

The effects of naked neck (Na) gene and sex on the apparent ileal Nitrogen and amino acids digestibility in Growing Meat Type Chicken

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ABSTRACT: This experiment was conducted to investigate the effects of naked neck gene (Na) and sex (male and female) on the ileal nitrogen and amino acids digestibilities. Chicks were assigned to 4 treatment pens, 2 gene types (homozygous NaNa and heterozygous Nana, naked neck) and 2 sexes, containing 18 chicks each. Chicks in all treatments were fed the same diet. Results showed significant effect of the sex on the final live weight. Therefore, the male birds were 11.6% more heavily than females. On the other hand, neither the sex nor the gene showed significant effect on the gut length and organ weights (gizzard and liver). In addition, there were no significant effects of gene or sex on the ileal nitrogen and amino acids digestibilities, but the male birds had a numerically higher nitrogen and amino acid ileal digestibility compared with female birds and There were negligible differences in amino acid digestibility for birds with Nana gene compare with NaNa gene. However, more researches are required to confirm these results.

Keywords: Naked Neck Gene, Sex, Live weight, Amino acid, Ileal digestibility

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Etlik piliçlerde çıplak boyun geni ve cinsiyetin ileal azot ve amino asit sindirilebilirliği üzerine etkileri

ÖZ: Bu çalışma çıplak boyun geni (Naked Neck-Na) ve cinsiyetin (erkek ve dişi) ileal azot ve amino asit sindirilebilirliği üzerine etkilerini araştırmak üzere yürütülmüştür. Bu amaçla civcivler, her birinde 18 adet civciv bulunan, 2 gen (homozigot NaNa ve heterozigot Nana) ve iki cinsiyet grubu olmak üzere toplam 4 deneme grubuna ayrılmıştır. Bütün deneme gruplarında hayvanlar aynı rasyon ile beslenmişlerdir. Cinsiyetin, final canlı ağırlığı önemli derecede etkilediği görülmüştür. Bu bağlamda erkek piliçlerin canlı ağırlığı dişilerden % 11.6 daha yüksek bulunmuştur. Diğer taraftan ne cinsiyetin ve ne de genin bağırsak uzunluğu ve organ ağırlıkları (taşlık ve karaciğer) üzerinde herhangi bir etkisi görülmemiştir. İleal azot ve amino asit sindirilebilirliğinin erkeklerde dişilere göre yalnızca rakamsal olarak yüksek olması dışında, gen ve cinsiyetin azot ve amino asit sindirilebilirlikleri üzerinde önemli bir etkisi olmamıştır. Nana geni ile NaNa geni karşılaştırıldığında amino asit sindirilebilirliğindeki farklılık önemsiz bulunmuştur. Bununla birlikte, daha fazla araştırma yapılarak bu sonuçların desteklenmesi gerekmektedir.

Anahtar Kelimeler: Çıplak boyun geni, Cinsiyet, Canlı ağırlık, Amino asit, İleal sindirilebilirlik

INTRODUCTION

Several studies reported that naked neck broilers possess a higher adaptation to high ambient temperature due to a reduction of feather coverage, exhibited higher growth rates and meat yields than normally feathered counterparts (1-4). On the other hand there are no studies which evaluated the ileal amino acids digestibility by these birds. The ileal digestibility represent an improved basis for feedstuff evaluation in poultry nutrition. Diet calculation based on digestible nitrogen (N) and amino acids (AA) could lead to improved use of alternative protein sources. In consequence, the feed costs and nitrogen output in poultry production reduced and at the economic benefits can be achieved (5). Additionally, it is generally well known that the protein requirement of animals is primarily a requirement for AA (6) and there are many studies with measurement of the ileal N and AA digestibility in chickens. The methods used to measure AA digestibility vary greatly and these have been reviewed by several studies (7-10).

However, ileal digestible amino acid values are considered to be improved measure of the protein value of feed ingredients. But there are several factors influencing digestibility and a consequently the variations in N and AA digestibility values is high. Earlier studies have provided data on ileal amino acid digestibility in chickens using different feedstuffs, classes and age of chickens. Ravindran et al. (11) and Kadim et al. (12) showed considerable variation between protein sources in the digestibility of amino acids. In addition, studies stated that the ileal AA digestibility was affected by the age (13) and sex (14) of the birds and is also depending on different birds' species (10). Therefore, different studies show inconsistent results for ileal digestibility across the feed and animal species.

