The effect of diet dilution with sand and wheat bran during 8-28 days of age on broiler performance , carcass characteristics and feed cost

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SUMMARY

An experiment was conducted to study the effect of diet dilution with sand and wheat bran in the starter period of age (8 to 28d) on performance , carcass characteristics and feed cost , in a completely randomized design . The experiment consisted of 4 treatments . 4 replicates , with 8 chicks per cach replicate . To dilute the diets four levels (0 , 10 , 15 , and 20 %) of sand and wheat bran (50:50) were used . Chicks were fed with pre - starter diet from 0-7 days of age . The diluted diets were offered to the chicks from 8-28 days old . During the finisher period chicks were fed common finisher diet . Feed and water were allowed ad libirum to all birds . During the experiment feed intake , body weight gain , and feed conversion ratio were measured weekly . Feed cost was calculated at the end of the experiment (48 days of age) . At the end of the experiment two chicks each replicate were selected and carcass characteristics were measured . Comparing mean levels of diet dilution with control chicks showed that feed intake in different levels of dilution was more than controls ($p < 0.05$) but there was no significant difference between 10 and 15 % levels of dilution and the control . Also there was no significant difference between 10 and 15 % dilution levels and the control in weight gain , live body weight , and feed conversion ratio at 28 day old of age . Due to compensatory growth after restriction period , there was no significant difference in feed intake , weight gain , and feed conversion ratio among restricted chicks and the controls at 48 - day - old , despite that feed intake in different levels of dilution was more than that of control chicks . Feed cost of the diluted diets was 6.29 % . 9.86 % , and 12.59 % lower than the control diet , respectively .

INTRODUCTION

The success of feed restriction programs in improving feed efficiency and allowing full body weight recovery has been attributed to a number of factors ; the energy that supports growth compensation may come from the reduced requirements for maintenance energy related to lower body weight and metabolic adaptation (Yu and Robinson , 1992) . Greater feed intake relative to body weight and its association with digestive adaptations may also be contributing factors to growth compensation (Zubair and Leeson 1994)

Younger broilers adjust feed intake to maximum physical capacity , so early growth rate can be tempered by lower energy diets ; in 7 day old birds , about 80 % of feed is directed to growth and only 20 % is needed to maintain the small body size , consequently feed is used very efficiently (Leeson , 2008) , so it is useful to restrict feed during early age without affecting final body weight since younger birds will compensate growth successfully (Zubair and Leeson , 1994 ; Leeson , 2008) . In formulating poultry diets , energy level is usually selected as the starting point . An appropriate energy level is one that most likely results in the lowest feed cost per unit of production . In areas of the world where high energy grains and feed - grade fats are a relatively inexpensive , high - energy diets are often most economical Cie . , the lowest feed cost per unit of product) . In Sudan , high - energy grains are expensive , and since broilers are grown on high - energy diets (3100-3200kcal / kg) , the diet used comprises high feed cost per unit of product .

In diet dilution methods , diets are mixed with , some edible and , non digestible ingredients , such as fiber , wheat bran , and wood shavings , and sand , which are cheap materials that reduce feed cost when added , so qualitative feed restriction can be used as a method of diet dilution to decrease cost without affecting the final body weight . This study aimed to evaluate the effect of diet dilution with sand and wheat bran on broiler performance , carcass characteristics , and feed cost .

MATERIALS AND METHODS

This experiment was carried out at the Animal Production Research Centre , Kuku , from 9 5 2009 to 266/2009 .

Experimental birds : One hundred and twenty eight unsexed , one - day old Cobb broiler chicks were reared in an open - sided house on deep litter with the floor space partitioned to provide accommodation for the eight broiler birds per replicate . Birds were randomly allocated to one of four treatment groups . Each treatment consisted of four replicates . The weights of the birds in the replicate groups were adjusted to give near uniform initial weights for all the groups .

Experimental diets : Five starter diets Table 1 were formulated such that treatment I was a standard broiler starter and diet 5 was a common finisher . Diets were diluted by inclusion of sand and wheat bran (wt : wt) in the levels 10 , 15 and 20 % for treatment 2 , 3 and 4 , respectively . All birds received the same pre starter diet to 7 - day of age . Treatment diets were offered to the birds from 8 to 28 days of age . The common finisher diet was offered to all birds from 29 to 48 days of age . All diets were available for ad libitum consumption throughout the experiment . Due to dilution the experimental diets were neither iso - caloric nor iso - nitrogenous .

Table 1. Composition and calculated nutrients of the experimental diets.

