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Effect Of Pellet And Crumble Feed In Starter Period By Using Starter And Super Starter Diets On Growth Performance And Intestinal Histology In Broiler Chicks

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ABSTRACT

This experiment was conducted at the University of Sulaymaniyah's poultry farm, Animal Science Department, College of Agricultural Engineering Sciences. This study is a component of my master's thesis. The experiment began on October 10, until November 13 of 2024, and the chicks were raised for 35 days. This study used 160 unsexed one old broiler chicks of the Ross 308 . the chicks divided to treatments by use completely randomized design in a 2 × 2 factorial was used two feed forms (pellet and crumble) and two feed quality in starter period (normal starter and super-starter) diet ،after starter period use same feed for grower (11-20) and finisher period (21-35) in all treatments. In starter period the interaction between pellet and super starter had significant ($p<0.05$) difference between treatments in weight gain, FCR, body weight and intestinal jejunal villi length. Consequently, in grower and finisher period, Within the same feed type, no significant differences ($P > 0.05$) were observed in body weight gain between crumble and pellet forms. Pellet super-starter achieved the highest value (3400.66 ± 352.69. Pellet starter had the best early-phase feed efficiency (FCR) (1.13 ± 0.05), while Crumble super-starter had the highest late-phase FCR (2.05 ± 0.28). Super-starter feeds outperform traditional starter meals in broiler development, influencing growth more than physical shape, indicating superiority for optimal poultry production ($P < 0.05$). observed the higher significant difference ($P < 0.05$) in body weight, body weight gain, FCR and intestinal villi length and width was constantly appear in treatments offered super -starter whether it was use pellet and crumble. this research it's a part of my master thesis..

***Keywords*:** pellet, crumble, starter, super -starter, performance, intestinal histology.

INTRODUCTION

Effect of Pellet and Crumble Feed in starter period by Using Starter and Super Starter Diets on Growth Performance and intestinal histology in Broiler Chicks is a critical area of poultry nutrition research. For example broiler chicks fed crumbles demonstrated improved or increased feed conversion ratios and enhanced gizzard development, which helped to positively affected morphology by intestinal and higher average daily feed intake (ADFI) and improved intestinal morphology, with longer villi in the duodenum and jejunum, which are crucial and important for nutrient absorption [1] [2,3]. On the other hand, pelleted feeds can result in decreased intestinal health and inferior early development performance, even though they may increase villus height and crypt depth [4,3]. Overall, the choice of feed form plays a critical role in optimizing both growth performance and intestinal health in broiler chicks. and intestinal histology of broiler chicks fed starter and super starter diets differ significantly based on the feed form, specifically between pellet and crumble feeds. suggesting that optimal best combinations can improve performance as a whole overall performance [5].A super starter diet for broilers, rich in protein and specific nutrients, improves growth performance and feed efficiency during early stage of development .According to Research diets containing 25% crude protein enhance body weight gain, feed conversion ratios, and economic efficiency [6].According to [7], pre-starter diets have a favorable effect on broiler chicken growth metrics and carcass yields, highlighting the significance of early nutritional interventions and a well-structured super starting diet. The significance of diet formulation in broiler management is shown by the impact that the energy content in starting meals has on nutrient digestibility and overall growth performance [8].

Materials And Methods

This experiment was conducted at the University of Sulaymaniyah's poultry farm, Animal Science Department, College of Agricultural Engineering Sciences. This study is a component of my master's thesis. The experiment began on October 10, 2024, and the chicks were raised for 35 days. This study used 160 unsexed day-old broiler chicks of the Ross 308 breed weighing 40g until December 13. Using pellet and crumble with Starter and Super Starter Diets, a comparative analysis of the effects of pellet and crumble feed on intestinal histology and growth performance in broiler chicks throughout the starter period.

