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BODY WEIGHT AND SOME BIOMETRICAL TRAITS OF GREY PARTRIDGES (*PERDIX PERDIX*) AT DIFFERENT AGES

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Abstract

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The aim of this study was to investigate the body weights, wing lengths, wingspans, tarsus lengths and third toe lengths of captive grey partridges, aged 3-15 weeks. The study was carried out on 61 birds (32 males and 29 females). They were measured on their 3rd, 6th, 9th, 12th and 15th weeks of life. With the exception of the wing length measured on the third week, all the remaining traits measured at any age did not differ significantly between sexes. In any studied periods, no significant intersexual differences appeared in the absolute gains of the majority of traits. Values of body weight, wing length, wing span and tarsus length, noted on the third week, correlated significantly with all the later measurements of the given trait. Thus, body weight and some biometrical traits of grey partridge chicks, measured on the third week of life, could already be applied as predictors of future body weight and size.

Key words: Phasianidae, Galliformes, body weight gain, tarsus length, wing length, toe length

Introduction

Grey partridge (*Perdix perdix*) is a phasianid species of Eurasian origin, primarily inhabiting steppes and open grasslands but adapted to farmlands, which has become the main habitat of this species. After World War II, the number of grey partridges declined substantially in Europe. The reasons behind this decline differ depending on the country but the intensification of agriculture and predation can be mentioned as some of the most important reasons in the last decades (Aebischer and Kavanagh, 1997; Panek, 2005; Kuijper et al., 2009; Tryjanowski et al., 2011). Different methods of breeding in captivity and releasing the grey partridges are carried out (e.g. Buner et al., 2011) so as to support wild populations, conserve species and increase the possibility of hunting. The growth of young birds is an extremely important issue both in nature (Ricklefs, 1968) and captivity. Hence, it has received much interest and many studies on the growth of different species of birds in captivity were conducted (Mushi et al., 1998; Leusink et al., 2010; Aminzade et al., 2012; Kokoszyński et al., 2011). However, to our best knowledge, the literature on grey partridge growth, based on long-term and systematic measurements, is scarce (Pis, 2010). Moreover, we did not come across any paper investigating the growth of grey partridges until they have reached an age suitable for their release into hunting grounds (12-14 week of age). The aim of this study was to investigate the body weight**s**, wing lengths, wingspans, tarsus lengths and third toe lengths in captive grey partridges of both sexes, aged 3-15 weeks.

Material and Methods

The research material consisted of randomly selected, one day-old grey partridge (*Perdix perdix*) chicks. The partridges came from the Polish Hunting Association - Research Station in Czempiń. They were marked individually, on their wings, after the first week of life. Based on the plumage colour, the gender was determined on the 15th week of life. More birds were marked but due to some reasons (lost of marks, escapes and mortality) a total of 61 individuals (32 males and 29 fe-

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males) were included into the final analysis. During the experiment, they were kept indoors under controlled environmental conditions. Until the 12th day of their lives, the birds were kept in wooden boxes, sized 1.2 x 1.2 m, which were placed in a heated room (nursery) with an area of 10 m^2. A litter made of wheat straw was used. During the first days of rearing, the temperature of the birds' living zone was 37°C, the temperature being maintained by infrared heaters. Artificial lighting (lighting programme) was not used. During the whole experiment (until 15 week of age), the *ad libitum* feeding used was based on a complete diet that consisted of 26, 22 and 17% of crude protein together with 2900, 2850 and 2800 kcal/kg of metabolic energy provided on 0-2, 3-4 and 5-15 weeks of life, respectively.

On the 3rd, 6th, 9th, 12th and 15th weeks of life, all partridges were weighed and the 3rd toe lengths, tarsus lengths, wing lengths and wingspans were measured according to the methods suggested by Baker (1993). Birds were weighed (accurate to 0.1 g) the first time during their 3rd week of life**.** The tarsus length refers to the distance between the recess on the back of the metatarsus and the last complete horny scutellum before the toes disperse. On the other hand, the toe was measured on the upper side of foot. This measure was the distance between the base of the claws and the joint between the toe and the tarsus. The measurement was performed using an electronic slide calliper accurate to the nearest 0.1 mm. Wing length was measured while the wing was closed, from the carpal joint to the tip of the longest primary regime. Wingspan was defined as the distance between the tip of the right and left wing, where the line runs along the dorsal side of bird. Both, the wing length and wingspan were measured using a ruler with a stop at zero (accurate to 0.1 mm). Absolute gains in body weight, 3rd toe length, tarsus length, wing length and wingspan were calculated for three periods (weeks 3-6, 6-9, 9-12 and 12-15).

Statistical calculations were conducted with the assistance of the SAS® v. 9.1 package. For all the measured traits, the mean, minimum and maximum values as well as the coefficient of variance (CV) were calculated. Differences between sexes in every week analyzed, with regard to the body weight and biometrical traits, were determined using the Student's t-test. Moreover, Spearman-rank correlation between the majorities of traits was also calculated.