Diet	Starter				Finisher
Diluting level	0%	10%	15%	20%	0%
Ingredients					
Sorghum %	66.95	62.05	57.05	59.05	69.45
Groundnut cake %	25	20	20	13	19
Super concentrate %	5	5	5	5	5
Wheat bran %	0	5	7.5	10	3.6
Sand %	0	5	7.5	10	0
Lime stone %	2	2	2	2	2
Dicalcium phosphate %	0.5	0.5	0.5	0.5	0.5
Organic acids %	0.1	0.1	0.1	0.1	0.1
Anti myctoxins %	0.1	0.1	0.1	0.1	0.1
Salt %	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100

Calculated nutrients					
ME (kcal\kg)	3093	2882	2757	2698	3082
Crude protein %	23.4	21.1	20.8	18.1	21.3
Ca %	1.37	1.37	1.35	1.2	1.3
Lysine %	1.2	1.2	1.27	1.1	1.2
Methionine%	0.48	0.47	0.47	0.45	0.48
CF %	4.1	4.2	4.4	4.1	4.1
P available%	0.66	0.66	0.66	0.56	0.66
Proximate analysis					
Dry matter %	94.4	93.50	92.2	92.5	93.7
Ash %	7.95	18.28	13.55	21.27	10.52
Crude protein %	22.88	20.83	20.72	23.87	26.815
Crude liber %	8.8	5.60	4.80	7.60	2.2
Ether extract %	2.8	1.6	2.4	2.4	9.2

Table 2. Cost of the experimental diets (SDG/ton).

Ingredients	Common starter	10%	15%	20%	Common finisher
Feterita	818	758	698	722	849
Groundnut cake	270	216	216	140	205
Broiler concentrate	186	186	186	186	186
Wheat bran	0	29	43	58	21
Sand	0	1	2	3	0
Lime stone	4	4	4	4	4
Dicalcium phosphate	19	19	19	19	19
Anti mycotoxins	12	12	12	12	12
Organic acids	9	9	9	9	9
Salt	1	1	1	1	1
Total cost	1319	1236	1189	1153	1306
Reduction in cost (%)		6.29	9.86	12.59	

Data collection : The data collected during the experiment included , weekly feed intake , weight gain , feed conversion ratio , and final body weight . Feed cost was calculated at the end of the experiment (48 days) . Eight birds from each treatment were randomly selected for carcass analysis at 48 days of age . Statistical analysis : In this experiment birds were assigned to the four dietary treatment groups following a completely randomized design (CRD) . When necessary , the data means analyzed by analysis of variance were separated by Duncan's Multiple Range Test . The level of significance was reported at ($P < 0.05$) .

RESULT AND DISCUSSION

dilution during 8-14 days of age :

The effects of diet dilution on performance during 8-14 days of age are shown in Table 3. Birds fed diluted diets (10 and 15 %) showed significantly ($P < 0.05$) higher feed intake than control ones . The increased level of feed consumption is an attempt of restricted birds to maintain nutrient requirement . This result is in agreement with Leeson et al . (1991) . (1996) . (1997) ; Yussefi Kelaricolaii et al . (2001) and Teimouri et al . (2005) . Birds fed 20 % diluted diet showed significantly reduced feed intake . Younger broilers adjust their feed intake to maximum physical capacity , so less feed is consumed due to increased bulk density of 20 % diluted diet . Despite the reduced feed intake of control birds , there were no significant difference in weight gain , feed conversion ratio and live body weight between birds fed 10 and 15 % diluted diets and control birds at 14 days of age.

Table 3. The effect of starter diet dilution during 8-14 days of age.

Parameters	Dilution levels 0%	10%	15%	20%
Feed intake (g/bird)	284^{a} ± 10.9	297^{b} ± 3.46	296^{b} ± 4.04	253^{c} ± 3.46
Weight gain (g/bird)	129.7^{a} ± 7.63	119.0^{a} ± 6.92	125.0^{a} ± 4.89	91.0^{b} ± 3.46
FCR (g/g)	2.17^{a} ± 0.09	2.52^{a} ± 0.15	2.37^{a} ± 0.09	2.75^{b} ± 0.17
Live body weight(g/bird)	275.5^{a} ± 8.96	269.0^{a} ± 6.93	272.0^{a} ± 6.00	238.0^{b} ± 0.00

**Means in the same raw with no common superscripts differ significantly (P<0.05).*

The effect of diet dilution during 15-21 days of age :

The effects of diet dilution on performance during 15-21 days of age are shown in Table 4. Although there were no significant difference in food intake among restricted and control birds , 15 and 20 % dilution levels showed decreased feed intake . The result is in agreement with Teimourier al . (2005) who reported decreased feed intake among restricted birds when feed intake was calculated excluding the diluting material (charcoal) .

