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Effect of Stocking Density and Marketing Age on Broiler Performance

Ahmed Ismael Mohammed[1], Saman Abdulmajid Rashid[2] , & Shahla Muhammad Saeed Kirkuki[2]

[1]*Dept. of Animal Production, University of Garmian.*
[2]*Dept. of Animal Science, College of Agricultural Sciences, University of Sulaimani.*
E. mail: Saman.Rashid@univsul.edu.iq

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Abstract

This study was conducted at the poultry farm of faculty of Agricultural Sciences, University of Sulaimani, in Bakrajo from 5/ 12/ 2015 to 16/ 1/ 2016. The aim of this study was to determine stocking densities and marketing age on production performance, meat quantity and quality of Ross-308 broilers. Three levels of stocking density (SD) (9, 13 and17 birds/ m^2) and three marketing age (28, 35 and 42 days) were used with four replication. The nine combinations were treatments as following: t1: stocking density (9 birds/ m^2) + marketing age (28 days), t2: stocking density (13 birds/ m^2) + marketing age (28 days), t3: stocking density (17 birds/ m^2) + marketing age (28 days), t4: stocking density (9 birds/ m^2) + marketing age (35 days), t5: stocking density (13 birds/ m^2) + marketing age (35 days), t6: stocking density (17 birds/ m^2) + marketing age (35 days), t7: stocking density (9 birds/ m^2) + marketing age (42 days), t8: stocking density (13 birds/ m^2) + marketing age (42 days) and t9: stocking density (17 birds/ m^2) + marketing age (42 days). Stocking density and marketing age level ($P \leq 0.05$) affected on the feed intake, body weight, feed conversion ratio and body weight gain significantly at periods 28, 35 and 42 days. Effect of stocking density and marketing age on body weight, body weight gain, feed intake, feed conversion ratio and mortality were significant through all reared periods. Live body weight was significantly ($P \leq 0.05$) effected by stocking density, marketing age, sex and their interaction.

Introduction

Broiler SD can generally be described as the number or live weight of broilers produced from area unit. Stocking density has been reported as factor of poultry welfare *[1]***.** Poultry producers aimed to maximize the kilograms of chicken produced per square meter of space in order to achieve a satisfactory economic return *[2]*.The influence of stocking of different poultry species on growth and productive performance has generated considerable interest in recent years *[3]* and reduction of broilers' welfare *[4; 5; 6]*. The overall effect on broiler chickens of reducing floor space can be reduced growth rate, feed efficiency, livability, and, in some cases, carcass quality *[7; 8]*.

In Sulaimani Region, the distribution of broiler chicks still according to number of birds per m^2 (11 to 13 birds/m^2) of floor surface for all broiler strains, without take into account the company recommendation about the recommended number of birds per m^2 of floor surface or kilograms (Kg) of live mass per m^2 of floor surface at slaughter according for each breed. In addition, the Ministry of Agricultural and Water

Source recommended that Poultries in Kurdistan Region must marketing there broiler production at 2 kg. For this reason this proposal aimed to investigate the live mass (Kg) or number of birds per m^2 of floor surface that gets a high performance of broiler. According to the previously mentioned researches, this study was undertaken to determine effect of different stocking densities, different marketing age and there interaction on broiler performance, carcass, cuts of carcass and protein and fat content in breast and thigh in addition to economic index of different stocking densities and marketing age.

Material and method

The experiment was carried out from 5/ 12/ 2015 to 16/ 1/ 2016 in Kurdistan Region at the poultry farm of college of Agricultural Sciences, University of Sulaimani in Bakrajo. The experiment included management and treating birds in the farm to study different stocking densities at different marketing age and its effect on performance and economic index and carcass quality (Fig. 1).

Experimental layout

Stocking Density	Marketing Age (MA1) 28 days	Marketing Age (MA2) 35 days	Marketing Age (MA3) 42days
SD1(9 birds/ m^2)	4 Replicates 36 birds (Each with 9 birds/pen)	4 Replicates 36 birds (Each with 9 birds/pen)	4 Replicates 36 birds (Each with 9 birds/pen)
SD2(13 birds/ m^2)	4 Replicates 52 birds (Each with 13 birds/pen)	4 Replicates 52 birds (Each with 13 birds/pen)	4 Replicates 52 birds (Each with 13 birds/pen)
SD3(17 birds/ m^2)	4 Replicates 68 birds (Each with 17 birds/pen)	4 Replicates 68 birds (Each with 17 birds/pen)	4 Replicates 68 birds (Each with 17 birds/pen)

