF based diet (R1) contributed less fat ($4.71 \pm 0.89\%$), and the combination diet R3 (MPF+MKF) showed an intermediate level ($5.12 \pm 0.96\%$). The fiber content increased with MPF inclusion ($9.69 \pm 0.10\%$), due to its high natural fiber concentration [25]. The R2 diet fiber content ($7.77 \pm 0.50\%$), may indicate an optimal balance for starter/grower stages. NFE values across diets remained high (56.21–59.66%), ensuring carbohydrate

availability for energy and acceptable ranges for efficient energy metabolism in broilers [20]. High NFE levels, largely from starch and soluble carbohydrates, can support rapid growth rates, particularly when paired with adequate protein and lipid levels. All these results indicated that the formulated mango-based diets maintained balanced macronutrient profiles, offered enhanced fat and energy density and provided additional fiber, beneficial for gut function.

3.3. Effect of Formulated Diets on Broiler Chicks Growth Performance

3.3.1. Evolution of Body Weight and Body Weight Gain

The evolution of body weight (BW) of broiler chicks during dietary treatment is depicted in Figure 1. From the beginning to the end of experiment, incorporation of MPF and MKF has conducted to the increase of body weight. After 45 days of age, the weight and weight gain of the animals were significantly different ($p < 0.05$) with each type of diet.

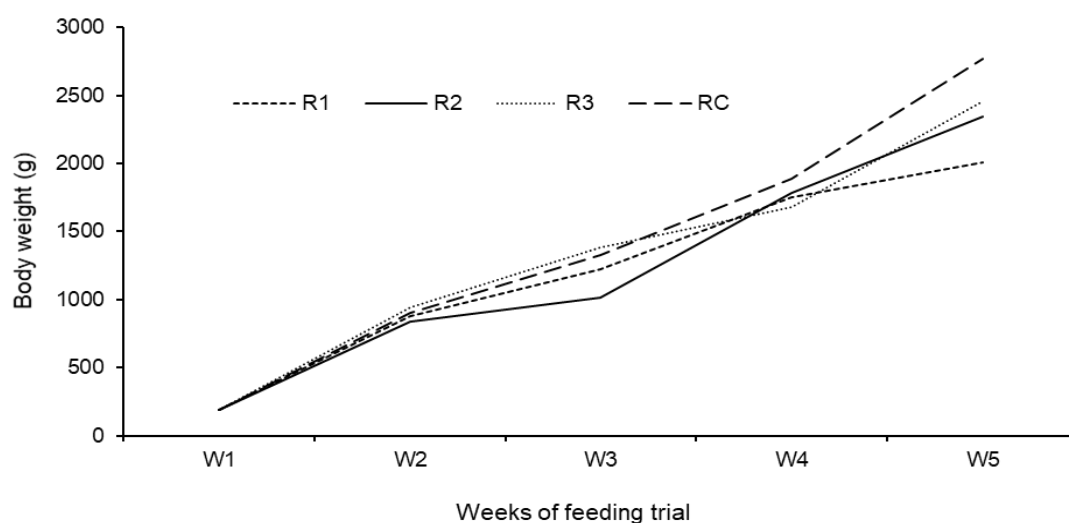


Figure 1. Evolution of body weight (BW) during feeding of broiler chicks. RC: control diet; R1, R2, R3: formulated diets incorporating MPF and MKF.

An average weight of 2086, 2489, 2516, and 2887 g were respectively recorded for diets R1, R2, R3 and RC. The highest body weight gain (Table 4) observed for the diet RC (81.31 ± 0.80 g) after 45 days may be explained by the lower content ($4.74 \pm 0.05\%$) of crude fibre compared to other diets. Indeed, crude fibre include other carbohydrates such as cellulose, hemicellulose, pentosans, all of which are poorly digested by poultry. Thus, these dietary carbohydrates often contribute to meet the energy requirement of poultry [26]. It was also observed that increasing rate of incorporation of MKF in the R2

diet had slightly decrease the body weight. This result is similar to that obtained by some authors [27]. Indeed, these authors indicated that the higher rate of incorporation of almond apricot cake is linked to the decrease in body weight of broilers chicks. This fact may be explained by the presence of condensed tannins which decrease protein digestibility [28]. These results highlight that strategic use of MPF and MKF in broiler diets can support growth, but inclusion rates must be optimized to minimize the negative effects of high fiber and anti-nutritional compounds like tannins.

Table 4. Evolution of body weight gain (BWG) during feeding of broiler chicks.

	RC	R1	R2	R3
Week 1	21.48 ± 0.50^a	21.48 ± 0.50^a	21.48 ± 0.50^a	21.48 ± 0.50^a
Week 2	82.04 ± 0.57^d	97.48 ± 0.50^b	92.79 ± 0.72^c	106.83 ± 0.79^a
Week 3	79.86 ± 0.61^a	49.94 ± 0.80^c	24.72 ± 0.44^d	63.50 ± 0.90^b
Week 4	80.02 ± 0.75^b	75.72 ± 0.23^c	110.01 ± 0.15^a	41.89 ± 0.60^d

	RC	R1	R2	R3
Week 5	81.31 ± 0.80 ^a	20.79 ± 0.60 ^d	68.56 ± 0.50 ^c	74.95 ± 0.90 ^b

Means in the same row with different superscripts differ significantly at $p < 0.05$. RC: control diet; R1, R2, R3: formulated diets incorporating MPF and MKF.