Table 4. The effect of starter diet dilution during 15-21 days of age.

Parameters	Dilution levels 0%	10%	15%	20%
Feed intake (g/bird)	353.25a ± 8.13	369.25ab ± 15.1	348.25ab ± 11.84	349.25ab ± 40.35
Weight gain (g/bird)	279.75^{a} ± 68.99	259.75^{a} ± 21.42	254.00^{a} ± 22.46	172.00^{b} ± 16.05
FCR (g/g)	1.32^{a} ± 0.24	1.45^{a} ± 0.06	1.45^{a} ± 0.1	2.02^{b} ± 0.1
Live body weight (g/bird)	519.00^{a} ± 16.28	518.00^{a} ± 12.5	515.00^{a} ± 11.26	410.00^{b} ± 15.64

**Means in the same raw with no common superscripts differ significantly (P<0.05).*

The effect of diet dilution during 22-28days of age :

The effects of diet dilution on performance during 22-28 days of age are shown in Table 5. At day 28 (the end of restriction period) there were no significant difference in weight gain , feed conversion ratio and body weight between 10 and 15 % restricted birds and control ones . Feed intake of restricted birds was less than that of control birds . The result is in agrees with the findings of Teimouri et al . (2005) .

Table 5. The effect of starter diet dilution during 22-28 days of age.

	Dilution levels			
Parameters	0%	10%	15%	20%
Feed intake (g/bird)	565.5^{ac} ± 78.66	510.00^{ab} ± 54.69	521.75^{ab} ± 51.27	429.5^{ac} ± 36.48
Weight gain (g/bird)	328.25^{ac} ± 21.42	347.00^{ab} ± 6.00	322.5^{ab} ± 14.61	310.00^{ac} ± 15.64
FCR (g/g)	1.7^{a} ± 0.18	1.47^{ab} ± 0.15	1.62^{ab} ± 0.2	1.4^{b} ± 0.1
Live body weight (g/bird)	847.00^{ab} ± 32.7	875.00^{a} ± 20.41	837.5^{a} ± 19.82	720.00^{b} ± 30.29

**Means in the same raw with no common superscripts differ significantly (P<0.05).*

Overall performance (0-48 days) ; The effects of diet dilution during 8-48 days of age on overall performance are shown sin Table 6 . Feed intake between 8 to 48 days was not significantly affected by diet dilution in 8-28 days of age . Results of the present study are in agreement with the findings of Lee and Leeson (2001) ; Yussefi Kelaricolaii et al . (2001) and Teimouri et al . (2005) .

When birds resumed eating the common finisher diet (29-48d) did significantly affect body weight gain . Results of this study are in agreement with the findings of Leeson et al . (2001) ; Yussefi Kelaricolaii et al . (2001) : Lippens et al . (2002) and Teimouri et al . (2005) There was no significant difference among treatments for the feed conversion ratio in the whole period of the experiment (Urdaneta R. and Leeson S. , 2000) . This is in

contrast with the findings of Kasim and Leeson (1992) ; Pinchasoy and Jensen (1989) .

Birds fed 20 % diluted diet showed similar performance like control birds fed undiluted diets . The improvement in feed conversion ratio observed in feed restricted broilers has been attributed to reduced overall maintenance requirement caused by a transient decrease in basal metabolic rate . Many investigators have observed more efficient feed conversion in feed - restricted cohorts (Kasim and Leeson , 1992 ; Pinchasov and Jensen , 1989) . At 48 days of age there was no significant difference in body weight among treatments which indicated complete compensatory growth . This result is in contrast with the findings of Plavnik and Hurwitz (1990) : Jones and Farrell (1992) ; Santoso et al . , (1993 ") ; Zubair and Leeson (1994 ") ; Deaton (1995) and Teimouri et al . , (2005) .

Table 6. The effect of starter diet dilution during the starter period on overall performance.

	Dilution levels			
Parameters	0%	10%	15%	20%
Feed intake (g/bird)	2933.75^{ac} ± 219.91	2999.75^{ab} ± 262.2	3041.75^{ab} ± 86.03	2691.8^{ac} ± 164.01
Weight gain (g/bird)	1424.00 ± 123.33	1468.25 ± 86.72	1498.25 ± 60.5	1369.5 ± 154.01
FCR (g/g)	2.07 ± 0.1	2.05 ± 0.23	2.02 ± 0.1	2.00 ± 0.163
Live body weight (g/bird)	1706.25^{a} ± 218.3	1681.25^{ab} ± 190.8	1800^{ab} ± 167.08	1675^{ac} ± 220.79