The experiment was organized on broiler chicks, four hundred and sixty eight day-old Ross 308 broiler chicks obtained from a commercial hatchery were weighed and distributed to the pens as four replicates for three stocking densities, each of 9, 13 and 17 birds/ m^2 with three marketing age 28, 35 and 42 day, which were reared in the same environmental conditions. Chickens were feed with commercial feed, with different levels of nutrition substances as follows: starter (CP = 23.5% and ME = 3,000 kcal/ kg) was used for feeding from (1 to 14 day) of age and a grower feed (CP = 22.8% and ME = 3,116 kcal/ kg) from (15 to 28 day) of age then the finisher feed (CP = 20.5% and ME = 3,150 kcal/ kg) used from (29-42 day).

Body weight weekly (BW), body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR) and mortality ratio, was recorded at day 1, 7, 14, 21, 28, 35 and 42 of broilers age by number of bird each pens.

Statistical Analysis

General Linear Model (GLM) within the statistical program XLSTAT (2004, version-7.5.2) was used to analyze the two factors namely the marketing age and stocking density, as well as three factors namely marketing age, stocking density and periods or sex within the factorial Complete Randomized Design (CRD). Duncan Multiple Range Test *[19]* was used to test the significant differences between the means of the levels; level of significance used in all results was (0.05).

Results and discussion

Results of BW and FI affected by different marketing age and stocking density at different periods are shown in Table (1). The differences of body weight was significantly ($P \leq 0.05$) influenced by periods for all SD and MA. It is natural phenomena that BW increases with the age of birds. In addition, BW increased with

increase age may be due to increase feed intake. Live body weight at earlier periods of experiment was almost similar among all SD indicating insignificant differences of individuals into the experimental marketing with a vibration of BW increase between different SD. Insignificant effects of SD at earlier periods might be related to sufficient space for all birds and access to the feeder. However, the reason for this increase in growth during these periods was not understood. Kuenzel and Kuenzel (2007)[9] reported that it is related to metabolic heat production. In addition, the actual average temperatures from (1-14 d) were in close agreement with the temperature set point, and additional chicks at higher densities probably increased heat production, which, in turn, increased growth. Chicks do not attain the homoeothermic condition until approximately (14 d) of age *[10]* and poorly insulated during neonatal period, they are capable of using excess heat for growth.

Birds at P4 in SD1of M3 significantly (P≤0.05) had higher BW compared with other SD at M1 and M2, in addition, at P5 birds in SD2 of M1 and SD3 of M3 recorded significantly higher BW compared with other two SD .At P6 and P7 birds in SD3 of M2 and M3 had significantly (P≤0.05) lower BW compared with other SD.

BW decreased with increase SD due to the decrease of feed consumption with increasing stocking and age, which might be attributing to difficult access to feeding space and welfare *[11].* This study agreement with Sørensen et al., (2000*)[12]* found no difference observed between different SD at (28d), while Birds at a SD of (455 cm^2/bird) were lighter at (35 d) than were those at an SD of (625cm^2/bird). Dozier et al.,(2006)*[6]* and Dozier et al.,(2005) *[18]* observed that the growth rate improved by increasing the SD (25, 30, 35, 40kg BW/ m^2) at earlier periods of (1-17 d) and (1-15 d) respectively, while the growth rate diminished from (1-32 d) and (1-49 d), as well as, adversely affected growth rate at (28 and 35d) respectively.

Abdullah and Matarneh (2010) *[13]* found that BW increased rapidly until 35 d of age. Also Goliomytis et al.,(2003) *[14]* and Scheuermann et al.,(2003) *[15]* both reported that the growth rate increased progressively up to 6 week of age and then decreased. These results are not in line with study by Turkyilmaz *(2008) [16]* which showed SD had no significant effect on BW. Buijs et al., (2009*)[17]* reported that final BW acquired at (39 d) of age were not significantly affected by SD.

The observation of significant effects of SD and MA on FI was at P3 Table (1). Birds in SD3 had Significantly (P≤0.05) lower FI of MA1 and MA3 and numerically of MA2 compared with SD1at P3. However, there are also vibrations of FI between different SD for different MA. At P5, birds in SD3 significantly had lower FI compared with SD2, as well as with SD1 and SD2 of MA1 and M3 respectively, and numerically compared with SD1 and SD2. At P6, birds in SD2 and SD3 significantly (p≤0.05) had lower FI compared with SD1 of MA2, while at P7 birds in SD3 returned to be significantly (p≤0.05) had lower FI compared with SD1 and SD2. In addition, birds in SD2 also had lower FI compared with SD1 of MA3.

