

# Evaluation of the suitability of broiler chicken and turkey commercial feed mixes in the diets of grey partridge (*Perdix perdix* L.) during the rearing period

## Ocena przydatności mieszanek paszowych dla kurcząt brojlerów i indyków w dietach kuropatwy szarej (*Perdix perdix* L.) w okresie odchowu

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### Abstract

The aim of the study was to evaluation of the suitability of broiler chicken and turkey commercial feed mixes in the diets of grey partridge (*Perdix perdix* L.) during the rearing period. The study was carried out on a farm authorized by the Minister of the Environment to conduct breeding and farming of grey partridge, DL Pgt-6713-23/15852/13/RN dated 24 April 2013. The research material consisted of grey partridge chicks assigned to two groups: one, fed the complete feed mix for turkeys IB-1 till 4 weeks of rearing, followed by the complete feed mix for turkeys B-2 from 5 weeks on (group I, n = 22) and the other, fed the complete feed DKA-Starter for broiler chickens (group II, n = 22). The rearing cycle took 8 weeks. Observations within the experiment included deaths records and monitoring of health status, body weight, feed intake and maintenance conditions. Better parameters of partridges rearing were attained as a result of IB feeding. Birds fed with IB-1 and IB-2 feed mixes showed a higher body weight, as compared to chicks fed DKA-Starter (DKA-S). The difference persisted from the first week of rearing to the end of the feeding trial (respectively 0.32 g and 4.59 g). From day 1 until 8 weeks of age, partridges fed the IB feed showed greater average daily gains (4.17 g), a faster rate of growth (181.67%) and a greater final body weight, all at a lower feed intake compared to those fed mix with DKA-S. It has been found that the IB feed mix can successfully be used in the nutrition of grey partridges.

**Keywords:** body weight, compound feeds, feed consumption, grey partridge, growth rate indicators, rearing

## Streszczenie

Celem pracy była ocena przydatności mieszanek paszowych dla kurcząt brojlerów i indyków w dietach kuropatwy szarej (*Perdix perdix L.*) w okresie odchowu. Badania przeprowadzono na fermie, posiadającej zgodę Ministra Środowiska na prowadzenie chowu i hodowli zamkniętej kuropatwy zwyczajnej DL Pgf-6713-23/15852/13/RN z dnia 24.04.2013 r. Materiał badawczy stanowiły kurczęta kuropatwy. Kurczęta kuropatwy zwyczajnej podzielono na dwie grupy: żywione mieszanką paszową pełnoporcjową dla indyków IB-1 do 4. tygodnia odchowu i mieszanką paszową pełnoporcjową dla indyków IB-2 od 5 tygodnia odchowu (grupa I - 22 sztuki) oraz żywione mieszanką paszową pełnoporcjową dla kurcząt brojlerów DKA-Starter (grupa II - 22 sztuki). Okres odchowu trwał 8 tygodni. W czasie realizacji badań kontrolowano i rejestrowano upadki, stan zdrowotny, masę ciała ptaków, zużycie paszy i warunki utrzymania. Lepsze wyniki odchowu kuropatwy uzyskano w wyniku zastosowania mieszanki paszowej IB. W grupie ptaków żywionych mieszanką paszową IB-1 i IB-2 wykazano większą masę ciała ptaków, w porównaniu do piskląt żywionych mieszanką paszową DKA-Starter (DKA-S). Różnica utrzymywała się od pierwszego tygodnia odchowu do końca okresu doświadczalnego (odpowiednio: 0,32 g i 4,59 g). U kuropatw żywionych mieszanką paszową IB obserwowano od 1. dnia do 8. tygodnia życia większe średnie dobowe przyrosty (4,17 g), większe tempo wzrostu (181,67%) oraz większą, końcową masę ciała przy mniejszym spożyciu paszy niż u kuropatw żywionych mieszanką paszową DKA-S. Stwierdzono, że mieszanka paszowa IB może być z powodzeniem stosowana, jako pasza w żywieniu kuropatwy zwyczajnej.