Results

The birds investigated were not significantly sexually dimorphic, in terms of body weight, in any of the periods studied (P>0.05, Table 1). Wingspan, tarsus length and third toe length did not differ between sexes either. In the case of wing length, significant differences (P ≤0.05) were observed only during the third week of life. The wings of male chicks were significantly longer at this age but this was not the case at a later stage (Table 1).

Absolute values of body weight gain only differed significantly (P≤0.05) in the last period studied and these values were higher in females than in males (Table 2). The absolute gains in wing length and tarsus length were significantly higher (P≤0.05) in one of the sexes (females) only during the third period (9-12 weeks). In the case of wingspan, absolute values of gains differed significantly between sexes (being higher in males) only during the last period. Lastly, absolute values of third toe length gains did not differ significantly in any period (P >0.05, Table 2).

The correlations between all the body weight measurements were significant (P≤0.01, r=0.34-0.85). Also, all the measurements made on wing length (r=0.31- 0.7) as well as wingspan (r= 0.44-0.83) and tarsus lengths (r=0.5-0.95) were positively correlated (P≤0.01). The third toe length value, on the sixth week of life, did not correlate with the value of this trait on the third week of life (P>0.05). All the other pairs of measurements made on third toe lengths were positively correlated (P≤0.01, r=0.43-0.87).

Values of all the traits (body weight, wing length, wingspan, third toe length and tarsus length), measured on the third week of life correlated significantly (P≤0.01). Correlation coefficients ranged from 0.33 to 0.44 in correlations of toe length with other traits. All the other traits were more strongly related (r=0.75-0.9). At week six of age, all the traits also correlated significantly (r=0.54-0.88; P≤0.01). On the ninth week, the correlation coefficient values ranged from 0.29 to 0.77 (P≤0.01), for all the trait pairs, with the exception of the wing length/toe length correlation, where r equaled to 0.29 (P≤0.05). On the 12th week of life, the wing lengths of partridges was found to correlate with their toe lengths (r=0.26) and tarsus lengths (r=0.31; P≤0.05). All the remaining traits were more highly correlated (r=0.4-0.82; P≤0.01). During the last term's measurement (15 weeks), the correlations of wing length with third toe length (r=0.25) and tarsus length (r=0.29; P≤0.05) were again weaker than the correlations among all the other trait pairs (r =0.4-0.77; P≤0.01).

Discussion

Body weights obtained in our study, for chicks in their third week of life, were very similar to those noted by Cucco et al. (2006) in the first year of their study on the influence of carotene on grey partridge chick growth (where mean values ranged from 37.5 to 42.8, in different experimental groups). However, in their second year of study, these authors stated

Table 1
Values of biometrical traits in grey partridges at different ages

Trait	Age, weeks	Sex - statistical measures							
		Males (n=32)				Females (n=29)			
		mean	CV	min.	max.	mean	CV	min.	max.
Body weight, g	3	41.6	16.7	28.4	56.1	38.9	14.0	26.0	48.4
	6	110.5	14.8	84.2	160.9	105.2	14.2	66.7	130.1
	9	206.6	13.0	158.8	272.5	216.6	11.1	161.7	258.2
	12	292.7	9.8	200.3	351.6	284.5	10.5	232.6	336.6
	15	340.9	7.6	287.0	396.0	341.2	9.2	289.0	424.0
Wing length, mm	3	77.0*	5.3	67.0	85.0	75.0*	5.6	63.0	81.0
	6	110.0	6.2	110.0	130.0	111.0	5.2	96.0	119.0
	9	136.0	3.9	128.0	147.0	134.0	5.1	122.0	150.0
	12	146.0	3.6	137.0	159.0	147.0	3.3	132.0	157.0
	15	152.0	3.7	140.0	164.0	152.0	3.2	140.0	164.0
Wingspan, mm	3	267.0	5.5	237.0	295.0	260.0	5.8	215.0	281.0
	6	394.0	5.0	355.0	440.0	387.0	5.5	330.0	418.0
	9	474.0	3.1	445.0	496.0	471.0	3.9	440.0	510.0
	12	501.0	2.3	485.0	530.0	501.0	3.1	455.0	538.0
	15	513.0	2.6	490.0	537.0	510.0	3.1	465.0	550.0
Tarsus length, mm	3	25.1	6.4	22.7	29.6	24.7	5.5	21.4	26.9
	6	35.8	6.1	32.2	42.1	35.3	6.0	29.9	39.5
	9	41.6	3.5	38.2	44.4	41.1	3.8	38.2	44.8
	12	42.0	3.4	38.9	44.7	41.8	3.8	39.0	45.7
	15	42.6	3.3	40.0	45.2	42.2	3.7	39.2	45.9
3rd toe length, mm	3	17.0	9.9	14.0	21.1	16.6	9.8	14.4	20.1
	6	23.5	5.3	20.0	25.5	23.0	6.7	18.4	26.3
	9	24.8	4.1	21.7	27.5	24.5	4.8	22.0	26.5
	12	25.6	4.1	23.2	27.8	25.2	3.8	23.2	26.8
	15	26.3	4.2	24.1	28.5	26.0	4.0	24.4	29.4

* Means, within rows, differ significantly ($P \leq 0.05$)

that 21 day-old chicks were much heavier (with mean values ranging from 47.7 to 50.5). Thus, the year of study can influence the weight of a chick a lot. Our data were collected over one year only which was, possibly, rather 'bad' for partridge chicks.

