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Effect of protein, fat and carbohydrate supplemented diets on the growth performance and feeding behavior of Budgerigars (*Melopsittacus undulatus*)

Nargis Naheed[1], Shabana Kalsoom[1], Iqra Mehmood[1], Muhammad Dilawaiz Khan[2], Muhammad Huzaifa Mahmood[2], Rizwana Kiran[1], Komal Abid[1], Mubasher Rauf[3*]

[1]*Department of Zoology, Wildlife & Fisheries, University of Agriculture, Faisalabad, Pakistan*

[2]*Department of Agronomy, University of Agriculture, Faisalabad, Pakistan*

[3]*Department of Pathology, Cholistan University of Veterinary and Animal Sciences Bahawalpur, Pakistan*

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Abstract

Diet plays a vital role in the growth and development of animals, humans and birds. An experiment was designed to study the effect of various diets with varying concentrations to check the feeding behaviour and growth performance of budgerigar's birds. Total twenty budgerigar's birds were bought from bird's market in Faisalabad Pakistan. These birds remained under observation for 150 days in four treatments (T_1, T_2, T_3, T_4) and three supplemented diets (Protein, Fats, and Carbohydrates) were applied. Concentrations of different supplemented diets were different protein (120-130g/day), fat (200-250ul of oil/120-140/day) and carbohydrate (130140g/day) was given after 24hours. Statistical analysis was performed to check the results which showed significant results in the case of carbohydrate and fat supplemented diets while protein supplemented diet showed non-significant results as compared to the control diet.

* **Corresponding Author:** Mubasher Rauf ✉ mubasherrauf@cuvas.edu.pk

Introduction

Birds have great economic and ecological importance in human's life (Peres and Palacios, 2007). Bird's species are used in manufacturing of decoration pieces (Green and Elmberg, 2014). Parrots are important flagship taxa for helpful maintenance in biodiversity. Parrots are members of the order Psittaciformes, which includes more than 350 bird species, including parakeets, macaws, cockatiels and cockatoos, according to the Integrated Taxonomic Information System (ITIS). There are many types of parrots, all parrot species have a few traits in common (Guittar *et al.*, 2009). Parrots are birds because of their intellectual and delicate qualities. Behavior and beautiful shade of feathers makes parrots fascinated for humans (Homberger, 2006; Giret *et al*., 2010). Birds can act as hunters, pollinators, rummagers, seed dispersers and seed killers (Kariuki *et al.,* 2013). Behavior is common between fruit or seed eating birds, insects and mammals (White, 2011). The feeding habits and behaviour of parrots are useful to increase the growth performance (Lindell *et al*., 2012). Many birds can be classified as granivorous species (grain or seed-based diet), for example cockatiels (*Nymphicus hollandicus*) and budgerigars (*Melopsittacus undulatus*) (Westfahl *et al*., 2008). *Melopsittacus undulatus*, commonly known as the budgerigar, is naturally distributed through Australia except for coastal areas in the far East and the far south-west. This species has also been introduced to many areas around the world including S. Africa, Japan, U.S., Switzerland, and New Zealand, however, they have only successfully been established in southwest Florida (Juniper, 2010).

Dietary fibers are the richest source for pluses and carbohydrates in complex form. The pulses contain proteins which exposed by in vitro digestibility (Mansoor and Yusuf, 2002). Natural composition of pulses is rich in proteins and carbohydrates but poor in lipids (Asif *et al.,* 2013). Millet and Sorghum are favored foods while Lovebirds ate Maize (Dodman *et al.,* 2000). Carbohydrates have contained 65-70% of the bird diet because it is the chief basis of energy (Klasing, 2007). Protein content vary in nectar, fruits and seeds: trace amounts of protein present in nectar, 5% crude protein (CP) present in wild fruits and 14% CP present in seeds (Pryor, 2003). Eggs of birds have high levels of sulphur amino acids (Houston *et al.,* 2007). In agricultural lands, birds may offer direct (for pollination of gainful crops) and indirect (seed spreading of plants which help in control of erosion through equilibrium of soil) benefits to agriculturalists (Triplett *et al.,* 2012). In the present study, three different nutrient protein, carbohydrates and fat supplemented di*et al*ong with control food was fed to the budgerigars (*Melopsittacus undulatus*) and checked the behavior pattern like preening, tail flaring, flapping of wings, biting, locomotion on perch, locomotion on cage floor and body weight was observed.

Materials and methods

The research was performed in Community College Laboratory in University of Agriculture, Faisalabad, Pakistan.