3.3.2. Feed Conversion Ratio

The effect of MPF and MKF incorporation on feed conversion ratio (FCR) is presented in Figure 2.

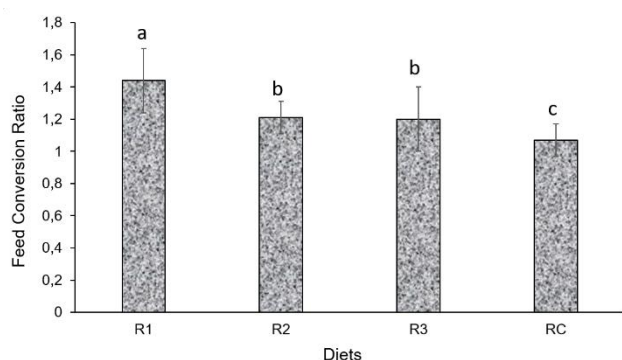


Figure 2. Feed conversion ratio (FCR) during feeding of broiler chicks after 45 days of treatment. values with different superscripts differ significantly at $p < 0.05$.

Feed intake increased while considering all the 4 diets during the experiment. Feed conversion ratio (FCR) was highest (1.44 ± 0.10) in the R1 diet compared to others diets R2 (1.21 ± 0.10), R3 (1.20 ± 0.15) and RC (1.07 ± 0.10). The feed conversion ratio obtained in this study were below to the normal range of 1.75-2.00 according to some authors [29]. The main factors that affect feed conversion consist of genetic, ventilation, sanitation, feed quality, type of feed, the use of additives, water quality, disease, drug, maintenance management, lighting and feeding [30]. Furthermore, the significant differences ($p < 0.05$) in FCR between diets suggest that dietary composition had a measurable effect on nutrient digestibility and utilization efficiency. These findings indicate the importance of optimizing incorporation levels of alternative feedstuffs like MPF and MKF to maintain feed efficiency while leveraging their functional and nutritional benefits.

3.3.3. Carcass Yield and Mortality Ratio

The values of carcass yield and the mortality for different treatment groups are presented in Table 5.

Table 5. Carcass yield and the mortality rates for experimental diets.

	RC	R1	R2	R3
Number of deaths	0	3	6	0
Mortality rate (%)	0	6.67	13.33	0
Carcass weight (g)	2569.50	1675	2001.60	2160
Carcass yield (%)	88.99	80.27	80.45	85.83

Mortality in all the groups varied from 0% (R3, RC) to 13.33% (R2) after 45 days of experimentation. Mortality rates across the RC and R3 groups were within acceptable limits (<5%) for broiler production, showing that no adverse health effects resulted from the incorporation of mango by-products [31]. The R3 group receiving 15% MKF highlighted more cases of mortality (13.33%) at 45 days of age. This mortality may be due to significant presence of anti-nutritional factors such as condensed tannins which induce adverse effects as reported in previous study [28]. The carcass yield of birds fed with R3 diet was comparable to the control and higher than the R1 and R2 groups. The lower carcass yield in R1 group may be due to

lower nutrient utilization efficiency [25]. However, combining MPF with MKF appeared to counterbalance this effect. This suggests a possible synergistic effect when combining the two mango by-products, potentially balancing nutrient supply and reducing the negative impact of high fiber or tannin content.

4. Conclusion

The aim of this study was to evaluate the effect of mango peels and kernel flours (MPF, MKF) on broilers chicks' growth performance. This work revealed that MPF and PKF are considered as a good source of nitrogen free extract (NFE)

and could be used in poultry feed. The R3 experimental diet was better used by the chickens compared to diets R1 and R2, respectively. These experimental diets have showed a considerable body weight gain. In addition, consumption indices changed with the age of the animals. This study demonstrates that MPF and MKF can be included up to 7.5% in broiler diets without adversely affecting growth performance, feed intake, or carcass yield, making them sustainable alternative feed ingredient. However, the inclusion of MKF up to 15%, resulted in reduced weight gain and feed efficiency, likely due to anti-nutritional factors. Overall, mango by-products, offer a promising opportunity to reduce feed costs and promote agricultural waste in poultry production systems, especially in mango-producing regions.

Abbreviations

BW	Body Weight
BWG	Body Weight Gain
MPF	Mango Peel Flour
MKF	Mango Kernel Flour
FCR	Feed Conversion Ratio

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Author Contributions

Dao Klognin: Data curation, Investigation, Methodology, Writing – original draft

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Zoue Lessoy Thierry: Conceptualization, Data curation, Funding acquisition, Supervision, Writing – review & editing

Niamke Lamine Sebastien: Data curation, Validation, Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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