CHAPTER 20

DDGS in Duck and Geese Diets

Introduction

GLOBAL DUCK AND GOOSE PRODUCTION CONTINUES TO INCREASE, especially in Asia countries (The Poultry Site a,b). World meat duck production was 4.4 million tons in 2013, with 83.8 percent produced in Asia (The Poultry Site, 2015a). China is the world's leader in meat duck production (2.9 million tons) followed by Malaysia (129,600 tons), Myanmar (107,000 tons), Vietnam (102,500 tons), Thailand (89,900 tons), South Korea (69,400 tons), and Taiwan (64,000 tons). The primary duck species used to produce duck meat are Pekin, Muscovy (France) and mule ducks (hybrid cross for production of fois gras). The major duck species used for egg production are Jinding and Shao ducks in China; Tsaiya ducks in Taiwan; Khaki Campbell, Indian runner, and Desi ducks in Vietnam, Cambodia and Indonesia (Pingel, 2004). About 37 percent of total egg production in Thailand is derived from duck eggs, followed by Cambodia (21 percent), Indonesia (19 percent), Bangladesh (16 percent), China (15 percent) and the Philippines (12 percent; Pingel, 2004).

Global goose meat production was 2.7 million tons in 2013 (The Poultry Site, 2015b), with Asia accounting for 96 percent (2.6 million tons). Similar to meat ducks, China is the leading producer of goose meat (2.55 million tons), followed by Taiwan (19,550 tons) and Myanmar (6,840 tons).

Unfortunately, very few research studies have been conducted to evaluate DDGS in meat and layer duck diets or meat and layer goose diets. However, the purpose of this chapter is to provide a summary of published information on feeding DDGS to ducks and geese.

Ducks

Meat ducks

Nutrient requirements of ducks are not well established because there are many types of ducks used in various countries (Creswell, 2012). Therefore, without accurate knowledge of nutrient requirements, it is difficult to properly formulate diets to achieve optimal performance. Furthermore, knowledge of the metabolizable energy and digestible amino acid content of commonly used feed ingredients (including DDGS) makes it even more difficult to accurately formulate duck diets. Baéza (2015) conducted an excellent overview of the nutritional requirements and feeding management of meat type ducks (**Table 1**). Baéza suggested that the optimal levels of crude protein in starter, grower and finisher diets for mule ducks are 23.5, 15.4 and 13.8 percent respectively. Baéza (2015) also indicated that AME requirement for optimal weight gain and feed conversion in Pekin ducks (two to six weeks of age) is about 3,000 kcal/kg, but dietary levels greater than 2,700 kcal/kg of AME increase abdominal fat.

Wen et al. (2017) determined the energy and lysine requirements for Pekin ducks from hatch to 21 days of age, and estimated that the lysine requirements (based on weight gain) were 0.94 and 0.98 percent for diets containing 2,750 and 3,050 kcal/kg AME, respectively. Kong and Adeola (2010) determined the apparent ileal digestibility in DDGS and other feedstuffs for White Pekin ducks (**Table 2**). As expected, soybean meal had the greatest nitrogen and apparent amino acid digestibility compared with DDGS, corn and wheat. However, apparent digestibility of lysine was lowest in DDGS compared with these other feed ingredients, and have been due to excessive heating during the drying process.

Creswell (2012) suggested that corn DDGS can be used up to 10 to 15 percent in duck diets, but Kowalczyk et al. (2012) showed that feeding diets containing up to 25 percent DDGS for Pekin ducks between 22 to 56 days of age had no negative effects on growth performance, carcass composition or chemical composition, pH, and color of breast meat. Similarly, Peilod et al. (2010) showed that adding 24 percent DDGS to growing and finishing diets for mule ducks had no negative effects on growth performance.

Adamski et al. (2011) evaluated the effects of adding 0, 15, 25 and 30 percent DDGS to diets for male and female Pekin ducks from 22 to 49 days of age on growth performance and carcass characteristics (**Table 3**). At slaughter, a subsample of five males and five females were selected from each dietary treatment for evaluation of carcass characteristics. Results of this study showed that adding up to 30 percent DDGS to Pekin duck diets had no effect of live body weight, slaughter yield, carcass weight, breast and leg muscle weight, as well as the weight of skin with subcutaneous fat and abdominal fat weight. Furthermore, there were no differences in pH, color and cholesterol content of breast muscle, but feeding 30 percent DDGS diets increased fat content of breast muscle in males and protein content of breast meat in females. However, final body weight of females fed the 30 percent DDGS was less than males. These results suggest that DDGS can be fed up to 30 percent of the diet for meat ducks.

Table 1. Suggested energy and nutrient requirements for meat type ducks (adapted from Baéza, 2015)			
	Starter (day 1-14)	**Grower (day 15-35)**	**Finisher (day 35-49)**
AME, kcal/kg	2,800-2,900	2,900-3,000	2,950-3,050
Standardized ileal digestible amino acids %			
Lysine	1.00	0.75	0.65
Methionine	0.37	0.29	0.26
Methionine + cysteine	0.70	0.55	0.49
Tryptophan	0.16	0.13	0.12
Threonine	0.62	0.48	0.44
Arginine	1.05	0.81	0.72
Isoleucine	0.65	0.50	0.45
Valine	0.77	0.59	0.51
Minerals and choline			
Calcium %	0.70	0.65	0.60
Available phosphorus %	0.35	0.32	0.30
Sodium %	0.20	0.16	0.14
Choline, mg/kg	1,800	1,500	1,250