Sample collection

Budgerigars (*Melopsittacus undulatus*) was purchased from Bird Market (Jhang Bazar, Faisalabad) to Community College Laboratory in University of Agriculture, Faisalabad. Weight gain (WG) was measured fortnightly and feed efficiency (FE) was determined at the end of the experimental feeding trial. Feeding activities were observed during dawn and dusk while growth of birds was evaluated in each month of the experimental trial. At the end of feeding trial, the birds of all four treatments were taken from each cage respectively; body weight was measured by using a weight balance. Concentration of fats in diet supplements was measured directly by micro-pipette while concentrations of proteins and carbohydrates were determined by weight balance.

Treatments

There was four different treatments and these treatments was replicated into male and female of *Melopsittacus undulates*. These treatments are; T_1= Control diet, T_2= Protein supplemented diet, T_3= Fat supplemented diet and T_4= Carbohydrate

supplemented diet.

Experimental diets

The experimental diets were divided into normal basal diet and supplemented diets. Composition of normal basal diet was shown in Table 1 (Asif *et al.,* 2013). Supplemented diets were divided into protein, carbohydrate and fat supplements. Composition of each supplemented diets is given below. Five protein supplemented diets were formulated per day that shown in Table 2 (Pryor, 2003). Four carbohydrate supplemented diets were formulated per day which shown in Table 3 (Koutsos and Klasing, 2005). Three fat supplemented diets were formulated per day which shown in Table 4 respectively.

Supplemented diets

Protein and carbohydrate supplemented diets were soaked overnight at room temperature, boiled and at last was given in a cage to each bird species while fat supplements mixed in experimental basal diet, were given to bird species in experimental feeding trial of five months.

Experimental feeding trial

Prior to the start of the feeding trial, birds were fed the normal commercial diet for three days to adjust the experimental basal diet. The feeding trial was conducted in a cage of 45(width) ×45(length) ×45(height) centimeters received supplemented diet of 110-160 g/day with two perches of 15cm. Specific temperature conditions provided to the budgerigars was 22 °C at the beginning of the feeding trial and 44 °C at the end of the feeding trial against the normal changes of natural laboratory temperature. Temperature and relative humidity were measured by temperature and relative humidity meter HTC-1. Bird species were randomly distributed to each cage as groups of 8 parrots and fed experimental diets to measured body weight fortnightly for 20 weeks. Total body weight of the birds per cage was determined every fortnight, and the amount of diet fed was adjusted accordingly. The cages were equipped with feeding trays and small water buckets, and cleaned on daily basis.

Statistical analysis

All data were analyzed by two-way ANOVA (Statistix software 8.1 version) to test the effects of the four dietary treatments. When a significant treatment effect was observed, a Least Significant Difference (LSD) test was used to compare means. Treatment effects were considered with the significant level at $P<0.05$.

Results

Preening

Results of the nutrients were significantly different from each other's. Results showed that effect of carbohydrates for preening was maximum as compared to fat and protein in both sex (male & female). Results indicated that carbohydrate effect on preening in male was 14.56 and 14.86 percent in female while fat showed 11.37 in male and 12.11 percent in female. Protein showed minimum results 8.66 in male and 10.24 percent in female.

Table 1. Composition of Fat Normal Basal Diet.

Ingredients	Concentration (g/day)
Foxtail millet (white kangni)	10
Brown corn millet (chinna)	10
Sunflower seeds (soya beans)	10
Barley growers (javi)	10
Pearl millet (bajra)	20
Kurtam	40
Canary feed	10

Tail flaring

Tail flaring results showed significantly different from each other's. Results showed that carbohydrate effect in tail flaring was also maximum as compared to other nutrients. Tail flaring results of carbohydrates was 7.61 in male and 6.64 percent in female while fat showed 5.59 in male and 4.59 percent in female. Protein results in tail flaring was also minimum in male 3.40 and in female 4.38 percent.

Flapping wings

Flapping results of the three nutrients was significantly different from each other's. Results showed that carbohydrates effect on flapping wings was 7.56 in male and 8.92 percent in female. Results

of fat on flapping wings was 4.05 in male and 4.32 percent in female while protein have minimum effect on flapping wings in male 3.96 and 3.73 percent in female.

Table 2. Composition of Protein Supplemented Diet.

Ingredients	Concentration (g/day)
Boiled chickpeas	150
Boiled moong beans	150
Boiled mash beans	140
Pelleted diet	4.78
Hard-boiled egg	3.29

Cage biting

Cage biting results of carbohydrates was observed maximum as compared to protein and fat in males. Results showed that 6.53 percent cag biting was observed in male and 6.64 percent in female when they were fed with carbohydrates. Fat results showed 5.84 percent in male and 7.24 percent in female and protein showed minimum results regarding cage biting 3.11 percent in male and 2.91 percent in female.

