Acta Agraria Kaposváriensis (1999) Vol 3 No 1, 35-40
Pannon Agrártudományi Egyetem, Állattenyésztési Kar, Kaposvár
Pannon University of Agriculture, Faculty of Animal Science, Kaposvár

Comparative study on the energy utilization of pigeons, guinea-fowls and broiler chicks

K. Dublecz, L. Vincze, I. Meleg[1], L. Wágner, L. Pál, Á. Bartos
Pannon University of Agriculture, Georgikon Faculty, Department of Animal Nutrition
Keszthely, H-8361 Deák F. u. 16.
[1]Pannon University of Agriculture, Faculty of Animal Science, Department of Poultry Science
Kaposvár, H-7400 Guba S. u. 40.

ABSTRACT

Experiments were conducted to compare the energy utilization of pigeons, guinea-fowls and domestic chickens (n=5 birds per treatment). After 48 h starvation birds were force fed by the experimental diets and excreta were collected during the following 48 h. Endogenous energy losses (EEL) were determined using fasted animals. Different species excreted different (P<0.001) amounts of EEL, which was the lowest for pigeons and the highest for broiler chicks. Nitrogen correction of EEL (EELn) reduced the differences between pigeons and guinea-fowls but the value for broilers remained significantly (P<0.001) higher. The same tendency was found when the endogenous energy excretion of birds on body weight basis were compared. Apparent and true metabolizable energy values, corrected to zero nitrogen balance (AMEn and TMEn) of experimental diets were significantly higher (P<0.001) when they were determined with pigeons. No consistent differences in the energy utilization between chicks and guinea-fowls were obtained.
(Keywords: energy, utilization, pigeon, guinea-fowl, chicken)

ÖSSZEFOGLALÁS

A galamb, a gyöngytyúk és a brojlercsirke energiaértékesítésének összehasonlító vizsgálata

Dublecz K., Vincze L., Meleg[1] I., Wágner L., Pál L. Bartos Á.
Pannon Agrártudományi Egyetem, Georgikon Mezőgazdaságtudományi Kar, Takarmányozástani Tanszék
Keszthely, 8361 Deák F. u. 16.
[1]Pannon Agrártudományi Egyetem, Állattenyésztési Kar, Baromfitenyésztési Tanszék
Kaposvár, 7400 Guba S. u. 40.

Az elvégzett kísérletek a galamb, a gyöngytyúk és a brojlercsirke energiaértékesítésének összehasonlítására irányultak (n=5 állat/kezelés). A kísérleti tápok kényszeretetésére az állatok 48 órás éheztetését követően került sor, majd az ürüléket az ezt követő 48 óra során gyűjtöttük. Az endogén energiaürítés (EEL) mérése éheztetett állatokkal történt. A vizsgált fajok EEL ürítése szignifikánsan (P<0,001) különbözött. A legkisebb értéket a galamb, míg a legnagyobbat a brojlercsirke esetében kaptuk. Az EEL nitrogén-korrekciója (EELn) csökkentette a galamb és a gyöngytyúk közötti különbséget, de a brojlercsirkére vonatkozó érték ez esetben is szignifikánsan (P<0.001) nagyobb volt. Az *endogén energiaürítés egységnyi testtömegre vonatkozó értékei hasonló tendencia szerint alakultak. A kísérleti tápok zéró nitrogén retencióra korrigált látszólagos (AMEn) és tényleges (TMEn) metabolizálható energiatartalma szignifikánsan (P<0,001) nagyobb volt ha a mérés galambokkal történt. A csirkék és gyöngytyúkok energiaértékesítése között nem tapasztaltunk számottevő különbséget.*

(Kulcsszavak: energia, hasznosítás, galamb, gyöngyös, csirke)

INTRODUCTION

Diets for all classes of poultry are usually formulated by using metabolizable energy (ME) values determined with the domestic chicken. This practice is open to criticism, since some researchers have reported differences in energy utilization between different species of birds.

Chicken obtain more AME from high-energy diets and less from low-energy diets than turkeys (*Slinger et al.,* 1964). *Leeson et al.* (1974) reported also that fibrous, low-energy diets are usually better utilized by turkeys than chicks. *Mutzar et al.* (1977) suggested that ducks have greater ability to digest cellulose than chicks. Significant differences were also found between ducks and chickens in the ME utilization of several diets (*Siregar and Farrel,* 1980). On the other hand *Mohamed et al.* (1984) found no significant differences in the ME-values obtained for Muscovy ducklings and domestic chickens.

A comparison involving chickens and Japanese quail failed to prove significant differences in diet AME values (*Begin,* 1968). Only few interspecies comparisons have been made among other bird species. Our experiments were designed to compare the ME values of various diets in pigeons, guinea-fowls and domestic chickens.

MATERIALS AND METHODS

Adult male pigeons, guinea-fowls and 6 week old broiler chicks were kept in individual cages(n=5 birds/treatment). Commercial samples of maize, wheat or extracted soybean meal were introduced into a nitrogen free diet B (*Table 1*) Apparent and true metabolizable energy values, corrected to zero nitrogen balance (AMEn, TMEn) of the basal diet (B) and experimental diets (S,M,W) were determined according to the wet force-feeding method as described by *Teeter et al.* (1984). Diets were finally ground and mixed with water until a homogenous mixture was obtained. The feed:water ratio was 100:75, 100:70, 100:90 and 100:90 respectively for wheat, maize, soybean meal and N - free diet. Known amounts of N-free diet were poured into the crop of animals, while the force feeding of the three other diets was performed by a feeding pump. Birds were fasted before and after force feeding for 48 h. Excreta were collected during the second 48 h period in nylon bags which were stuck around the cloaca.

