

Preliminary data on diet of the Lesser Kestrel (*Falco naumanni* Fleischer) in Aralık, Iğdır province (Eastern Anatolia Region, Turkey)

Aralık, Iğdır (Doğu Anadolu Türkiye)'da küçük kerkenez (Falco naumanni Fleischer) diyeti hakkında ön veri

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• Geliş tarihi / Received: 21.05.2020 • Düzeltilerek geliş tarihi / Received in revised form: 20.01.2021 • Kabul tarihi / Accepted: 16.02.2021

Abstract

Studies on the feeding biology of Lesser Kestrel (*Falco naumanni*) have limited in Turkey. The aim of this study was to contribute to the knowledge of its feeding ecology in arid areas. In this study, pellet compositions of Lesser Kestrel were examined. Compositions of 17 pellets of *Falco naumanni* were used in the study. 182 preys which belong to 8 different taxa were found in the diet composition. Insecta (f= 59.34%) and Arachnida (f= 37.36%) taxa were the main preys in the diet composition of *Falco naumanni*. Solpugidae (Arachnida) (f= 35.16%) had the high prey rate in the dietary composition. The significant ratio of members of Solpugidae was similar to the results of the other semi-arid and arid areas.

Keywords: Pellet, Semi-desert, Solpugidae, Turkey

Öz

Türkiye'de küçük kerkenezin (*Falco naumanni*) beslenme biyolojisi ile ilgili sınırlı sayıda çalışma vardır. Bu çalışmanın amacı, bu türün kurak alanlardaki beslenme ekolojisine yönelik bilimsel değerlendirmelere katkıda bulunmaktır. Bu çalışmada küçük kerkenezin pelet içerikleri incelenmiştir. Çalışmada türe ait 17 peletin içeriği değerlendirilmiştir. Diyet bileşiminde 8 farklı taksona ait 182 av tespit edilmiştir. *Falco naumanni*'nin diyet bileşimindeki ana avlar; Insecta (f= %59,34) ve Arachnida (f= 37,36%) taksonlarıdır. Arachnida'dan Solpugidae familyası (f= %35,16), diyet bileşiminde yüksek av oranına sahiptir. Solpugidae üyelerinin bu belirgin oranı, diğer yarı kurak ve kurak alanların sonuçları ile benzerlik göstermektedir.

Anahtar Kelimeler: Pelet, Yarı-çöl, Solpugidae, Türkiye

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1. Introduction

Many different methods are used in finding out prey preferences such as pellet analysis, stomach content analysis, and regurgitation of juvenile birds, fecal analysis, and examination of prey remains in the nest and around the feeding area or direct examination (Duffy and Jackson, 1986; Marti et al., 2007). Pellet analysis is a frequently used method in finding out feeding strategies of raptors (Terry, 2008).

Lesser Kestrel (*Falco naumanni* Fleischer) is a long-distance migratory Old-World falcon, which breeds in the Mediterranean and steppe zone of the Palearctic Region and wintering in east and south Africa (Iñigo and Barov, 2011; Forsman, 2016) and it is also a widespread and common summer visitor over much of Turkey. In Eastern Anatolia, they generally breed in small colonies of from 2 to 5 pairs, and it is reported these populations are probably declining (Kirwan et al., 2010).

The Lesser Kestrel has a diet composition which consists of mostly big insects such as orthopterans, termites, coleopteran such as beetles and also some other larger terrestrial arthropods (Cramp, 1980; Kopij and Liven-Schulman, 2012). Tella et al. (1996) also reported lower rates of small mammals, reptiles and birds in the diet of the Lesser Kestrel.

Although there are a great number of studies were carried out to find out the prey preferences of this species within its area of distribution (Rocha, 1998; Anderson et al., 1999; Lepley et al., 2000; Rodríguez, 2004, Rodríguez et al., 2010; Kopij 2007), there are quite few studies were carried to find out diet composition of Turkey population (Lyaister and Sosnin, 1942; Avcı, 2018). There is a great information gap on the feeding ecology of the Lesser Kestrel through eastern Anatolia. Therefore, the primary aims of this study were to investigate the diet composition of the Lesser Kestrel in semi-arid habitat and to make contributions to the literature.