Table 3. Composition of Carbohydrate Supplemented Diet.

Ingredients	Concentration (g/day)
Boiled rice	120
Boiled wheat grains	130
Boiled corn grains	120

Locomotion on perch

Carbohydrate results was maximum in locomotion on perch when they fed on carbohydrates as compared to fat and protein. Carbohydrate results showed that 5.89 percent of locomotion on perch was observed in male and 6.19 percent in female. Fat results showed that female locomotion on perch was 6.64 and in male 6.53 percent. Protein results was observed minimum in both sex 3.11 percent in male and 2.91 percent in female.

Locomotion on cage floor

Locomotion on cage floor results showed that carbohydrate effect was maximum as compared to fats and protein. Results showed that 6.12 percent locomotion was observed on male and 5.88 percent in female. Fat showed 4.12 percent in male and 4.20 percent in female while protein results was minimum in male 3.02 percent and female showed 2.92 percent.

Body weight (g)

Results of body weight of *Melopsittacus undulatus* were significantly different from each other's. Results showed that the effect of carbohydrate supplements were higher than protein and fat supplements. Body weight results of carbohydrate supplements were 40g and 38g in male and female. Body weight results of fat supplements were 35g and 32g in male and female, and protein supplements results of body weight were 25g and 27g in male and female.

Table 4. Composition of Fat Supplemented Diet.

Ingredients	Concentration (ul/day)
Coconut oil	200
Olive oil	230
Avocado oil	250

Discussion

Results of our study showed that effect of carbohydrates for preening, tail flaring, flapping wings, cage biting, locomotion on perch and locomotion on floor cages was maximum as compared to fat and protein in both sex (male and female). Results indicated that carbohydrate effect on preening in male was 14.56 and 14.86 percent in female while fat showed 11.37 in male and 12.11 percent in female. Protein showed minimum results 8.66 in male and 10.24 percent in female. Similar findings were also observed in (Hausmann *et al.*, 2003) who performed an experiment on the pigeon bird and check the effects of different supplements. Tail flaring results of carbohydrates was 7.61 in male and 6.64 percent in female while fat showed 5.59 in male and 4.59 percent in female. Protein results in tail flaring was also minimum in male 3.40 and in female 4.38 percent. Results were not similar to the (Tripet *et al.*, 2002) whose studies were on the different supplements and fat showed better results as compared to the other supplements. Flapping

results of the three nutrients was significantly different from each other's. Results showed that carbohydrates effect on flapping wings was 7.56 in male and 8.92 percent in female. Results of fat on flapping wings was 4.05 in male and 4.32 percent in female while protein have minimum effect on flapping wings in male 3.96 and 3.73 percent in female. Ornborg *et al.* (2002) suggested, on the basis of their personal observations, that dirt and fat something confirmed by our results with budgerigars.

Together these two studies suggest that feather condition (Ornborg *et al.*, 2002) and preening (this study) influence plumage. Male budgerigars spend about 10% of their time preening in captivity (authors' unpublished observations).

Table 5. Statistical analysis.

Treatments	Sex	Preening %	Tail flaring %	Flapping wings %	Cage biting %	Locomotion on perch %	Locomotion on cage floor %	Weight (g)
Carbohydrates	Male	14.54±0.01	7.61±0.06	7.56±0.04	5.84±0.03	5.89±0.04	6.12±0.04	40
	Female	14.86±0.04	6.64±0.07	8.92±003	7.24±0.03	6.19±005	5.88±0.03	38
Protein	Male	8.66±0.10	3.40±0.01	3.96±0.01	3.11±0.02	3.27±002	3.02±0.01	25
	Female	10.24±0.15	4.38±0.02	3.73±0.02	2.91±0.01	3.02±0.03	2.92±0.01	27
Fat	Male	11.37±0.04	5.59±0.03	4.05±0.05	6.53±0.03	5.76±0.02	4.12±0.03	35
	Female	12.11±0.05	5.49±0.02	4.32±0.02	6.64±0.05	5.72±0.03	4.20±0.02	32

This figure is in the range reported for other bird species (Cotgreave and Clayton, 1994). Preening behaviour, as an important part of the daily time-budget, may therefore represent a cost if it reduces the time available for other activities. Indeed, great tits (*P. major*) experimentally infested with the hen flea (*Ceratophyllus gallinae*) reduced their sleeping time significantly so as to engage in nest sanitation behaviour (Christe *et al.*, 1996). During the breeding season, when time budgets are tight, birds may not be able to increase their preening time (Tripet *et al.*, 2002). Further investigation is necessary to confirm the generality of the link between the supplements and their effectiveness on the budgerigar's species.

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