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**MORPHOLOGICAL AND HORMONAL
CHARACTERISTICS OF EARLY
AND LATE QUAIL MIGRANTS**
(With 3 Tables and 2 Figures)

By

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مقارنة الخصائص المورفولوجية والهرمونية للسمان المهاجر
في أول وآخر موسم الهجرة

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أجريت دراسة مقارنة للخصائص المورفولوجية والهرمونية على عدد ٨٢ عينة سمان تسم صيدها في أول وآخر الموسم من الساحل الشمالي الشرقي لمصر في الفترة من سبتمبر وحتى أوائل نوفمبر ١٩٩٩ وتم تقسيمها إلى مجموعتين أول وآخر الموسم. سجلت قياس أوزان الطيور ارتفاع متوسط وزن الإناث في أول الموسم (٤,٦٤ ± ٨ جم) مقارنة بوزنها في آخر الموسم (٦,٠٦ ± ٥٩,٣ جم) عند معنوية مقدارها (٠,٠٩٥) بزيادة في الوزن نسبتها (٩%) وارتفعت متوسط أوزان الذكور في أول الموسم (٦٢,٦٥ ± ١ جم) مقارنة بمتوسط أوزانها في آخر الموسم (٧٣,٥٧ ± ٣ جم) بمعنوية مقدارها (٠,٠٤٣) وزيادة في الوزن نسبتها (١٤,٦%) بينما لم يكن هناك اختلاف معنوي بين متوسطات الأوزان في الأجناس داخل المجموعة الواحدة سواء أول أو آخر الموسم وكذلك بين أطوال الجناح حيث تراوحت الأطوال في ذكور آخر الموسم بين (٢,١٦ سم و ٢,١٤ سم) بينما تراوحت في الإناث بين (١٦ سم و ١٣,٩ سم) وتراوحت أطوال الجناح في ذكور أول الموسم بين (١٦ سم و ١٤ سم) بينما تراوحت في الإناث بين (١٦ سم و ١٣ سم) أما مقارنة متوسط مستويات T3 و T4 بين الأفراد في أول وآخر الموسم وجد اختلاف معنوي بين مستويات T3 بين الذكور والإناث في المجموعة الواحدة حيث سجلت أعلى مستوى لها عند الإناث عند معنوية (٠,٠١٤) بينما لم يكن هناك اختلاف معنوي بين الأجناس المتشابهة في المجموعتين كما لم يكن هناك اختلاف معنوي في متوسط مستوى T4 داخل المجموعة الواحدة بين الذكور والإناث بينما كانت أعلى عند الذكور في أول الموسم مقارنة بأخر الموسم عند معنوية (٠,٠١٣).

SUMMARY

This study was carried out in 1998-1999 where a total of 82 quails was live captured from the north coast of Egypt to compare morphological and hormonal characteristics of early versus late arrivals. The samples were divided into early arrivals, captured in the first two weeks of September, and late arrivals, captured in late October and Early November. Comparing body mass within groups early arriving males had on average a body mass of 64.4 ± 2.8 gm compared with an average of 65.6 ± 1.7 attained by females without significant difference. Late arriving males had an average body mass of 57.73 ± 1.3 gm with no statistical difference compared with the average value 59.06 ± 1.3 gm attained by females. However, by comparing values between groups, it was evident that early arriving females had higher body mass (64.4 ± 2.8 gm) than late arriving females (59.06 ± 1.3 gm, $P=0.095$) with an average loss of 9% of body mass by late arrivals. Early arriving males had higher average body mass of 65.62 ± 1.7 gm than late arriving males (57.73 ± 1.3 gm, $P=0.043$), with an average loss of 14.6% of body mass by late arrivals. The measurement of wing lengths in late arrivals ranged between 16.2 and 14.2 cm in males and 16.0 and 13.9 cm in females, while in early arrivals it ranged between 16.0 and 14.0 cm in males and 16.0 and 13.0 cm in females without any statistical difference between all values. By comparing serum levels of T3 between groups early arriving females had no different significant levels compared with that of late arriving females ($P=0.932$) and early arriving males had no different significant levels compared with that of late arriving males ($P=0.681$). Within groups females had higher average plasma levels of T3 compared with males ($P=0.014$, $P=0.04$). There was no significant difference in the average T4 levels within groups or between sexes, however between groups early arriving males had higher average plasma levels of T4 than that of late arriving males ($P=0.013$).

Key words: *Morphological and Hormonal Characteristics, Quail Migrants.*

INTRODUCTION

Bird migration with its large scale dimensions has attracted the attention of biologists for centuries. This phenomenon involves complex interrelationship of anabolic and catabolic metabolism and reproduction

development (Farner 1955). It has been proved that many exogenous and endogenous factors play an important role in the control of animal migration (Milne and Robertson 1965; Berthold 1974). In recent years, however, the situation has begun to change and some substantial progress has been made in the understanding of several physiological and eco-physiological aspects of migration (Gwinner, 1990). Most avian species, for example, cope with fluctuating food abundance and climate by periodic migration which have been proposed to be partially controlled by various endocrine mechanisms (Berthold, 1975).