Table 2. Comparison of apparent dry matter, nitrogen and amino acid digestibility (percent) of DDGS, corn, soybean meal and wheat for White Pekin ducks (adapted from Kong and Adeola, 2010)				
	DDGS	**Corn**	**Soybean Meal**	**Wheat**
Dry matter	63^{c}	79^{a}	80^{a}	72^{b}
Nitrogen	77^{b}	75^{bc}	88^{a}	79^{b}
Arginine	84^{bc}	79^{cd}	94^{a}	78^{d}
Cystine	73^{a}	54^{b}	81^{a}	72^{a}
Histidine	81^{b}	84^{bc}	92^{a}	83^{b}
Isoleucine	79^{b}	75^{b}	90^{a}	81^{b}
Leucine	88^{a}	85^{ab}	89^{a}	82^{bc}
Lysine	69^{c}	78^{b}	90^{a}	77^{b}
Methionine	85^{b}	86^{b}	92^{a}	85^{b}
Phenylalanine	84^{b}	81^{bc}	90^{a}	84^{b}
Threonine	70^{b}	62^{c}	84^{a}	66^{bc}
Tryptophan	79^{d}	80^{cd}	93^{a}	91^{ab}
Valine	79^{b}	68^{c}	87^{a}	73^{bc}

[a,b,c,d]ry mattereans within a row with different superscripts differ (P less than 0.01).

Table 3. Effect of dietary DDGS inclusion rate and sex on body weight gain (22 to 49 days of age) and carcass composition of Pekin ducks (adapted from Adamski et al., 2011)

	Control		15% DDGS		25% DDGS		30% DDGS	
	Males	Females	Males	Females	Males	Females	Males	Females
Body weight, g								
Day 1	55	53	53	53	55	54	54	53
Day 21	1,017	976	1,030	1,164	1,118	1,087	1,098	1,008
Day 49	3,036	3,131	3,022	3,117	3,035	2,997	3,028	2,831
Live weight at slaughter, g	3,020	3,090	3,080	3,020	2,950	2,980	2,930	2,890
Carcass weight with neck, g	2,013	1,944	2,057	1,992	1,874	1,948	1,880	1,887
Slaughter yield %	66.6	62.9	66.8	66.0	63.5	65.4	64.2	65.3
Breast muscle, g	224	256	248	234	186	206	194	199
Leg muscle, g	276	258	267	239	267	268	245	249
Total carcass muscle, g	500	514	515	473	453	474	439	448
Skin with subcutaneous fat, g	490	587	550	634	457	546	513	561
Abdominal fat, g	21	28	32	39	22	26	24	24

Layer ducks

Similar to meat type ducks, nutrient requirements for laying ducks are not well defined for different types in different countries. However, Baéza (2015) suggested energy and nutrient requirements for laying ducks based on experience and a summary of limited studies (**Table 4**).

The U.S. Grains Council (USGC) sponsored a study conducted at the I-lan Branch of the Livestock Research Institute in Taiwan. Researchers evaluated the effects of feeding diets containing corn DDGS on the production performance and egg quality of brown Tsaiya duck layers from 14 to 50 weeks of age (Huang et al., 2006). Ducks were randomly assigned to one of four dietary treatments containing 0, 6, 12 or 18 percent DDGS. Diets were isocaloric and isonitrogenous and contained 2,750 kcal/kg ME and 19 percent crude protein. Results from this study showed that adding DDGS at levels up to 18 percent of the diet for laying ducks had no effect on feed intake, feed conversion or quality of the egg shell. When laying ducks were fed the 18 percent DDGS diet, egg production rate increased in the cold season, and egg weight tended to be higher by including 12 percent or 18 percent of DDGS in the diets. Egg yolk color was linearly improved with increasing amounts of DDGS in the diets, which indicates that the xanthophylls (natural pigments) present in DDGS can be well utilized by the laying ducks. Furthermore, when DDGS was added to duck layer diets, fat percentage and linoleic acid content of yolk was increased. These results indicate that DDGS can be effectively added up to 18 percent to layer duck diets to improve the egg yolk characteristics without influencing the egg production and quality.

Geese

Unfortunately, no feeding studies have been published on the effects of feeding DDGS to geese for meat or egg production. Therefore, studies are needed to help this increasing segment of food animal production capture economic and nutritional value from adding DDGS to goose diets.

Summary

Limited published information suggests that DDGS can be used effectively up to 30 percent in meat type duck diets and up to 18 percent in layer duck diets to achieve acceptable performance, meat and egg quality. No studies have been published to determine energy and digestible amino acid content in DDGS for geese and the effects of increasing dietary inclusion rates on performance. However, greater diet inclusion rates are likely possible if energy and nutrient requirements are known for the types of ducks being fed and if accurate AME and digestible amino acid values for DDGS and other feed ingredients are known for ducks. Compared to broilers and layers, ducks and geese are able to utilize high fiber ingredients more effectively, especially when using carbohydrase and phytase enzymes, which suggest that much greater DDGS inclusion rates can be used for ducks and geese. Further research is needed to optimize DDGS use in duck and goose diets.

Table 4. Suggested energy and nutrient requirements for egg laying ducks (adapted from Baéza, 2015)	
AME, kcal/kg	2,650
Standardized ileal digestible amino acids %	
Lysine	0.80
Methionine	0.36
Methionine + cysteine	0.64
Tryptophan	0.16
Threonine	0.58
Arginine	0.96
Isoleucine	0.62
Valine	0.72
Minerals and choline	
Calcium %	3.50
Available phosphorus %	0.35
Sodium %	0.20
Choline, mg/kg	1,250

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