Pellet and crumble Manufacturing:

the pellets are manufactured in golden feed factory is located in Bazyan-sulamaniah, pellet machines are made by Turkish company the capacity of this factory 20 ton/hour, the pellets can be manufactured in different sizes according to broiler ross manual. The pelleting process involves forcing the softened feed ingredients through a set of holes in a metal die by pressure exerted by the pellet rollers different designs exist in which usually two or three rollers are used. Pellet die holes round, non-tapered shape and can have diameters ranging from (2, 3, 4 and 5mm), depending on the growth period. As the pellet die rotates, feed is pressed between the die liner wall and a set of rollers. Pellets with desired lengths are cut off by an assembly by knives mounted on the inside of the die casting. Crumble Making: **Crushing:** Take the finished pellets and crush them into smaller pieces. this can be done using a mechanical crumbler.
-Starter period use mini pellet: diameter1.2mm length 3mm (millimeter) and crumble 1-2mm .
- Grower period use pellet: diameter 2mm length 4mm.
-Finisher period use pellet: diameter 4mm length 5 mm.

Body weight gain (BWG):

After the end of each period, body weight gain was calculated for each replicate using the following equation:
Body weight gain = Live body weight at the end of the period -Live body weight at the beginning of the period. [9]

Feed intake (FI):

Feed intake was calculated by measuring the amount of feed that were non-eaten by the chicks at the end of the week in each replicate. Feed intake was recorded every seven days, and was calculated by this equation:

$$= \frac{\text{feed provided at the begining of period(g)} - \text{feed provided at the end of the period(g)}}{Total\ number\ of\ birds}$$

Average feed intake (g):

$$= \frac{\text{feed intake by bird in known period(g)}}{(\text{number of living in same period} * \text{nnmber of period days}) - \text{total age of died bird}}$$

[9]

Feed conversion ratio (FCR):

The feed conversion ratio is the amount of feed intake estimated to unit weight for each weight gain estimated in the same unit, and it is calculated using the formulas below:

$$\text{feed conversion ratio} = \frac{\text{average of feed intake by one bird in duration}}{\text{average of weight gain by one bird in same duration}}$$

[9]

Intestine histology

At 10:35 days of age, the birds were slaughtered, and 24 samples of the jejunum were taken. After being cleaned and dehydrated, the tissues were embedded in paraffin. After that, the samples were divided into irregular pieces, stained with H&E, and viewed under a light microscope. A computer application called Quick Photo Micro 3.0 was used to take digital pictures for morphometric analysis in order to determine the jejunum villi's height and base width [10].

Cross-sections of ten villi were randomly chosen based on intact lamina propria, and the crypt depth was assessed at0× 40—the objective magnification. The computer program was utilized to measure the height and depth of the jejunum villi crypt.

The study used a variety of techniques to quantify the depth and width of the jejunum villi in birds [11] The distance between the junction and the basement membrane of the epithelial cell at the bottom of the crypt was used to calculate the villus width. Each bird's average height and base width were reported as averages [10,11].

Table 1: show feed ingredients in super starter, starter, grower and finisher.

Ingredients %	Super starter	Starter	Grower	Finisher
Soya bean meal	44	36	30.8	25.2
Yellow Corn	40	50	45	45
Premix*	3	2.5	2.5	2.5
Soy Oil	2	2	2.5	2.7
Limestone	1.5	1.5	1.2	1
Wheat	9.4	7.9	17.9	23.5
Salt	0.1	0.1	0.1	0.1
Toxin binder	+**	-***	-	-
Protaese	+	-	-	-
Essensial oil	+	-	-	-
Acidefire	+	-	-	-
Emulsifeir	+	-	-	-
Total /kg	100	100	100	100
	Analysis			
Protein	24.19	22.6	20.2	18.01
Energy	3000	3000	3100	3150
Ash	4.22	4.26	4.17	4.34
Fat	4.8	4	4.84	5.15
Fiber	2.94	2.68	2.68	2.58
Moisture	9.41	8.88	10.75	11.32
Lysine	1.8	1.5	1.3	1.2
Methionine	0.7	0.65	0.6	0.5
Calcium	1	0.9	0.8	0.7
Phosphor	0.5	0.45	0.4	0.35