Table -1: Effect of interaction of Stocking Density (SD) and Marketing Age (MA) on Production Performance (Body weight (BW) and Feed Intake (FI).

Periods Age (day)	Stocking Density Birds/ m^2		Marketing Age (day) MA1 28	MA2 35	MA3 42	Marketing Age (day) MA1 28	MA2 35	MA3 42
			Body Weight (g)			Feed Intake (g)		
P1 (1day)	SD1	9	37.35^{o}	37.68^{o}	37.94^{o}			
	SD2	13	37.86^{O}	38.20^{o}	37.63^{o}			
	SD3	17	37.99^{o}	37.63^{o}	38.02^{o}			
P2 7	SD1	9	162.6^{n}	159.95^{n}	154.45^{n}	152.78^{o}	152.78^{o}	152.78^{o}
	SD2	13	168.22^{n}	166.73^{n}	166.73^{n}	148.44^{o}	148.44^{o}	148.44^{o}
	SD3	17	164.65^{n}	157.09^{n}	169.59^{n}	150.74^{o}	150.74^{o}	150.74^{o}
P3 14	SD1	9	419.98^{m}	428.7^{m}	444.65^{m}	418.4^{m}	423.61^{m}	418.40^{m}
	SD2	13	457.43^{m}	416.74^{m}	462.57^{m}	405.05^{mn}	405.05^{mn}	406.25^{mn}
	SD3	17	440.79^{m}	427.79^{m}	419.63^{m}	374.68^{n}	375.92^{mn}	373.76^{n}
P4 21	SD1	9	959.75^{kl}	953.15^{kl}	1002.05^{j}	735.36^{jkl}	720.44^{kl}	772.0^{i}
	SD2	13	977.35^{k}	961.45^{kl}	967.25^{kl}	742.54^{k}	713.31^{kl}	768.79^{ij}
	SD3	17	937.65^{l}	957.65^{kl}	937^{l}	725.32^{jkl}	691.2^{l}	696.65^{kl}
P5 28	SD1	9	1602.79^{gh}	1557.03^{i}	1622.63^{g}	1061.86^{h}	1046.78^{h}	1087.22^{g}
	SD2	13	1681.99^{f}	1579.3^{hi}	1576.43^{hi}	1087.64^{g}	1027.08^{h}	1142.19^{f}
	SD3	17	1611.74^{gh}	1584.34^{ghi}	1676.91^{f}	1048.86^{h}	1025.69^{h}	1047.27^{h}
P6 35	SD1	9		2419.45^{d}	2467.8^{c}		1333.04^{d}	1263.0^{e}
	SD2	13		2399.83^{d}	2412.8^{d}		1267.30^{e}	1276.39^{e}
	SD3	17		2342.06^{e}	2310.68^{e}		1240.82^{e}	1265.94^{e}
P7 42	SD1	9			3265.05^{a}			1736.42^{a}
	SD2	13			3231.66^{a}			1650.4^{b}
	SD3	17			3110.05^{b}			1532.06^{c}

$^{a-o}$ in each column means with different letter significantly differ (P≤0.05)

There was no significant effect of SDs on BWG for MA1, MA2 and MA3 at P2, P3 and P4 age Table (2). At P5, birds in SD3 for MA3 had significantly ($p \leq 0.05$) better BWG (739.91g) compared with SD1 and SD2.While at P6 the BWG of birds in SD3 for MA3 significantly ($p \leq 0.05$) depreciated compared with other two densities SD1 and SD2 This reduction in growth rate was due to the decrease in feed consumption *[20].* Whereas, at P7 despite the no significant differences of BWG among three SDs, birds in SD2 numerically higher value of BWG. The results was agreement with Guardia *et al., (2011)[28]* reported that BW gain in (1- 32d) no effected by SD, whereas from (32-39d) the high SD had a negative effect on BW gain compared with the low SD, While, Son *(2013)[27]* resulted that there was no effect of SD on BWG in the first two weeks of breeding ,while in the 4 to 5 weeks of ages significantly increase in low than high density group .this study was not in line with Feddes *(2002)[26]* that showed during the starter period (0-16 d) BWG had influenced as SD increases from medium (37 kg/m2) to high rates (40 kg/m2). No significant differences in BWG among densities groups during the finisher period (17-30 days) were found.