To our knowledge, there are no studies to evaluate the effect of genotype and sex on ileal amino acids digestibility in naked neck genotypes. Therefore, the objective of the present study was to investigate the effect of the naked

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neck genotype (Na) and sex (male and female) on the ileal nitrogen and amino acids digestibility.

MATERIAL and METHODS

Animal and Housing

The gene types of the chicks used in this experiment were homozygous (NaNa) and heterozygous (Nana) naked neck male and female. These Chicks were at 35 days of age and were used in a previous experiment with uniformity start live body weight and diet. All chicks were housed in an environmentally controlled room, in floor pens with wood shavings as bedding until 42 days of age. Chicks were assigned to four treatments pens (2-gene type and 2 sexes) as mentioned above, containing 18 chicks each.

All birds were fed the same diet containing 22.6% CP and 3358 kcal ME/kg. Titan dioxide (TiO₂) was added as an indigestible indicator in the diet at level of 0.3%. Diet compositions are shown in Table 1. The birds had free access to drinking water and diet for 7 days. At 42 days of age all birds were weighted for determination the final live body weight (LBW). For the measurement of ileal N and AA digestibility, all birds per treatment were divided randomly to three replicate (6 birds per replicate). All birds were asphyxiated with CO₂ and the intestine section beginning at Meckel's diverticulum up to 2 cm anterior to the ileo-cecal junction was immediately removed, and only the chyme from terminal two-thirds of this section was immediately collected. Contents were pooled within the six birds as a replicate (3 replicates per treatment), immediately frozen at -20°C, freeze-dried, and ground through a 0.5- mm screen for later chemical analyses. Also six birds per treatment (1 bird = one replicate) were randomly selected and the length of the small intestine was measured and the weight of gizzards, livers and hearts were recorded. The animal welfare authorities approved this experiment in accordance with the German Animal Welfare Regulations.

Table 1 Composition of the diets used in the experiment

Ingredient	%
Corn	14.671
Wheat	10.511
Wheat starch	35.691
Soy protein concentrate	20.962
Fish meal	3.949
Wheat gluten	3.646
Soy oil	7.44
Di calcium phosphate	1.450
Arbocell (Cellulose)	0.950
Calcium carbonate	0.280
Sodium chloride	0.150
Titan dioxide	0.3
Chemical calculated composition	
DM %	92.45
Crude protein %	22.6
AME (MJ/kg)	14.1
(kcal/kg)	3358
Lysine %	1.06
Methionine%	0.30
Methionine + Cyst%	0.61
Calcium%	0.9

Chemical Analyses and Calculations

Diets and freeze-dried digesta were analysed for dry matter (DM), nitrogen (N), amino acids (AA) and titanium dioxide (TiO₂). The nitrogen (N) content was determined due to the DUMAS-method (LECO[®]LP-2000. LECO instrument GmbH. Kirchheim. Germany). Amino acid analyses (except Tryptophan and Tyrosine) were done by ion-exchange chromatography (Biochrom 30, Amino Acid Analyzer, Labor service Onken GmbH, Gruendau, Germany), following acid hydrolysis of the proteins (15). The concentrations of TiO₂ in the diet and in the digesta were determined photometrical following a digestion procedure according to the method described by Brandt et al (16). The apparent ileal digestibility coefficients (AIDC) for N and AA were calculated according to the following equation:

$$\text{AIDC}\% = 100 - [(FI / II \times (\text{AAo}\% / \text{AAi}\%) \times 100]$$

Where;

FI = Feed indicator (%)

II = Ileal indicator (%)

AAo = AA Concentration(%)in digesta

AAi = AA Concentration (%) in the diet

Statistical Analysis

To determine the effects of gene, sex, and their interaction on the studied parameter, the data were treated by 2 × 2 factorial analysis of variance with naked neck gene and sex effects using the General Linear Models (GLM) Procedure of SPSS program (IBM SPSS Statistics 19). Results are presented as mean value and standard error (± SE).