2. Materials and methods

This study was carried out in the provinces of Iğdır in the Eastern Anatolia Region of Turkey in 2018 (Figure 1). Lesser Kestrel pellets were collected from the steppe in the northeast of Mount Ağrı (in between Aralık-Mount Ağrı, 39°45'N, 44°33'E) where desert and semi-desert vegetation are dominant (Korotyaev et al. 2016), within the borders of the province of Iğdır on 30th of April. Since the area is a military zone, it is not intensely used by human beings. *Calligonum* sp., which is frequently seen in the research area, is the dominant plant species in the sand desert alongside Aras valley (Iğdır) (Korotyaev et al., 2016). Characteristics of arid climate are generally seen in the province of Iğdır. While the average temperature is 13.3°C and average rainfall is 34.5 mm in April when the pellets were obtained, the average annual temperature is 12.1°C and average rainfall is 256.0 mm (Karaoğlu, 2011).

The dissecting of the pellets was carried out according to Yalden (2009). Each pellet was examined separately to avoid the mistake of prey per pellet. Pellets were placed in beakers filled with water and beakers were kept in a 60 °C water bath for 10 minutes. This step helps to easily separate the fur from bones and chitin. The remains were left to dehydrate after dissection.

Skull and mandible were used for the identification of small mammals according to Kryštufek and Vohralik (2001) and Tez (2000). Elytra of beetles, leg part, chelicerae of sunspiders, manus, jaw, telson and pedipalpus parts, which can be identified easily, were used in the identification of invertebrates. The identification of invertebrate taxa was made according to Chinery (1993).

The minimum number of individuals (MNI) of small mammal, bird and insect taxa inside the pellet composition, frequency (f%) and average prey amount for each pellet rates were calculated.



Figure 1. Semi-desert habitat where pellets were collected and Mount Ağrı (star: Aralık district-Iğdır, Eastern Anatolia Region of Turkey).

3. Results

In the diet of Lesser Kestrel, prey items were assigned to 8 different taxa, including Solpugidae (sunspiders, Order: Solifugae), Scorpionidae (scorpions, Order: Scorpiones), Tettigoniidae (bush crickets, Order: Orthoptera), Formicidae (ants, Order: Hymenoptera), Carabidae (ground beetles, Order: Coleoptera) and unidentified members of Orthoptera/Mantodea families (Figure 2). Additionally, Reptilia and Mammalia were

identified in a low-frequency (Table 1). A significant part of the diet composition of Lesser Kestrel consists of arachnids (F=37.36%) and insects (F=59.34%) taxa. Diet composition consists of Hymenoptera (Formicidae), Coleoptera (Carabidae) and Orthoptera (Tettigoniidae) taxa, with f=35.16%, f=10.99 % and f=10.44%, respectively. Sunspider remains, which formed a significant part of diet composition were found in 94% (min-max:1-7) of the pellets (Table 1).

Table 1. Diet composition of *Falco naumanni* from Aralık, Iğdır (Eastern Anatolia Region of Turkey), minimum number of individuals (MNI) and Frequency (f%).

Prey taxa	<i>Falco naumanni</i>	
	MNI	f%
<i>Crociodura suaveolens</i>	1	0.55
Mammals total	1	0.55
Solpugidae	64	35.16
Scorpionidae	4	2.20
Arachnids total	68	37.36
Formicidae	64	35.16
Tettigoniidae	19	10.44
Carabidae	20	10.99
Orthoptera/Mantodea	5	2.75
Insects total	108	59.34
Reptile	5	2.75
Reptile total	5	2.75
Total pellet		17
Total prey item		182
Mean number		3.03
prey/pellet		[min-max: 1-20]