No sexual dimorphism was found in any of the measured traits (body weight, wing length, wingspan, tarsus length and third toe length) with the exception of wing length which was higher in male chicks on the third week of life. Similarly, Pis (2012) who investigated body weight, wing length, tarsus length and bill length of grey partridges and of chukars (*Alectoris chukar*) at various ages between the first and the 120th day of life, did not find any differences between males and females in all of the variables he measured. On the other hand, Özek et al. (2003) stated that the weights of all the carcass components were significantly greater in male than in female 16 week old, chukar partridges. Interestingly, Çağlayan et al. (2011) who studied another species of *Alectoris*, rock partridge (*Alectoris graeca*) and measured its body weight and some other traits as from the day of hatching till the 14th week of life, revealed that males were significantly heavier than females, already on their sixth week of life and later on as well. These authors also found that in the case of some other traits (e.g. shank depth), significant intersexual differences started appearing earlier already. In another phasianid species, that is, ring-necked pheasants (*Phasianus colchicus*), significant intersexual differences in body weight were stated already in their third or fourth week of life (Kokoszyński et al., 2011; Górecki et al., 2012; but see Kuźniacka and Adamski, 2010). Such a striking difference between the results obtained from common pheasants and grey partridges were not surprising. These two phasianid species clearly differ in terms of mating

Table 2
The absolute gains of biometrical traits in grey partridges

Trait	Period, weeks of age	Sex - statistical measures			
		Males (n=32)		Females (n=29)	
		mean	CV	mean	CV
Absolute gains of body weight, g	1 (3-6)	68.9	17.9	66.2	16.5
	2 (6-9)	106.0	12.5	101.4	17.3
	3 (9-12)	76.1	19.5	77.9	16.9
	4 (12-15)	48.2*	32.5	56.7*	26.8
Absolute gains of wing length, mm	1 (3-6)	3.6	13.2	3.6	10.0
	2 (6-9)	2.2	24.2	2.3	24.9
	3 (9-12)	1.0*	41.3	1.3*	42.1
	4 (12-15)	0.6	80.2	0.5	73.9
Absolute gains of wingspan, mm	1 (3-6)	12.7	9.6	12.7	9.7
	2 (6-9)	8.0	15.0	8.4	14.6
	3 (9-12)	2.6	38.2	3.0	37.4
	4 (12-15)	1.2*	71.4	0.8*	66.3
Absolute gains of tarsus length, mm	1 (3-6)	10.7	15.7	10.6	13.2
	2 (6-9)	5.7	25.5	5.8	26.9
	3 (9-12)	0.4*	88.6	0.7*	79.8
	4 (12-15)	0.6	97.5	0.4	79.5
Absolute gains of 3rd toe length, mm	1 (3-6)	6.4	32.1	6.4	32.3
	2 (6-9)	1.3	77.5	1.5	78.6
	3 (9-12)	0.8	69.1	0.6	72.8
	4 (12-15)	0.7	70.4	0.8	69.2

* Means, within rows, differ significantly ($P \leq 0.05$)

system and sexual dimorphism. The ring-necked pheasant is a polygynous species with a very clear sexual dimorphism in adult birds whereas the grey partridge is monogamous and characterized by a weak sexual dimorphism in mature specimens (e.g. Felix, 1980; McGowan, 1994)

We stated that all the traits measured on the same date were positively correlated. Similar results on game pheasants aged 3-16 weeks were published by Górecki et al. (2012) who measured the same traits four times, as in the study presented, with the exception of toe length. The only insignificant correlations found by these authors were between tarsus length/wing length and wing length/wingspan over the third week of life. Çağlayan et al. (2011) stated that shank length, shank width, shank depth, head width and head length of rock partridges correlated with body weight from their second week of life (or even earlier in the case of a few traits).

We also stated that all the measurements of the same trait correlated significantly (with the exception of toe length during the 3rd and 6th weeks). Górecki et al. (2012) found very similar relations in pheasants. In their study, the wing length on the third week did not correlate significantly with any later measurements made on this trait. All other wing length measurements were correlated. This was also true for all the measurements of body weight, tarsus length and wingspan.

Conclusion

Body weight is a very important factor influencing the survival of grey partridges. Liukkonen et al. (1996) found that the cooling speed is related to weight in partridge chicks. Southwood and Cross (2002) also studied grey partridge chicks and demonstrated that chilling resistance correlated with weight and not with age. Scarselli et al. (2001) revealed that shortly after being released, lighter partridges had a higher risk of being predated than heavier ones. Thus it is more profitable to be heavier in the case of both, chicks and older birds in age suitable for release.

We found that the body weight of grey partridges, on their third week of life, could be used to predict the values of this trait in their later ontogeny until the 15th week of life. In addition, it might also be a good predictor for survival after their release.

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