*dofamix Premix consist of :17% crud protein,0.6% crud fiber, 0.37%crud fat, 70% crud ash, 14.4calcium, 3.65phosphorus, 7%lysin, 9%methionine, 1%thruonine. Trace elements: 2,400 mg Fe (3b103 Iron (II)sulphate monohydrate); 80 mg I (3b202 Calcium iodate); 600 mg Cu (E4 Cupric (II)sulphate-pentahydrate); 2,800 mg Mn (3b502 Manganese (II)oxide); 2,800 mg Zn (3b605 Zinc sulphate monohydrate); 10 mg Se (E8 Sodium Selenite).
** add theses material for ratio.
*** absent these materials in ratio.

Results And Discussions:

Table2: Show the effect of interaction between feed form and feed quality in Starter period consequently grower and finisher period on (body weight/g ±SE).

Feed type		BW		
		Starter (0-10)	Grower (11-20)	Finisher (21-35)
Crumble	Normal-Starter	244.00±7.00^{b}	789.64±38.08^{a}	1924.26±12.31^{ab}
Pellet	Normal-Starter	241.61±7.46^{b}	790.83±12.62^{a}	1887.06±36.77^{b}
Crumble	Super-Starter	246.66±7.36^{b}	812.35±34.23^{a}	2070.35±94.03^{a}
Pellet	Super-Starter	281.43±8.57^{a}	814.29±13.81^{a}	2093.70 ±31.27^{a}

(Mean ±SE) a, b, c Means in the same column followed by different letters are significantly different at ($p \leq 0.05$); NS, not significantly; SE, Standard error.

Tables (2) Shows the effect of interaction between feed form and feed quality in starter period consequently grower and finisher period on (BW). The birds fed pellets with a super-starter diet gained greater body weight during the starter period (281.43±8.57a) when compared to the other groups. In this phase, the advantages gained from the other treatments—crumble normal, pellet normal, and crumble super starter—were equal and less significant. The treatments do not significantly differ ($p>0.05$) from one another over the grower period. The weight gains for all groups ranged from 789.64±38.08a to 814.29±13.81a, suggesting that food and feed type had little impact at this stage. In the finisher period, birds fed the Pellet Super-Starter (2093.70±31.27a) and Crumble Super-Starter (2070.35±94.03a) had significantly higher body weights compared to the Pellet Normal-Starter group (1887.06±36.77b). The Crumble Normal-Starter group (1924.26±12.31ab) was in between and not significantly different from either group.The pellet super-starter group had the greatest body weight gain during the finisher period

(2093.70±31.27a), closely followed by the crumble super-starter group (2070.35±94.03a). They had significantly higher body weights compared to the normal starter groups; both groups achieved significantly better. The normal crumble group showed a greater value but not statistically different from either group gain (1924.26±12.31ab). The study found significant differences in body weight among broilers fed pellet and crumble feeds at different growth stages. Pellet diets underperformed regardless of diet phase, while pellet Super feed was more effective in promoting late-stage growth. Pelleted diets improved early weight gain and feed conversion [12]. broiler growth performance is influenced by feed type, with pellets limiting intake in younger birds due to hardness, but increasing feed efficiency due to reduced waste [13]. Crumble and pellet form Super feed enhances weight growth and nutrient absorption in the finisher phase, maximizing broiler growth and efficiency in their early stages [14].

Table3: Show the effect of interaction between feed form and feed quality in starter period consequently grower and finisher period on (body weight gain/g ±SE).

Feed type		BWG			
		Starter (0-10)	Grower (11-20)	Finisher (21-35)	Overall (0-35)
Crumble	Normal-Starter	204.75± 7.50^{b}	505.63±32.50 ^{a}	1000.62±37.43^{b}	1885.01±12.02^{b}
Pellet	Normal-Starter	202.99±7.11 ^{b}	519.21± 14.33^{a}	996.23±43.38 ^{b}	1848.44±37.06 ^{b}
Crumble	Super-Stater	236.29±7.871 ^{a}	565.68 ±30.65^{a}	1258.00± 78.91^{a}	2029.98±93.95 ^{a}
Pellet	Super-Starter	243.06±10.09^{a}	572.86 ±18.04^{a}	1179.40±26.34 ^{a}	2055.33±29.64 ^{a}

(Mean ±SE) a, b, c Means in the same column followed by different letters are significantly different at ($p \leq 0.05$); NS, not significantly; SE, Standard error.