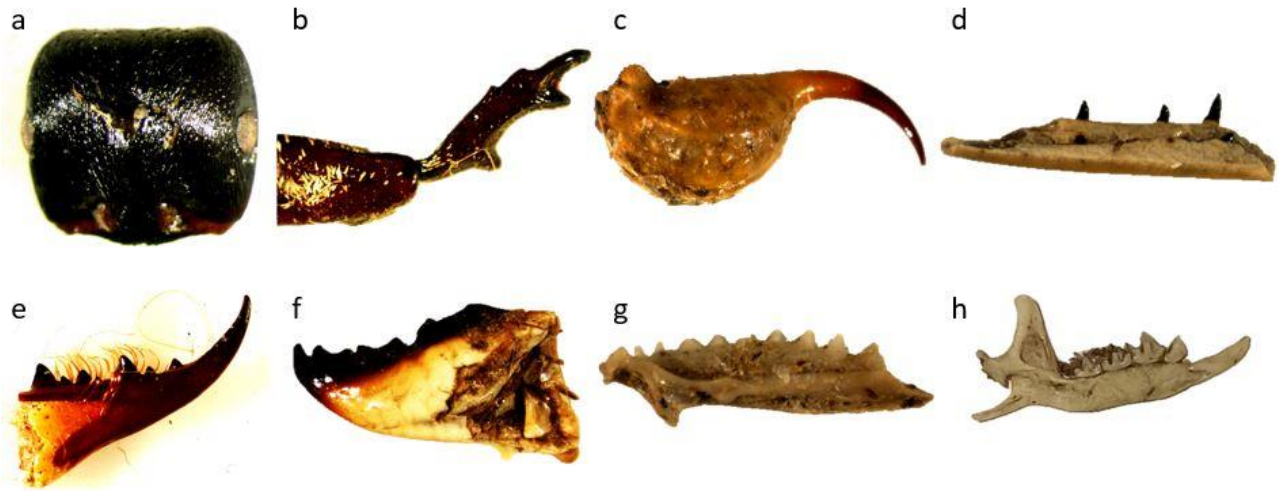


Figure 2. Body parts of preys (a-Formicidae, b-Carabidae, c-Scorpionidae, d-Mantodea/Orthoptera, e-Solpugidae, f-Tettigonidae, g-Reptilia, h-Mammalia)

4. Discussion and conclusion

The species is possibly breeding in the region of the study area (Boyla et al., 2019), but it is the passage migrant species according to observations of this study.

A great number of studies conducted to find out diet composition show that a great part of Lesser Kestrel consists of insects (Lepley et al., 2000; Kok et al., 2000; Khaleghiadeh and Javidkar, 2007; Pérez-Granados, 2010; Rodríguez et al., 2010; Ganbold et al., 2017; Di Maggio et al., 2018). In this study, we determined 108 individuals belonging to three families of Insecta. Besides, it was reported that 5 individuals belonging to Orthoptera or Mantodea family. A total of 108 individuals belonging to these families account for more than half of all preys (59.34%). According to our results, sunspiders were the most hunted group after insects (37.36%). While the members of Orthoptera and Coleoptera are dominant in the breeding and non-breeding European population of Lesser Kestrel, sunspiders' taxa take up a significant part in the diet composition of Israel and African populations (Anderson et al., 1999; Kok et al., 2000; Kopij, 2002). Kopij and Liven-Schulman (2012) reported that sunspiders can be the primary prey in the diet of Lesser Kestrel in arid areas of Southern Palearctic Region. The results of this study show that as in Israel, the diet composition of Lesser Kestrel in arid or semi-arid habitat contains sunspiders (Solpugidae), unlike European population (Table 1). The results of this study contained high amounts of sunspiders as in Israel. In addition, in a study conducted in a semi-desert area in Mongolia, Ganbold et al. (2017) reported that the diet composition could have insect and

reptile taxa rather than sunspiders. We reported a low rate of reptiles (2.75%). These differences could be a result of that the diet composition of Lesser Kestrel, which is an opportunist raptor, can differ according to the habitat type, the intensity of agricultural land, season, breeding, or non-breeding periods (Anderson et al., 1999; Kopij and Liven-Schulman, 2012).