Finding and occupying suitable habitats and adequate food by migrants to replenish their depleted energy during migration is a major constraint met by migrants (Loria and Moore 1990; Moore and Young, 1991). Early migrants had better territories and had higher success in selecting smaller and higher quality territories for better survival than late migrants (Ellerger, 1991 and Tye, 1992).

The role of thyroid hormones has been assessed to play a key role in the regulation of migratory behavior (Smith, 1982). Comparative hormonal studies estimating the circulating blood levels of thyroid hormones in both migratory and resident doves revealed higher levels of thyroid hormones in migratory doves compared with non-migratory doves (Mahmoud, 1996).

This study aims at comparing morphological and hormonal characteristics between early and late quail migrants and correlating the findings with their migration strategy.

METHODOLOGY

A total of 82 quails (42 females and 38 males) was live collected during migration from the north coast of Egypt from September to October 1998-1999. Quails collected in the first two weeks of September were noted as early migrants where late migrants were collected in late October and early November. Collected birds were identified as males and females by examining internal sex organs.

1- Morphological parameters:

The two groups of quails were weighed intact to the nearest gram by an electronic balance for body mass determination. Total wing length was measured to the nearest 0.1 cm and correlated to body mass according to Reed and Plante (1987).

2- Radio-immuno assay for tri-iodothyronine (T3) and thyroxine (T4)

Blood samples were collected from scarified birds and placed into glass test tubes for centrifugation. After centrifugation serum was collected and stored in a freezer for determining the levels of T3 and T4 according to Hall et. al. (1988). The detection limit of the assay defined as the apparent concentration at 95% B/B0, is approximately 0.2 n.g/dl. Both levels of T3 and T4 were tested with the use of RIA-mat test tubes coated with anti-T3 and T4 antibodies which is a competitive test for radioactive determination of total tri-iodo-thyronine in serum. The detection limit of the RIA-mat is <10n.g/100ml.

3- Average values within and between groups were tested statistically by student T-test.

RESULTS

1- Morphological characteristics:

In terms of body mass within groups males of early migrants had on average a body mass of (65.6 ±1.7 gm) compared with the average of (64.4± 2.8 gm) in females with no statistical difference in the T-test value. Males of late migrants had on average a body mass of (57.73 ±1.3 gm) compared with the average body mass of their counter sex (59.06± 1.3 gm), without statistical difference. Between the two groups of quails early female migrants had on average higher body mass (64.4± 2.8 gm) than late female migrants(59.06± 1.3 gm, t= -1.74, P= 0.095). Similarly, early male arrivals had higher body mass (65.62± 1.7 gm) than that of late male arrivals (57.73 ±3.1 gm, t=-2.26, p= 0.045), Table (1).

Table 1: Average body mass in early and late quail migrants separated by sex.

| Timing of migration | Sex | n | Average weight (gm) ±se | Estimate of difference within a group |
|---------------------|--------|----|-------------------------|---------------------------------------|
| Early migrants | male | 28 | *65.62 ± 1.7 | ^a -1.18 gm, p=0.72 |
| | Female | 18 | **64.4 ± 2.8 | |
| Late migrants | male | 8 | *57.73 ± 3.1 | ^a 1.33 gm, p=0.69 |
| | Female | 24 | **59.06 ± 1.3 | |

^a not significant

*t=-2.26, p=0.045

**t=-1.74, p=0.095

In terms of wing length there was no statistical difference between sexes or between early and late migrants. The average wing length in early females was 14.9 ± 0.5 cm while males had an average of 15.3 ± 0.5 cm. The average wing length in late female migrants was 14.9 ± 0.8 cm while late male migrants had on average 15.0 ± 0.7 cm, Table (2).

Table 2: Average wing length in early and late quail migrants separated by sex.

| Timing of migration | sex | Max. Cm | Min. cm | Average wing Length/cm + se |
|---------------------|--------|---------|---------|-----------------------------|
| Early migrants | male | 16.2 | 14.2 | 15.3 ± 0.5 |
| | female | 16.0 | 13.9 | 14.9 ± 0.5 |
| Late migrants | male | 16.0 | 14.0 | 15 ± 0.7 |
| | female | 16.0 | 13.0 | 14.9 ± 0.8 |

3- Hormonal characteristics:

Between groups the average circulating plasma level of T3 in early female migrants (102.6 ± 8.8 n.g/dl) was not significantly different from that in late female migrants (103.8 ± 11 n.g/dl, $p=0.932$). Similarly, The average circulating plasma level of T3 in early male migrants (64.4 ± 8.2 n.g/dl) was not significantly different from that of late male migrants (73.3 ± 8.3 n.g/dl, $P=0.681$). The average circulating plasma level of T4 in early male arrivals (1.691 ± 0.12 n.g/dl) was higher than that in late male migrants (1.185 ± 0.10 n.g/dl, $t=3.25$, $P=0.007$). Within groups females whether early or late arrivals had higher plasma levels of T3 than that of males, Table (3), Figs. (1&2).