**Słowa kluczowe:** hodowla, kuropatwa zwyczajna, masa ciała, mieszanki paszowe, spożycie paszy, wskaźniki wzrostu

## Introduction

The steady decline in the population of grey partridges (*Perdix perdix L.*) began in Europe in the second half of the 20th century (Meriggi et al., 2007; Kuijper et al., 2009). Constantly developing agriculture led to the displacement of the species, making it the relict of extensive agriculture (Potts, 1980). Decline of populations of partridges regularly moved from the western to the eastern part of the continent (Kuijper et al., 2009).

Since the early 1990s, is shown a decline in the numbers of wild grey partridges in Poland, which is reflected in hunting yields (Panek, 2000; Kokoszyński et al., 2013). In 2015, the population of partridges in Poland dropped by more than three times, as compared to the 1990s (from 960 thousand birds in 1995 to about 283.6 thousand in 2015). At the same time, there was about a ten-fold decrease in the numbers of hunted partridges, which reached the level of 2.5 thousand birds in the hunting season 2014/2015 (Central Statistical Office, 2015). The decline in the partridge population has many reasons. One is a high rate of devastations in nests and brooding hens, which means that only a part of breeding pairs is able to raise their offspring. In their first days of life, the chicks feed on animal food (insects), hence pesticides, especially insecticides and herbicides, represent a great threat

(Southwood and Cross, 1969; Green, 1984; Rands, 1985; Borg and Toft, 2000). Other reasons underlying the decline in the populations of partridges include intensive agricultural land use and severe winters (Manly, 1977; Pépin et al., 2008). Well known are cases of partridges freezing to death. To the decline of this species also contributes to pressure from predators (Tapper et al., 1996). Winter protection of free-living partridges consists in building wind shelters and providing food; one should also control the population of weasels, badgers and foxes, not to mention feral cats, dogs as well as the abundance of crows and magpies (Czyżowski et al., 2009). The decline in partridge populations are also due to diseases, monoculture crop farming and increasing areas of barren agricultural land (Tompkins et al., 1999; Šálek et al., 2004; Jarosz, 2007).

Aviary breeding of partridges is a way protect the birds and provides the possibility of re-introduction (Buner and Schaub, 2008; Rymešová et al., 2013). The primary purpose of breeding is producing material for introduction or breeding material that can be sold to other breeders (Górski, 2003). Nutrition is an important factor influencing the quality and profitability of aviary breeding of these Galliformes; hence, feeding should be optimized by developing nutrition schemes suitable for the given population of partridges (Krystianiak and Torgowski, 1998; Maciołek and Bąkowska, 2005a, 2005b; Biesiada-Drzazga et al., 2011).

Previous studies addressing the problems of rearing wild Galliformes were mostly focused on pheasants. There are no scientific reports on the effects of diversified nutrition in relation to young partridges. The aim of the study was to evaluation of the suitability of broiler chicken and turkey commercial feed mixes in the diets of grey partridge (*Perdix perdix* L.) during the rearing period.

## Materials and methods

The study was carried out on a farm that possessed the consent issued by the Minister of the Environment to conduct farming and breeding of grey partridge, DL Pgt-6713-23/15852/13/RN dated 24 April 2013. The research material consisted of a population of partridge chicks divided into two groups, 22 birds each. The groups arranged this way were fed different complete feeds: group I were offered turkey complete feed mixes IB-1 (up to 4 weeks of age) and IB-2 (from 5 to 8 weeks of age) and group II were fed DKA-S, a starter feed for broiler chickens from 1 to 8 week of age.

The feed was offered to birds in the form of fine pellets and crumbs. In the first week, the feed was crushed and given in the form of powder. The feeds were of a high nutritional value and good quality. The feed mixes IB-1 and IB-2 contained 27.5% and 25.5% total protein, respectively. The DKA feed mix contained 21.82% crude protein. The data on the nutritional value of the applied feeds have been collected in Table 1. Day-old chicks also received LACTAVIT C in order to acidify the sterile gastrointestinal tracts and facilitate colonization by the desired microbiota. From 2 weeks of age on the birds were ad libitum offered finely chopped young nettle leaves. In the third week of rearing, the diet was enriched with chopped lettuce and Persian clover, also available at will. The complete feeds were also medicated using vitamins and supplements (Polfasol B compositum, Dolfos D). The rearing took 8 weeks.