Tables (3) Show the effect of interaction between feed form and feed quality in starter period consequently grower and finisher period on (body weight gain). when given a super starter diet in the starter phase, birds fed crumble or pellet feed had significantly higher BWG (236.29±7.87a and 243.06±10.09a, respectively) than birds fed the normal starter diet (204.75±7.50b for crumble and 202.99±7.11b for pellet). All groups showed statistically comparable weight increases during the grower phase, indicating no significant differences between the treatments; nevertheless, quantitatively, the super starting diets again generated larger BWG. When compared with birds on normal starter diets (1000.62±37.43b for crumble and 996.23±43.38b for pellet), those on super starter diets had a significantly greater BWG during the finisher phase (1258.00±78.91a for crumble and 1179.40±26.34a for pellet). In comparison to the standard starter treatments (1885.01±12.02b for crumble and 1848.44±37.06b for pellet), both super starter treatments showed a significantly higher total BWG during the entire period (2029.98±93.95a for crumble and 2055.33±29.64a for pellet). Broilers' nutritional needs are consistently met during early growth phases, with crumbles being more advantageous for young birds in the grower period [15]. suggesting pelletized Super feed may promote early development [13] According to [16] . Crumbles in early growth may be more advantageous for young bird. crumble diets enhance young birds' growth performance by increasing body weight gain and improving feed conversion ratios, regardless of the diet's energy content, indicating the importance of diet form in early development[17]. The study found that pellet and crumble super-starters outperformed pellet starter and starter in terms of overall performance, suggesting that Super Feed promotes cumulative growth [18].

Table 4: Show the effect of interaction between feed form and feed quality in starter period consequently grower and finisher period on (Feed intake/g ±SE).

Feed type		Feed intake			
		Starter (0-10)	Grower (11-20)	Finisher (21-35)	Overall (0-35)
Crumble	Normal-Starter	211.50 ±5.42^{a}	842.95±46.01 ^{a}	1975.84± 65.51^{a}	3204.30±92.17 ^{a}
Pellet	Normal-Starter	230.27± 12.92^{a}	760.12± 17.04^{a}	2006.62 ±145.41^{a}	3180.03± 147.93^{a}
Crumble	Super-Starter	214.81±9.98 ^{a}	795.34± 19.99^{a}	2363.56± 197.28^{a}	3373.70±212.36^{a}
Pellet	Super-Starter	218.98± 9.42^{a}	755.27±9.43 ^{a}	2426.40±363.27 ^{a}	3400.66±352.69 ^{a}

(Mean ±SE) a, b, c Means in the same column followed by different letters are significantly different at ($p \leq 0.05$); NS, not significantly; SE, Standard error.

Tables (4) Show the effect of interaction between feed form and feed quality in starter period consequently grower and finisher period on (Feed intake). Birds fed pellet and super-starting diets gained slightly more weight on average during the starter period (218.98±9.42 g) than the crumble and normal-starter groups (211.50±5.42 g), but this difference was not statistically significant. The crumble with the normal-starter group gained the most body weight during the growth period (842.955±46.018 g), while the pellet with the super-starter group gained the least (755.27±9.43 g); however, these differences were not statistically significant. The groups fed super-starter diets gained much more weight during the finisher period. The crumble with the super-starter group (2363.56±197.28 g) and the pellet with the super-starter group (2426.40±363.27 g) had the maximum weight increase. However, the pellet and crumble groups fed regular beginning foods showed lower values.The super-starter groups were better than the normal-starter groups when taking into account the total amount of body weight gained. The crumble with the super-starter group (3373.70±212.36 g) finished second to the pellet with the super-starter group, which had the largest overall gain (3400.66±352.69 g). The crumble and pellet groups achieved (3204.30±92.17 g and 3180.03±147.93 g), respectively, while the normal-starter groups showed slightly lower total improvements. These numerical variations were not statistically significant, however. The same result was in agreement with the finding that pelletized feeds promote better early intake due to decreased waste and enhanced handling qualities [13]. Super-fed groups showed higher intake during the finisher phase compared to starter-fed groups, suggesting the super diet formulation better meets older birds' nutritional needs [19].