In this study, lizards and small mammal prey rates in the diet composition of Lesser Kestrel were found to be in low levels when compared with insect taxa. Depending on the insect intensity in the habitat of Lesser Kestrel, low rates of reptiles and mammals can increase in the diet (Ganbold et al., 2017). According to Ananian (2009), in a study conducted by Lyaister and Sossin (1942), unlike the present study, small rodents and lizards formed the main prey in the pellets of Lesser Kestrels which were obtained from the same habitat in the present study. In a study in Central Anatolia, Avci (2018) reported the results as taxon levels and reported that a great amount of Coleoptera and Orthoptera, and in small quantities of Solpugidae and other arthropods in the diet content.

In conclusion, diet ecology studies are one of the most important parts of ecology researches of raptors. In Turkey, the feeding ecology of Lesser Kestrel was of poor interest in ornithology studies and there are only two studies in Turkey (Lyaister and Sossin, 1942; Avci, 2018). And also, diet can vary depending on the study area, season, prey intensity in the area and habitats. Since the sample size and the number of potential breeding Lesser Kestrel was small in this study, and only a few other studies have reported similar observations on the diet specialization of birds, this niche is

probably only used by a small percentage of Lesser Kestrel. For these reasons, to better understanding of diet of Lesser Kestrel, more detailed studies are needed in Turkey. Future studies with a larger sample size are needed in order to determine the importance of birds in the diet of the Lesser Kestrel in urban habitats and whether the change in diet affects breeding success.

References

- Ananian, V. (2009). On the distribution and ecology of the lesser kestrel *Falco naumanni* in Armenia. *Sandgrouse*, 31(1), 44-54.
- Anderson, P.C., Kok, O.B., and Erasmus, B.H. (1999). Diet, body mass and condition of lesser kestrels *Falco naumanni* in South Africa. *Ostrich*, 70, 112-116. <https://doi.org/10.1080/00306525.1999.9634523>
- Avcı, S. (2018). Gölbaşı (Ankara) Bölgesi'ndeki küçük kerkenezin (*Falco naumanni*, Fleischer, 1818) üreme başarısı, habitat ve besin tercihleri üzerine araştırmalar. Master's Thesis. Hacettepe University Institute of Science, Ankara.
- Boyla, K.A., Sinav, L., ve Dizdaroğlu D.E. (2019). Türkiye üreyen kuş atlası. İstanbul: WWF-Türkiye, Doğal Hayatı Koruma Vakfı.
- Chinery, M. (1993). *Collins Field Guide to the Insects of Britain and Northern Europe*. London: Collins.
- Cramp, S. (1980). *The Birds of the Western Palearctic*. Vol. 2. Oxford: Oxford University Press. 960 p.
- Di Maggio, R., Campobello, D., and Sarà, M. (2018). Lesser kestrel diet and agricultural intensification in the Mediterranean: an unexpected win-win solution? *Journal for Nature Conservation*, 45, 122-130. <https://doi.org/10.1016/j.jnc.2018.08.009>
- Duffy, D.C., Jackson, S. (1986). Diet studies of seabirds: a review of methods. *Colonial Waterbirds*, 9, 1-17. <https://doi.org/10.2307/1521138>
- Forsman, D. (2016). *Flight Identification of Raptors of Europe, North Africa and the Middle East* (2nd ed.). London: Bloomsbury.
- Ganbold, O., Azua, J., Suuri, B., Paik, I., Khuderchuluun, O., Paek, W.K., and Reading, R.P. (2017). Diet composition of lesser kestrels in Ikh Nart Nature Reserve, Mongolia. *Journal of Asia-Pacific Biodiversity*, 10, 460-464. <https://doi.org/10.1016/j.japb.2017.07.002>
- Iñigo, A., Barov, B. (2011). Action Plan for the Lesser Kestrel *Falco naumanni* in the European Union. SEO-BirdLife, BirdLife International for the European Commission.
- Karaoğlu, M. (2011). Zirai Meteorolojik Açından Iğdır İklim Etüdü. Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi 1(1), 97-104.
- Khaleghizadeh, A., and Javidkar, M. (2007). Past and present population and rodent diet of the lesser kestrel (*Falco naumanni*) in Northern Iran. *Falco*, 29, 12-16.
- Kirwan, G.M., Boyla, K., Castell, P., Demirci, B., Özen, M., Welch, H., and Marlow, T. (2010). *The Birds of Turkey*. London: Christopher Helm.
- Kok, O.B., Kok, A.C., Van, E., and C.A. (2000). Diet of the migrant lesser kestrels *Falco naumanni* in their winter quarters in South Africa. *Acta Ornithologica*, 35, 147-151. <http://dx.doi.org/10.3161/068.035.0207>
- Kopij, G. (2002). Food of the lesser kestrel (*Falco naumanni*) in its winter quarters in South Africa. *The Journal of Raptor Research*, 36, 148-152.
- Kopij, G. (2007). Seasonal and annual dietary changes in lesser kestrels *Falco naumanni* wintering in Lesotho. *Ostrich*, 78, 1-5.
- Kopij, G., Liven-Schulman, I. (2012). Diet of the lesser kestrel, *Falco naumanni*, in Israel: (Aves: Falconiformes). *Zoology in the Middle East* 55(1), 27-34. <https://doi.org/10.1080/09397140.2012.10648914>
- Korotyaev, B.A., Gültekin, L., Volkovitsh, M.G., Dorofeyev, V.I., and Konstantinov, A.S. (2016). Bioindicator beetles and plants in desertified and eroded lands in Turkey. *Journal of Insect Biodiversity*, 4(1), 1-47. <https://doi.org/10.12976/jib/2016.4.1>
- Kryštufek, B., and Vohralik, V. (2001). *Mammals of Turkey and Cyprus*. Order Insectivora (Introduction, Checklist, Insectivora). Koper: Knjiznica Annales Majora.
- Lepley, M., Brun, L., Foucart, A., and Pilard, P. (2000). Régime et comportement alimentaires du falcon crecerellette *Falco naumanni* en crau en période de reproduction et post-reproduction. *Alauda*, 68, 177-184.
- Lyaister, A.F., Sosnin, G.V. (1942). *Materials on the Ornithofauna of the Armenian SSR*. Yerevan, Armenia: Armfan.
- Marti, C. D., Bechard, M., and Jaksic, F. M. (2007). Chapter 8: food habits. Bildstein, K. L., & Bird, D. M. (Ed.), *Raptor research and management techniques* (p. 129-151). China: Hancock House.
- Pérez-Granados, C. (2010). Diet of adult lesser kestrels *Falco naumanni* during the breeding season in Central Spain. *Ardeola*, 57, 443-448.