Table 1. Complete compound feed mix profile

Detailed data	IB- 1 Prestarter	IB- 2 Starter	DKA- S Starter
Metabolizable energy (MJ)	11.87	12.04	12.14
Total protein (%)	27.5	25.5	21.82
Crude fibre (%)	3.5	4	2.4
Crude ash (%)	7	7	6
Crude fat (%)	4.4	5.7	4
Ca (%)	1.4	1.3	0.95
P-soluble (%)	0.78	0.7	0.45
Na (%)	0.17	0.17	0.16
Lysine (%)	1.76	1.53	1.3
Methionine (%)	0.72	0.62	0.56
Cysteine (%)	1.11	1.04	0.79
Tryptophan (%)	0.33	0.3	0.22

Composition of a feed mix IB-1: post-extraction soy meal, yeast and parts, micronized flax seeds, maize, wheat, vegetable oils and soya fats, calcium carbonate, sodium chloride, monocalcium phosphate, sodium carbonate. Composition of a feed mix IB-2: post-extraction soy meal, yeast *Kluyveromyces lactis*, guar flour, mannose oligosaccharides, micronized linseed, maize, wheat, vegetable oils and fats, calcium carbonate, sodium chloride, monocalcium phosphate, sodium carbonate. Composition of a feed mix DKA-S: wheat, barley, maize, calcium carbonate, wheat bran, hulled soya beans extracted roasted, vegetable oil, monocalcium phosphate, sodium chloride, fish meal.

From 1 day to 4 weeks of rearing, the chicks were kept in a brick nursery, in 1 x 1 m cages of adjustable size, enlarged with the growth of the birds. The heating was provided using a heat bulb, which gave the temperature 36 °C in the first week, 34 °C in the second, and 32 °C in the third week. The relative humidity in the nursery remained at 60-70%. After 4 weeks of rearing, partridges were transferred to a wooden shed with a chicken run. The heat source was also a heat bulb. The windows had been painted over with red paint to prevent feather pecking and cannibalism. On sunny days, the birds used the runs that had previously been sown with Persian clover and sunflower. The feed was offered ad libitum out of feeders used for chickens.

On a daily basis, over the entire trial period, death cases, health status, feed intake, and maintenance conditions were monitored. Each week, the birds were measured for body weight. The following were calculated: the mean daily body weight gains, growth rate, feed mix consumption during rearing, feed mix consumption per bird and feed mix consumption per 1 kg of body weight gain. The growth rate index for the respective periods of rearing was calculated according to the following formula:

$$K\% = \frac{(Wt - Wo) \times 100}{\frac{Wt + Wo}{2}}$$

where:

Wt – final body weight on the day of analysis,

Wo – initial body weight.

The data were analyzed in terms of the type of feed mix used. The resulting data were statistically analysed using the following mathematical model (StatSoft Inc., 2009):

$$Y_{ij} = m + a_i + e_{ij}$$

where:

$Y_{ij}$  – trait level,

m – population mean,

$a_i$  – effect of type of feed,

$e_{ij}$  – error.

## Results and discussion

The survival rate of birds after the 8-week rearing period was 100% (Table 2). No severe diseases were encountered, only symptoms of a slight vitamin B deficiency were found in 3-week partridges fed DKA-Starter. The symptoms appeared first on the claws. From that moment until the end of the rearing cycle, all groups of birds were administered Polfasol B compositum, dissolved in water, and Dolfos B, added to the ration. Vitamin B deficiency symptoms subsided within a week. Znaniecka and Wajda (1977) observed a high chick mortality rate, oscillating around 30%. Those deaths were due to late broods and infectious diseases (coccidiosis).

Table 2. Selected indices of rearing grey partridges (*Perdix perdix* L.) chicks (number of individuals)

Indices	Type of compound feed mix	
	IB-1, IB-2	DKA-S
Number of chicks	22	22
Number of reared birds	22	22
Survival rate	100	100

IB-1, IB-2 - commercial complete feed mixes for broiler turkeys; DKA-S - commercial complete feed mix for broiler chickens.