Table 5: Show the effect of interaction between feed form and feed quality in starter period consequently grower and finisher period on (Feed Conversion Ratio (g/kg ±SE).

Feed type		FCR			
		Starter (0-10)	Grower (11-20)	Finisher 21-35)	Overall (0-35)
Crumble	Normal-Starter	1.03±0.06 [b]	1.54 ±0.01[a]	1.97±0.01 [a]	1.70±0.04[b]
Pellet	Normal-Starter	1.13±0.05 [b]	1.58 ±0.05[a]	2.01±0.15 [a]	1.72±0.09 [b]
Crumble	Super-Stater	0.94±0.04 [a]	1.40±0.09 [a]	1.87±0.12 [a]	1.66±0.10 [a]
Pellet	Super-Starter	0.90±0.03 [a]	1.41±0.05[a]	1.85±0.28 [a]	1.65±0.17 [a]

(Mean ±SE) a, b, c Means in the same column followed by different letters are significantly different at ($p \leq 0.05$); NS, not significantly; SE, Standard error.

Tables (5) Show the effect of interaction between feed form and feed quality in starter period consequently grower and finisher period on (Feed Conversion Ratio The group that received pellet feed with a super starter had the best FCR (0.90±0.03), and crumble with a super starter came in next (0.9±0.04). Compared to the normal beginner groups, these values were significantly lower. While the differences between treatments were not statistically significant, FCR was also higher in the groups fed the super starting diet during the grower period (11–20 days). The crumble-super starter group once again had the lowest FCR all over this time frame (1.405±0.094), while the pellet-normal starter group had the greatest (1.584±0.058). The pellet-super starter group had the highest FCR over the finisher period (21–35 days) (1.85±0.28), closely followed by the crumble-super starter group (1.87±0.12). During this time, the FCRs of the normal starter groups were higher; the pellet-normal starter had the highest value (2.01±0.15). Overall, the birds fed the super starter diet exhibited higher FCRs from day 0 to day 35. The pellet-super starting group had the lowest overall FCR (1.65±0.17), followed by the crumble-super starter group (1.66±0.10). The pellet-normal starter had the highest overall FCR (1.72±0.09), whereas the normal starter groups had greater FCRs overall. This study suggests that feed efficiency was increased throughout the rearing period by using a super starting diet, regardless of feed form. The feed conversion ratio data reveals that pelletized Super feed, outperforming starter and pellet, may improve early growth efficiency by reducing feed waste and improving nutrient availability. [13] .Pellet shape doesn't guarantee efficiency without appropriate feed formulation; short-term effects of feed type may not last long, as evidenced by lower total FCR in normal-starters[20].FCR remained consistent over intermediate growth phases, with Crumble (Starter) having the highest value, indicating that broilers grow accustomed to different feed types Crumble (Super-starter) and Crumble (Starter) have superior FCR in the finisher phase, resulting in improved FCR and reduced production costs in broilers[21]. Broiler FCR improves in the first few weeks when fed pelleted diets, suggesting crumble-form meals can encourage greater nutrient utilization in later growth stages due to enhanced digestibility or gut health [12,22].