There was no significant effect of SDs on FCR for MA1, MA2 and MA3 at P2, P3 and P4 age Table (2). At P5, birds in SD3 for MA3 had significantly ($p \leq 0.05$) better FCR (1.42) compared with SD1 and SD2.While at P6 the FCR of birds in SD3 for M3 significantly ($p \leq 0.05$) depreciated compared with other two densities SD1 and SD2. Whereas, at P7 despite was no significant differences of FCR among three SDs, birds in SD3 numerically higher value of FCR. FCR depreciated with increase age due to increase feed intake and decreased growth rate *[20].* Other results indicated that SD did not significantly affect FCR at (1-17d) age *[6; 18; 26].* Ravindran et al., (2006)*[23] and* Son (2013) *[27]* showed that there was no clear effect of SD on FCR in first two weeks, while, FCR were significantly increased in low density than high density group of 4 to 5 weeks- old age. While, Asaniyan (2014)*[21]* noticed that FCR at weeks 2, 3, 4 and 6 of the eight weeks study duration, birds on SD (18 birds/m^2) had the lowest FCR values compared to birds on the other SD (6and 12birds/m^2) .However Guardia *et al., (2011)[28]* found FCR to be negatively affected by the increase in SD during the period from (32 to 39 d).

The result showed the different not significant ($p \leq 0.05$) at p2, P3, P4 while effects of SD and MA on mortality were appeared at P5, P6 and P7 (Table 3). Whereas, at P5 the higher significant ($p \leq 0.05$) mortality was recorded in SD1 MA2 compared with SD2 and SD3 for MA2 and other SDs for MA1and MA3 in this period. Moreover, mortality in SD1 and SD3 for M2at P6 and M3at P7 were significantly ($p \leq 0.05$) higher compared with SD2, while SD2 for M3 at P2 was significantly ($p \leq 0.05$) higher compared with SD1 and SD3. Similar results were found that mortality percentage was significantly affected by density *[16; 25; 26].* also mortality increased progressively with age *[29; 30].* Imaeda (2000) *[31]* reported mortality of birds housed at (18 birds/m^2) was significantly higher than were those of birds housed at (12 and 15 birds/m^2). [11] observed Mortality increased numerically at SD above (10 birds/ m^2).While, Dozier et al.,(2006)*[6]* and Son *(2013)[27]* reported that mortality were not affected with increasing SD during (1-15,28,35,42 d) of age.

The results in Table (3) showed significant ($p \leq 0.05$) effects of interaction between SDs and MA on BW. Birds in SD1 followed SD2 for MA3 had significantly ($p \leq 0.05$) higher BW (3265.05 and 3231.66 g) and compared with SD3 for MA3 and all other SDs for MA1 and MA2. In addition, the BW birds in SDS for MA2 were significantly ($p \leq 0.05$) higher than BW and of birds in SDs for MA1. Never the less, there are no significant differences between SDs for MA1 and MA2. Body weight increased with age and decreased with increased density. These results may be due to difficult access to feeding space and welfare *[11].* This result was agreement with Goliomytis et al.,(2003) *[14]* and Scheuermann et al.,(2003) *[15]* reported that growth rate increased progressively up to (6) week of age. Dozier et al.,(2005) [18] reported that increasing SD above 30 kg of BW/m^2 affected on growth rate. Studies recorded that at (12 birds/m^2) density showed higher means for average BW than at (16 birds/m^2) density[32, 33]. While, other results found that SD had no significant effect on BW*[16, 21].* Also, Buijs et al., (2009*)[17]* reported that final BW at (39 d) of age was not significantly affected by SD.

The results in Table (3) showed significant ($p \leq 0.05$) effects of interaction between SDs and MA on BWG. Birds in SD1 followed SD2 for MA3had significantly ($p \leq 0.05$) higher BWG (3227.109 and 3194.03 g)

compared with SD3 for MA3 and all other SDs for MA1 and MA2. In addition, BWG of birds in SDS for MA2 were significantly ($p \leq 0.05$) higher than BWG of birds in SDs for MA1. Never the less, there are no significant differences between SDs for MA1 and MA2.