Table 3 shows data on body weight in partridge chicks in subsequent weeks of rearing, in relation to the applied complete feed mix. The data show that the feed mix type largely affected the body weight of the birds. On the first day of life, hatchlings from both dietary groups did not significantly differ in body weight. Remarkable differences in the weight of birds fed different feeds were not found until 2 weeks. Those fed the IB gained nearly 12 g more in weight, as compared with partridges offered DKA-S ( $P < 0.01$ ). After 3 weeks of rearing, further weight gain of birds in the nutrition group IB was observed. The birds were already by 21 g heavier ( $P < 0.01$ ). After 7 weeks, the average body weight of birds fed the IB feed mix increased by 23.95 g in relation to those fed the DKA-S. After 8 weeks of rearing, body weights of all the partridges fed with different feeds were more similar, with low, non-significant differences. The body weight of partridges at 8 weeks of age in own studies was similar to the body weight of partridges at the 12<sup>th</sup> week of life ascertained by Adamski and Kuźniacka (2007). Kokoszyński et al. (2017) showed partridges at the age of 12 weeks with an average body weight of 324.2 g (female) to 344.8 g (male). Significantly lower mean body weight of grey partridges in the 3<sup>rd</sup> and 6<sup>th</sup> weeks of life, respectively: 38.9-41.6 g and 105.2-110.5 g in their studies, Nowaczewski et al. (2014). In partridges aged 32 weeks Kokoszyński et al. (2013) found higher body weight in male than female grey partridges (301.4 g vs 299.5 g).

Table 3. Body weight of the grey partridges (*Perdix perdix* L.) chicks in the successive weeks of rearing, depending on the applied compound feed mix (g)

Age of chicks	Type of compound feed mix		LSD <sub>0.05</sub>	LSD <sub>0.01</sub>	
	IB-1, IB-2	DKA-S			
Day 1	$\bar{x}$	8.68	9	0.264	0.348
	SD	0.48	0.76		
1 <sup>st</sup> week	$\bar{x}$	19.68	19.14	0.589	0.775
	SD	1.09	1.67		
2 <sup>nd</sup> week	$\bar{x}$	51.54	38.73	1.595	2.099
	SD	1.94	5.03		
3 <sup>th</sup> week	$\bar{x}$	83.23	61.45	2.785	3.664
	SD	8.83	3.29		
4 <sup>th</sup> week	$\bar{x}$	128.73	118.5	1.139	1.499
	SD	2.31	3.08		
5 <sup>th</sup> week	$\bar{x}$	179.54	160.73	3.622	4.768
	SD	9.19	8.11		
6 <sup>th</sup> week	$\bar{x}$	223.64	202.5	4.365	5.746
	SD	7.82	12.53		
7 <sup>th</sup> week	$\bar{x}$	248.27	224.32	4.643	6.112
	SD	12.6	9.39		
8 <sup>th</sup> week	$\bar{x}$	271.68	267.09	6.19	8.148
	SD	15.04	14.59		

SD - standard deviation,  $\bar{x}$  – mean, LSD - lowest significant difference.

The growth of partridges may be analysed in terms of the average daily weight gains (Table 4). The data demonstrate that partridges fed the IB feed had higher daily gains from day 1 to 4 weeks of age, as compared with those fed DKA-S (respectively, 3.43 and 3.13 g). From weeks 5 to 8, daily gains in DKA-S fed partridges were slightly higher. During the entire rearing period, from day 1 till 8 weeks – the average daily gains were higher in the partridges fed with IB (4.17 g). Similar daily body weight gains of the grey partridges in the period from 1 to 3 weeks of age were shown in their studies by Nowaczewski et al. (2014). Mróz (2003)

showed a similar pattern of body weight gains in pheasants. In a study on application of mixed feeds in nutrition of the common pheasant, Kokoszyński et al. (2011) found the average daily weight gain in the period from day 1 to 4 weeks of age ranging from 5.9 g (females) to 6.8 g (males). It is worth noting that the average daily weight gain was higher in partridges fed IB, as compared with DKA-S. The effect of feed was pronounced, however, mainly during the initial period of life, until 4 weeks of age.