Table 6: Show the effect of interaction between feed form and feed quality in Jejunum Villi (Height and Width/μ meter ±SE) in 10 and 35 days

Feed type		Period			
		10 days (age)		35 days(age)	
		high	widith	high	Widith
Crumble	Normal-Starter	479.75 ± 20.14[b]	71.77 ± 8.25[b]	1348.96± 55.12[b]	165.78 ±11.59[b]
Pellet	Normal-Starter	477.00 ± 17.44[b]	74.37 ± 5.90[b]	1352.89± 60.86[b]	177.53 ±10.51[b]
Crumble	Super- Starter	532.33 ± 23.63[a]	88.90 ± 5.03[a]	1500.47± 36.20[a]	200.96 ±12.53[a]
Pellet	Super- Starter	537.50 ± 35.58[a]	86.33 ± 8.41[a]	1536.99± 69.96[a]	210.16 ±7.83[a]

(Mean ±SE) a, b, c Means in the same column followed by different letters are significantly different at ($p \leq 0.05$); NS, not significantly; SE, Standard error.

The study found that super starter meals significantly increased the height and width of jejunum villi at normal-starter and over all of age compared to regular starting diets. The diet content was more crucial for intestinal growth than feed structure, suggesting that altered intestinal architecture may promote nutrient absorption and chicken development.

The study reveals that the super starter diet significantly increases villus width and height in birds at normal-starter and over all of age, regardless of feed type. The villi of the animals fed the super starter diet were taller at normal-starter of age, and wider at overall period. This suggests that the super starter diet improves intestinal architecture, leading to better growth performance and nutrient absorption. The enhanced villus structure may be due to the increased nutritional density or improved digestibility of the super starting formulation [23,24].

Conclusion

The result of this study indicate broiler growth performance is greatly influenced by feed formulation, particularly super-starter feeds, which consistently result in higher cumulative weight gain and better long-term growth performance. Pellet super-starter has the best early-phase feed efficiency and reaches the highest body weight.

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حساب خسائر وحدات حاصدة القمح عند سرع وارتفاع قطع مختلفة

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الخلاصة

أجريت هذه التجربة في مزرعة بجامعة السليمانية، قسم علوم الحيوان، كلية علوم الهندسة الزراعية. هذه الدراسة هي جزء من أطروحة الماجستير الخاصة بي. بدأت التجربة في 10 أكتوبر، حتى 13 نوفيمبرمن عام 2024، وتم تربية الكتاكيت لمدة 35 يومًا. استخدمت هذه الدراسة 160 كتكوتًا من دجاج اللحم القديم غير محدد الجنس من سلالة (روز308)،تم تقسيم الكتاكيت الى معاملات باستخدام تصميم عشوائى كامل فى عامل(2*2) تم استخدام شكلين من اشكال العلف (الحبيبات والفتات) ونوعين من جودة العلف فى فترة البادئ (بادئ فائق وبادئ عادى) وبعد فترة البادئ استخدام نفس العلف لفترتى النو والتشطيب فى جميع المعاملات . فى فترة البادئ كان لتفاعل بين الحبيبات والادئ الفائق فرقا معنويا بين المعاملات فى زيادة الوزن ومعدل تحويل الغذائى ووزن الجسم وطول الزغابات المعوية الصائمية.وبالتالى فى فترة النمو والانهاء وضمن نفس نوع العلف،لم تلاحض اى فروق ذات دلالة احصائية فى اكتساب وزن الجسم بين اشكال (الحبيبات والفتات)حقق علف بادئ الفائق الحبيبات اعلى قيمة(352.697±3400.661) كان لهذا العلف افضل كفاءةالتغذية فى مرحلة المبكرة (1.134±0.055)بينما اعلاف البادئ الفائق(الفتات)اعلى كفاءة التغذيةفى مراحل متاخرة (2.057±0.287)لتتفوق اعلاف بادىء الفائق على وجبات التقلدية فى نمودجاج التسمين.مما يشير تفوق فى انتاج الدواجن الامثل لوحض وجود فرق كبير فى وزن جسم وزيادة وزن الجسم وطول وعرض الزغابات المعوية باستمرارفى المعاملات المقدمة العلف البادىء الفائق سواء كان يستخدم الحبيبات والفتات.

الكلمات المفتاحية: حبيبات، فتات، بادئ، بادئ فائق، أداء، علم الأنسجة المعوية.