RESULTS

Live Body Weight and Organ Weight

The live body weights (LBW) at 42 of age for all birds are shown in Table 2. The results showed significant effect of the sex on the LBW 42. Therefore, the male birds reached a mean LBW of 2714 and 2735 g/bird whereas the female birds' reached a mean LBW of 2484 and 2404 g/bird. Otherwise, the gene showed no significant effect on the end live body weight. In this study, there were no significant effects of the sex or of the gene on the gut length and liver weight. Only the sex showed a significant effect on the organ weight of gizzard and heart. Therefore, these organs weights of male broilers were higher than that of female as shown in table 2. There were no interactions between gene and sex in this experiment regarding these studied parameters.

Apparent Ileal Digestibility of N And Amino Acids

The results of the apparent ileal N and amino acids digestibilities are shown in Table 3 and Table 4. There were no significant effects of gene and sex on nitrogen (N) and apparent ileal amino acids (AA) digestibility, but the male birds showed numerically a higher digestibility in N and AA compared with females birds in this study and there were negligible differences in AA digestibility for birds with heterogeneous Nana gene. The apparent ileal AA digestibility ranged from 64.29 by Cys (female NaNa) to 87.92 in Glu (male broiler Nana). No interactions between gene and sex were found for apparent ileal digestibility of N and AA.

Table 2 Effect of naked neck gene and sex on the live body weight (LBW), organ weight and intestinal length at 42 day of age (means, \pm SE)

Parameters	Treatment				Probabilities		
	Female		Male		Sex	Gene	Sex \times Gene
	Na/Na	Na/na	Na/Na	Na/na			
LBW ¹ g	2484 \pm 66.9	2404 \pm 52.8	2714 \pm 90.7	2735 \pm 82.7	***	NS	NS
Intestinal ² length cm	143.4 \pm 4.9	140.6 \pm 10.3	147.0 \pm 5.2	146.8 \pm 3.6	NS	NS	NS
Doudenum Cm	26.3 \pm 1.3	23.8 \pm 2.9	27.5 \pm 1.2	28.5 \pm 0.4	NS	NS	NS
Jejanum cm	65.0 \pm 2.7	63.9 \pm 4.9	65.5 \pm 3.2	64.2 \pm 2.8	NS	NS	NS
Ileum cm	52.2 \pm 2.7	52.8 \pm 5.3	54.0 \pm 2.2	53.5 \pm 1.6	NS	NS	NS
Gizzard g	52.3 \pm 2.8	48.5 \pm 4.4	63.2 \pm 5.7	59.4 \pm 3.3	*	NS	NS
Liver g	75.1 \pm 6.0	74.8 \pm 6.8	78.2 \pm 5.3	79.7 \pm 4.1	NS	NS	NS
Heart g	13.5 \pm 0.7	13.2 \pm 1.3	16.7 \pm 1.3	17.7 \pm 0.9	**	NS	NS

¹n =18 birds per treatment; ²small intestine, n = 6 birds per treatment (one bird= one replicate)

***P<0.001; ** P<0.01; * P<0.05; NS: not significant

Table 3 Effect of naked neck gene and sex on apparent ileal N and essential AA digestibility (%) at 42 day of age (means, \pm SE)

N and essential AA	Treatment				Probabilities		
	Female		Male		Sex	Gene	Sex \times Gene
	Na/Na	Na/na	Na/Na	Na/na			
N	71.2 \pm 4.2	76.5 \pm 4.2	80.9 \pm 0.9	80.1 \pm 1.2	NS	NS	NS
Arg	81.3 \pm 3.6	83.9 \pm 3.4	86.6 \pm 0.6	86.8 \pm 0.9	NS	NS	NS
His	76.7 \pm 3.9	80.3 \pm 3.3	81.9 \pm 1.0	82.9 \pm 1.2	NS	NS	NS
Iso	75.4 \pm 4.5	79.4 \pm 3.9	81.0 \pm 1.3	82.6 \pm 1.2	NS	NS	NS
Leu	78.2 \pm 3.9	81.8 \pm 3.5	83.1 \pm 1.0	84.4 \pm 1.1	NS	NS	NS
Lys	72.4 \pm 5.0	77.2 \pm 5.3	79.7 \pm 1.4	81.6 \pm 1.6	NS	NS	NS
Met	74.2 \pm 5.0	78.9 \pm 5.1	81.4 \pm 1.4	83.1 \pm 1.1	NS	NS	NS
Phe	80.9 \pm 3.6	83.6 \pm 3.1	85.5 \pm 0.9	86.3 \pm 0.9	NS	NS	NS
Thr	66.9 \pm 5.0	72.4 \pm 4.0	74.4 \pm 2.0	77.2 \pm 1.5	NS	NS	NS
Val	73.1 \pm 4.6	77.4 \pm 4.0	79.7 \pm 1.3	81.3 \pm 1.4	NS	NS	NS