Table 4. Mean daily body weight gains of the grey partridges (*Perdix perdix* L.), depending on the rearing stage and applied feed mix (g)

Rearing stage		Type of compound feed mix		LSD <sub>0.05</sub>	LSD <sub>0.01</sub>
		IB-1, IB-2	DKA-S		
Until 4 <sup>th</sup> week	$\bar{x}$	3.43	3.13	0.108	0.142
	SD	0.05	0.07		
From 5 <sup>th</sup> until 8 <sup>th</sup> week	$\bar{x}$	3.29	3.8	0.026	0.035
	SD	0.24	0.27		
From 1 <sup>st</sup> day until 8 <sup>th</sup> week	$\bar{x}$	4.17	4.1	0.095	0.125
	SD	0.23	0.22		

The growth parameters in partridges in relation to applied feed mix are presented in Table 5. The data show that both birds fed IB and DKA-S were characterized by a very rapid growth from day 1 to 4 weeks of age. During this period, the IB-fed group of partridges demonstrated a faster growth rate. From 5 to 8 weeks, the rate of growth decreased and ranged from 40.81 to 49.7%. Similarly, Winnicka (quoted by Mróz, 2003) observed the most intensive growth of pheasants until 4 weeks of age. The fast rate of growth in the first weeks of life results in an increased demand for nutrients, much higher than in the subsequent period (Rutkowski, 1996). With age, protein synthesis slows down and fat storage increases.

Table 5. Growth rate indices of the grey partridges (*Perdix perdix* L.), depending on the applied feed mix (%)

Rearing stage		Type of compound feed mix		LSD <sub>0.05</sub>	LSD <sub>0.01</sub>
		IB	DKA-S		
From 1 <sup>st</sup> until 4 <sup>th</sup> week	$\bar{x}$	174.74	171.8	0.566	0.745
	SD	0.99	1.64		
From 5 <sup>th</sup> until 8 <sup>th</sup> week	$\bar{x}$	40.81	49.7	0.734	0.966
	SD	1.56	1.93		

Feed mix consumption by grey partridges is presented in Table 6. The data shows that the chicks consumed slightly less feed if fed the IB compared with the DKA-S; despite this, they attained a slightly greater body weight after eight weeks of rearing (Table 3).

Table 6. Mean feed mix consumption by grey partridges (*Perdix perdix* L.) depending on the age and type of applied feed mix (g)

Rearing stage	Feed mix consumption			
	Daily		Total	
	IB-1, IB-2	DKA-S	IB-1, IB-2	DKA-S
Until 28 <sup>th</sup> day	8	9	224	252
From 29 <sup>th</sup> until 42 <sup>th</sup> day	18	20	252	280
From 43 <sup>th</sup> until 56 <sup>th</sup> day	21	22	294	308

Table 7 presents the total feed mix consumption by the birds over the entire period of rearing, feed mix consumption per bird, as well as feed mix consumption per 1 kg of weight gain. These data show that consumption of feed mix per 1 kg of weight gain was lower in birds fed IB than DKA-S, and was 2.8 kg and 3.14 kg, respectively (feed conversion ratio respectively 1:2.8 and 1:3.14). Rutkowski (2001) reported similar feed consumption per 1 kg body weight gain in pheasants. Znanięcka and Wajda (1976), who studied the applicability of concentrates in common pheasant nutrition, reported slightly lower values, compared to this study, of unit consumption of DKA-S feed mix per 1 kg of weight gain.

Table 7. Feed mix consumption by grey partridges (*Perdix perdix* L.) during the rearing period (kg)

Detailed data	Type of compound feed mix	
	IB	DKA-S
Overall feed mix consumption in the group	16.9	18.5
Feed mix consumption per 1 bird	0.77	0.84
Feed mix consumption per 1 kg of body weight gain	2.8	3.14
Feed conversion ratio	1:2.8	1:3.14

## Conclusions

In conclusion, the feeds composed for broiler chickens and turkeys can be effectively used in the nutrition of growing grey partridges. Application of the IB feed mix in growing partridges feeding, however, produced better results compared to the DKA-S feed mix.

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