Table 3: Average levels of blood circulating T3 and T4 in Early and late migrants separated by sex.

| Timing of migration | Sex | Average T3 n.g/dl | Average T4 n.g/dl | Significance Between groups/T-test | Significance within groups/T-test |
|---------------------|--------|-------------------|-------------------|------------------------------------|-----------------------------------|
| Early migrants | male | 68.4 ± 8.2 | 1.691 ± 0.12 | P=0.932 P=0.681 T3 | P=0.014 for T3 P=0.65 for T4 |
| | female | 102.6 ± 8.8 | 1.832 ± 0.28 | | |
| Late migrants | male | 73.3 ± 8.3 | 1.185 ± 0.10 | P=0.07 P=0.736 T4 | P=0.04 for T3 P=0.013 for T4 |
| | female | 103.8 ± 11 | 1.957 ± 0.64 | | |

DISCUSSION

Migratory birds depend on their fat deposit for migration and accumulating fat or restoring depleted fat by these birds usually have a positive impact on body mass. By comparing body mass data of early versus late migrants in this study it was evident that late migrants recorded less weight than early migrants. Females of late migrants had on average a loss of 9% of their body mass while males of late migrants had on average a loss of 14.6% of their body mass compared with early migrants. This loss in weight could be related to a severe depletion in body fat which was used up during migration. Hessel and Lambert (1980), assuming that all migratory individuals had taken off at the same time, suggested an average loss of weight by 0.9% per hour flight. Thus late arrivals might have flown longer in the air and subsequently prone to higher weight loss than early arrivals. This might be the case with late quail arrivals which had on average less body mass than early ones in this study. On the other hand, there was no difference in wing length between early and late arrivals, which reject any hypothesis that success in early arriving depend on some morphological characteristics acquired by the birds and assure that birds depend, on large extent, on their body mass for fast arrival to the wintering ground.

The role of thyroid hormones has been investigated by many researchers in controlling migration. Some studies on the migratory red-eyed bunting showed that thyroidectomy inhibits nocturnal restlessness and injection of T3 and T4 increased loco motor activity in these birds.

(Pathak and Chandola, 1982b). However little data are available on the different plasma levels of these hormones in early and late arrivals of migratory birds. The results in this study showed no clear-cut difference in the plasma levels of T3 between early and late migrants but comparing sexes it was evident that females of either groups had on average higher levels of T3 than males (Figs. 1 and 2). This might indicate that T3 has no visible role on whether birds arrive early or late to their wintering ground. Most of the studies carried out to investigate the role of T3 in migration indicated that T3 levels increase with the onset of migration and thus migratory birds had higher levels of T3 than sedentary birds (Smith, 1982). Mahmoud (1996), comparing the levels of T3 and T4 in sedentary and migratory doves, found that migratory doves had higher levels of T3 and T4 than sedentary doves. The results indicated that T3 and T4 have a substantial role on migration onset but probably not on timing of arrival. Pathak and Chandola (1984) also

showed the role of T3 and T4 in the onset of vernal migration in the Rose-coloured starling. Similar results were obtained in Canada geese, in which T4 levels were higher in the vernal post-migratory period but were lowest during the post-migratory period in autumn. Plasma levels of T3, on the other hand, were maximal during spring migration (John and George, 1978). The reason for the increased level of T3 in females than in males whether early or late is not very clear but it might have a role in building better body mass in females that will be needed for egg production and incubation upon return to the breeding ground. Pathak and Chandola (1982b) found that Red-headed bunting restored their body mass after injection of T3 and T4 and the level of T3 was seen to sharply decrease in starved birds but elevated after resumption of feeding (Brake et al., 1979). Thus, better mass gain means successful migration and good breeding potential for the birds involved. Pathak and Chandola (1982a) also mentioned that the increase in T3 levels in spring could be due to increased conversion of T4 to T3 rather than to an increase secretion of T3.

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Figure (1), average T3 levels of early male and female migrants.
(means are indicated by solid circles)

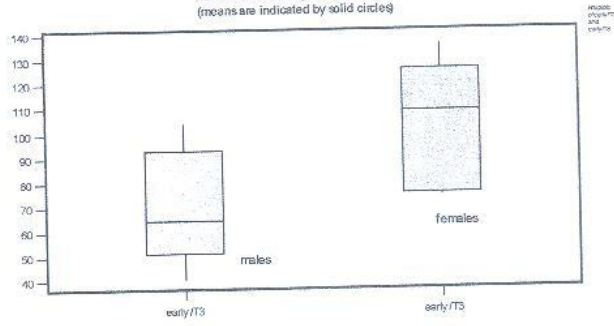


Figure (2), Average levels of T3 in late male and female migrants.
(means are indicated by solid circles)