NS: not significant

Table 4 Effect of naked neck gene and sex on apparent ileal non-essential amino acids digestibility (%) at 42 day of age (means, \pm SE)

Non-essential AA	Treatment				Probabilities		
	Female		Male		Sex	Gene	Sex \times Gene
	Na/Na	Na/na	Na/Na	Na/na			
Ala	75.3 \pm 4.2	78.1 \pm 4.0	79.2 \pm 1.3	81.2 \pm 1.3	NS	NS	NS
Asp	67.8 \pm 3.8	72.7 \pm 3.2	73.5 \pm 1.6	75.0 \pm 1.9	NS	NS	NS
Cys	64.3 \pm 5.2	69.0 \pm 3.5	69.8 \pm 2.7	68.7 \pm 2.3	NS	NS	NS
Glu	83.9 \pm 2.6	86.3 \pm 2.3	87.5 \pm 0.6	87.9 \pm 0.8	NS	NS	NS
Gly	70.4 \pm 4.2	74.9 \pm 3.5	75.5 \pm 1.6	77.4 \pm 1.6	NS	NS	NS
Pro	79.3 \pm 3.2	83.1 \pm 2.8	82.9 \pm 0.9	86.0 \pm 1.2	NS	NS	NS
Ser	76.9 \pm 3.4	80.9 \pm 3.3	81.6 \pm 1.1	83.7 \pm 1.3	NS	NS	NS

NS: not significant

DISCUSSION

This result indicated significantly high-end live body weight for male birds comparing to females birds. Sexual dimorphism for live body weight favoured males, where they weighed about 11.6% more heavily than females in this experiment. These results are closely related to those obtained by Rondelli et al. (17), Ajayi and Ejiolor (18) and were also in agreement with previous studies (19-22). In addition Soleimani et al. (23) reported that the male broilers had significantly (P<0.01) higher body live weights and also significantly (P<0.01) higher feed intake than females. The higher LBW of the males birds could be due to their dominant while feeding and sex hormonal differences (18). Higher body weights for naked neck genotypes (Na) were also reported in literature (24). Similar data to our experiments were observed by Rajkumar et al. (25) and Khan et al. (26), who indicated

also no significant difference in body weight between the naked neck genotypes (NaNa resp. Nana).

In this study, there was no effect of gene and sex on the apparent ileal N and AA digestibility. These results are not in agreement with results found by (14, 27) who reported that female broilers showed significant higher ileal apparent N and AA digestibility than the male broilers. On the other hand, results of AA digestibility in this study are in agreement with the results from (28), who mentioned that AA digestibility was not affected by sex of broilers. Earlier studies have reported differences in apparent ileal digestibility due to sex, but these results are inconsistent. Zuprizal et al. (29) reported higher true AA digestibility in male broilers at 6 week when compared with female broilers. However, sex differences were not observed at 3 of week. Also several other studies reported

no difference in sex regarding ileal AA digestibility (30). Unfortunately, there is no information available concerning the effect of naked neck gene on N and AA digestibility.

CONCLUSION

The present findings reveal that male birds yielded higher live body weight, gizzard and heart weight than female birds. On the other hand, the naked neck gene provided no effect relating to these parameters. This study showed also no effect of sex or gene on ileal N and AA digestibility. Therefore, this study suggests doing further researches to confirm these results.

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