**Means in the same row with no common superscripts differ significantly (P<0.05).*

Carcass characteristics :

The effect of diet dilution on Carcass characteristics is presented on Table 7. Carcass weights at 48 days of age were not affected by diet dilution . None of the other parts (thighs and drumsticks) was significantly affected

by feed restriction . This result is in agreement with Saleh et al . , 1996 ; Lippens et al . (2000) on the other hand Rezaei et al . (2006) stated that diet dilution did not have significant effect on carcass , breast meat , drum stick and thighs percentages

There was no significant difference in abdominal fat pad between restricted and full fed birds (Fontana et al . , 1993 ; Lippens et al . , 2000 ; Lee and Leeson , 2001) . The result is in contrast with the findings of Summers et al . (1990) ; Leeson et al . (1991) ; Robinson et al . , (1992) who reported lower fat content of the feed restricted birds .

Table 7. The effect of starter diet dilution during the starter period on carcass characteristics.

	Dilution levels			
Parameters	0%	10%	15%	20%
Carcass (g)	1242.25 ±155.64	1173.75 ±117.99	1306.25 ±149.12	1206.25 ±189.2
Breast (g)	392.75 ±74.95	394.5 ±43.67	400.0 ±77.02	405.75 ±58.58
Thighs (g)	248.75 ±50.72	226.25 ±18.46	238.25 ±26.56	258.25 ±15.12
Drumsticks (g)	188.25 ±18.94	185.75 ±11.05	179.5 ±24.51	197.5 ±21.01
Abdominal fat (g)	27.75 ± 12.81	25.75 ± 5.37	29.00 ± 9.55	28.25 ± 15.88

**Means in the same raw with no different superscript do not differ significantly at (P<0.05) of probability.*

CONCLUSION

In conclusion , diet dilution as used in this experiment indicated that the broiler chicken can withstand 20 days under nutrient when diets were diluted with wheat bran and sand (wt : wt) at the levels of 10 and 15 % without any loss in marketable final body weight . The cost of 10 and 15 % was lower by 6.29 % (83.00 SDG) and 9.86 % (130.00 SDG) , Table 2 ,

respectively . The study concludes that , qualitative feed restriction could be to reduce feed cost .

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اثر تخفيف العطف باستخدام الرمل و ردة القمح خلال 8-28 يوما من العمر على أداء دجاج اللحم وخصائص الذبيحة و تكلفة العلف

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ملخص البحث

أجريت تجربة لدراسة تأثير تخفيف العنف بالرمل وردة القمح في عمر 8-28 يوما على أداء دجاج اللحم و خصائص الذبيحة وتكلفة العنف في تصميم كامل العشوائية . تألفت التجربة من اربع معاملات ، وأربعة مكررات ، وثمانية كتاكيت لكل مكرر . خفف العلف باستخدام اربعة مستويات من الرمل وردة القمح (50:50) كانت كالتالي : 0 ، 10 ، 15 ، و 20 % غايت الكتاكيت على عطف قبل بادى في عمر 0-7 أيام ، وقدم العلف المخففة و في عمر 8 - 28 يوما ، ثم قدم علف ناهي عادي في عمر 29-46 يوما خلال التجربة سجلت القراءات التالية : معدل استهلاك العلف ، و الوزن المكتسب ، و معامل التحويل الغذائي اسبوعيا . بنهاية التجربة تم حساب تكلفة العلف تم اختيار طائرين من كل مكرر وقيست خصائص الذبيحة بمقارنة المتوسطات لكل من العلف المخفف و العليقة الضابطة وجد أن معدل استهلاك العلف في كل مستويات التخفيف كان أكبر من معدل استهلاك العليقة الضابطة عند مستوى معنوية 0.5 > P ، لكن لم يوجد فرق معنوي بين مستوي التخفيف 10 % و 15 % والعليقة الضابطة كذلك لم يوجد فرق معنوي بين مستويي التخفيف 10% و 15 % والعليقة الضابطة في الوزن المكتسب و الوزن الحي و معامل التحويل الغذائي عند عمر 28 يوما . نتيجة للنمو التعويضي بعد فترة تحديد التغذية لم يكن هناك فرق معنوي بين العلف المخفف و العليقة الضابطة في معدل استهلاك العلف و الوزن المكتسب و الوزن الحي و معامل التحويل الغذائي بنهاية التجربة (46 يوما على الرغم من أن كمية العلف المخفف كانت أكبر من الكمية المستهلكة من العليقة الضابطة تكلفة العلف المخفف كانت أقل من تكلفة العليقة الضابطة بنسبة 6.29 % ، و 9.86 % ، و 12.59 % ، على التوالي .