Body weight increased with age and decreased with increased density. These results may be due to difficult access to feeding space and welfare *[14, 15]*. This study was in line with Studies that showed BWG in the low density group was significantly higher compared to that of high density groups of total experimental period *[20, 27, 33]*, while, Ravindran et al., (2006)*[23]* and Adebiy et al., (2011) *[34]* indicated that SD had no effect on the weight gain of birds over the (35-d).

The results showed significant ($p \leq 0.05$) effects of interaction between SDs and MA on Birds FI Table (4). That SD1 and SD2 had significantly higher FI compared with SD3 and all other SDs for MA1 and MA2. In addition, M2 birds in SD1 had FI significantly ($p \leq 0.05$) higher compared with SD3. However, there are no significant differences among all FI of SD1, SD2 and SD3 for MA1. Never the less increasing age of marketing significantly

($p \leq 0.05$) increased FI of MA1, MA2 and MA3.In this study, feed intake increased with age and decreased with increasing SD, Birds at lower density groups got more chance to intake more feed than high density due to feeding space *[11]*. Also Abudabos et al., (2013)*[25]* found that high SD rate drastically reduce FI. Other studies observed that FI were decreased with increasing SD *[8; 20; 35]* and Ratsaka et al., (2012*)[22]* showed that FI affected by SD. While, other studies showed that the SD had not significant effect on total FI*[16; 33]*.

Effects of interaction between SDs and MA on FCR , at the M3 of the birds, had significantly ($p \leq 0.05$) had lower FCR compare with MA1 and MA2.As well as MA2 had lower FCR compare with MA1 furthermore ,there were no significant differences of FCR between all SD for MA1, MA2 and MA3. This result was agreement with Abdullah and Matarneh (2010) *[13]* found Feed conversion ratio increased with age and the best FCR was obtained during the first two week of age. Feddes *(2002)[26]* , Al-Homidan, and Robertson, (2007) *[36]* noted that SD had no significant effect of FCR. However, other studies were not in line with recent studies. Studies reported FCR were significantly increased in low-density compare with high-density group of 4 to 5 weeks ages because of birds of lower density have chance to intake more feed, this more feed is one type of lost because they didn't convert it into meat and finally unable to show better FCR value *[8; 25; 27]*. Ratsaka et al., (2012*)[22]* indicated The FCR of SD (0.08 m^2/chicken) was higher than that of SD (0.06m^2 and 0.05m^2) during(0-42d) age.

Mortality in SD1 (8.33%) followed by SD3 (7.35%) for MA2 significantly highest compared with SD2 and all SDs for MA1 (Table 5).While, there was not significantly different among SDs at MA1and MA2, Also other studies had similar observed that the mortality percentage were significantly affected by densities and increased with the age of the birds *[16; 25; 26; 37]*. Szőllősi et al., (2014) *[30]* indicated that mortality increased progressively with age. Other studies reported that mortality and total mortality of birds housed at (18 birds/m^2) were significantly higher than were those of birds housed at (12 and 15 birds/m^2) *[31, 38]*. Dozier et al.,(2006)*[6]* reported that mortality was not affected with increasing the SD during the (28, 35 and 42) days of age.

Table -2: Effect of Interaction of Stocking Density (SD) and Marketing Age (MA) on Production Performance: (Body Weight Gain (BWG), Feed Conversion Ratio (FCR) and Mortality).