- Rocha, P.A. (1998). Dieta e comportamento alimentar do peneireiro-de-dorso-liso *Falco naumanni*. *Airo*, 9, 40-47.
- Rodríguez, C. (2004). Factores ambientales relacionados con el éxito reproductivo del cernícalo primilla. Cambio climático e intensificación agraria. Ph.D. dissertation, University of Salamanca, Salamanca, Spain.
- Rodríguez, C., Tapia, L., Kieny, F., and Bustamante, J. (2010). Temporal changes in lesser kestrel *Falco naumanni* Diet during the breeding season in southern Spain. *The Journal of Raptor Research*, 44, 120-128. <https://doi.org/10.3356/JRR-09-34.1>
- Tella, J.L., Hiraldo, F., Donazar-Sancho, J.A., and Negro, J.J. (1996). Costs and benefits of urban nesting in the lesser kestrel: raptors in human landscapes. London: Academic Press.
- Terry, R.C. (2008). Modeling the effects of predation, prey cycling, and time averaging on relative abundance in raptor-generated small mammal death assemblages. *Palaios* 23(6), 402-410. <https://doi.org/10.2110/palo.2007.p07-071r>
- Tez, C. (2000). Taxonomy and Distribution of the white-toothed shrews (*Crocidura*) (*Soricidae*: *Insectivora*: *Mammalia*) of Turkey. *Turkish Journal of Zoology*. 24, 365-374.
- Yalden, D.W. (2009). *The analysis of owl pellets* (4th Ed.) Southampton: Mammal Society, 28 pp.