Periods Age (day)	Stocking Density Birds/ m^2		Marketing Age (day)								
			MA1	MA2	MA3	MA1	MA2	MA3	MA1	MA2	MA3
			28	35	42	28	35	42	28	35	42
			Body Weight Gain (BWG) g			Feed Conversion Ratio(FCR)			Mortality %		
P2 7d	SD1	9	125.25 n	122.27 n	116.51 n	1.23 mn	1.25 lmn	1.32 jklmn	0.00 def	0.00 def	0.00 def
	SD2	13	130.36 n	128.53 n	129.1 n	1.14 n	1.16 mn	1.15 mn	0.00 def	0.00 def	0.00 def
	SD3	17	126.67 n	119.46 n	131.57 n	1.20 mn	1.30 klmn	1.148 n	0.00 def	0.00 def	0.00 def
P3 14	SD1	9	257.38 m	268.75 m	290.2 m	1.63 efgh	1.62 efghi	1.46 fghijkl	0. 00 def	0.00 def	0.00 def
	SD2	13	289.20 m	250.01 m	295.84 m	1.40 hijklm	1.6 2 efghi	1.41 hijklm	0.00 d	0.00 def	0.00 def 0
	SD3	17	276.13 m	270. 7 m	250.04 m	1.41 hijklm	1.40 hijklmn	1.5 fghijkl	1.47 cdef	0.00 def	0.00 def
P4 21	SD1	9	539.77 ghikl	524.45 hijkl	557.41 ghijkl	1.36 ijklmn	1.38 hijklmn	1.39 hijklmn	0.00 def	0.00 def	0.00 def
	SD2	13	519.93 ijkl	544.71 ghijkl	504.68 kl	1.43 fghijkl	1.31 jklmn	1.53 fghijk	0.00 def	0.00 def	0.00 def
	SD3	17	496.87 l	529.87 hijkl	517.38 jkl	1.48 fghijkl	1.32 jklmn	1.36 ijklmn	1.47 cdef	1.47 cdef	0.00 def
P5 28	SD1	9	643.04 efg	603.89 fghijkl	620.58 fghij	1.66 efg	1.73 cde	1.76 cde	0.00 def	5.56 a	0.00 def
	SD2	13	704.64 cdef	617.85 fghij	609.18 ghijk	1.55 fghijk	1.7 def	1.93 bcd	0.00 def	0.00 def	0.00 def
	SD3	17	674.09 def	626.69 fghi	739.91 bcde	1.56 ghijk	1.64 efgh	1.42 hijklm	0.00 def	1.47 cdef	0.00 def
P6 35	SD1	9		862.78 a	845.18 a		1.55 fghijk	1.51 fghijk		3.13 bc	0.00 def
	SD2	13		820.53 ab	836.03 ab		1.58 fghij	1.56 fghij		0.00 def	3.85 abc
	SD3	17		757.73 abcd	633.76 fgh		1.64 efgh	2.09 ab		4.6 ab	0.00 def
P7 42	SD1	9			797.25 abc			2.2 a			2.78 bc
	SD2	13			819.21 ab			2.03 ab			0.00 def
	SD3	17			799.38 abc			1.97 abc			2.94 bc

a-n in each column means with different letter significantly differ (P≤0.05).

Table -3: Effect of Interaction of Stocking Density (SD) and Marketing age (MA) on Cumulative Production Traits: Body Weight (BW) an Body Weight Gain (BWG)).

Stocking Density Birds/ m^2		Marketing Age (day)					
		MA1	MA2	MA3	MA1	MA2	MA3
		28	35	42	28	35	42
		Body Weight (g)			Body Weight gain (g)		
SD1	9	1602.79 ^{d}	2419.80 ^{c} 5	3265.05 ^{a}	1565.43^{d}	2382.12^{c}	3227.11^{a}
SD2	13	1681.99 ^{d}	2399.83 ^{c}	3231.66 ^{a}	1644.13^{d}	2361.62^{c}	3194.03 ^{a}
SD3	17	1611.74 ^{d}	2342.06 ^{c}	3110.05 ^{b}	1573.75^{d}	2304.43 ^{c}	3072.03^{b}

$^{a-d}$ in each column means with different letter significantly differ (P≤0.05).

Table -4: Effect of Interaction of Stocking Density (SD) and Marketing Age (MA) on Cumulative Production Traits: (Feed Intake FI, Feed Conversion Ratio FCR and Mortality).

Stocking Density Birds/ m2		Marketing Age (day)								
		MA1	MA2	MA3	MA1	MA2	MA3	MA1	MA2	MA3
		28	35	42	28	35	42	28	35	42
		Feed Intake (g)			Feed Conversion Ratio FCR			Mortality %		
SD1	9	2368.40 ^{e}	3676.65 ^{c}	5429.83 ^{a}	1.51 ^{bc}	1.54 ^{b}	1.68 ^{a}	0.00 ^{b}	8.33 ^{a}	2.78 ^{ab}
SD2	13	2383.66 ^{e}	3561.18 ^{cd}	5392.46 ^{a}	1.45 ^{c}	1.51 ^{b}	1.69 ^{a}	0.00 ^{b}	0.00 ^{b}	3.85 ^{ab}
SD3	17	2299.6 ^{e}	3484.36 ^{d}	5066.42 ^{b}	1.46 ^{c}	1.51 ^{bc}	1.65 ^{a}	1.47 ^{ab}	7.35 ^{ab}	2.94 ^{ab}

$^{a-e}$ in each column means with different letter significantly differ (P≤0.05).

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