Endogenous energy losses (EEL) were determined using fasted animals. Birds were fasted for 4 days in this case and endogenous excreta were collected during the last 2 days. From the feed and dried excreta samples dry matter, nitrogen and gross energy contents were determined.

In each experiment 5 birds were used and the effects of different treatments were compared with one way (endogenous energy losses) or two way (species and diets) analysis of variance (Statgraphics version 5.0, 1991). When significant differences were found, means were separated by Duncan's multiple range test.

Table 1

Composition of experimental diets (g/kg)

Ingredients(1)	B (basal)(2)	S (soybean)(3)	M (maize)(4)	W (wheat)(5)
Maize starch(6)	840	440	240	340
Sunflower oil(7)	100	100	100	100
Cellulose(8)	40	40	40	40
Wheat(9)	-	-	-	500
Extracted soybean meal(10)	-	400	-	-
Maize (11)	-	-	600	-
Mineral and vitamin premix(12)	20	20	20	20

1. táblázat: A kísérleti tápok összetétele (g/kg)

Összetevők(1), Alaptakarmány(2), "S" szójadarát tartalmazó táp(3), "M" kukoricát tartalmazó táp(4), "W" búzát tartalmazó táp(5), Kukorica keményítő(6), Napraforgó olaj(7), Cellulóz(8), Búza(9), Extrahált szójadara(10), Kukorica(11), Ásványi és vitamin premix(12)

RESULTS

Different species excreted significantly (P<0.001) different amounts of EEL during the 48 h long collection period (*Table 2*). Nitrogen correction reduced EEL by a different manner but still the EELn value of chicks remained significantly (P<0.001) higher. The observed differences could only partly be attributed to the differences in body weights. When the EEL and EELn values, which based on the same body weight, were compared no significant difference was found between the values of pigeons and guinea-fowls. However, broiler chicks excreted also on this basis about two times more energy than pigeons and guinea-fowls.

Table 2

Endogenous energy excretion of pigeons, guinea-fowls and broiler chicks

	Pigeon(1)	Guinea-fowl(2)	Chicken(3)
Body weight (kg)(4)	0.47±0.026[a]	1.31±0.052[b]	1.40±0.029[b]
EEL/48 h (KJ)(5)	8.62±1.84[a]	26.23±2.28[b]	58.27±8.78[c]
EELn/48 h (KJ)(6)	4.48±0.96[a]	7.33±0.69[a]	23.68±6.40[b]
EEL/kg body weight (KJ/kg)(7)	19.86±5.04[a]	20.07±1.82[a]	41.87±6.61[b]

Values represent Mean±S.D. (*Az értékek az átlagot és az átlag szórását jelölik.)* Averages with different superscripts within the same row differ significantly (P<0.001). (*Az eltérő indexel jelölt azonos sorban lévő átlagok szignifikánsan különböznek.)*

2. táblázat: A galamb, a gyögytyúk és a brojlercsirke endogén energiaürítése

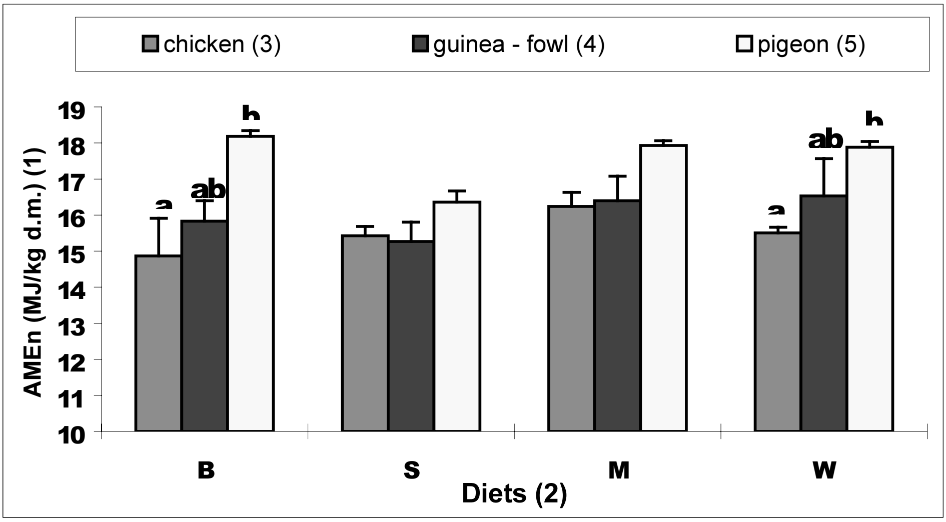
Galamb(1), Gyöngytyúk(2), Csirke(3), Testtömeg(4), 48 órás endogén energiaürítés(5), 48 órás nitrogén korrekciós endogén energia ürítés(6), Egységnyi testtömegre vonatkozó endogén energia ürítés(7)

Both species and diets had significant effects on the measured AMEn and TMEn. In the average of the diets AMEn for pigeons (17.52±0.20 MJ/kg DM) exceeded significantly (P<0.001) those for guinea-fowls (15.98±0.34 MJ/kg DM) and broiler chicks (15.52±0.29 MJ/kg DM). The same tendency was found when the TMEn content of diets were compared (17.67±0.20; 16.13±0.34 and 16.43±0.29 MJ/kg DM for pigeons, guinea-fowls and chicks respectively).

Comparing the AMEn contents of the individual diets the highest values were observed in all cases for pigeons. Although pigeons metabolized substantially higher ME of each individual diet than chickens and guinea-fowls, significant differences (P<0.001) were found only between the AMEn values of the basal and wheat containing diets (*Fig. 1*) and between the TMEn values of the basal diet when they were measured with chickens and pigeons (*Fig. 2*).

Figure 1

AMEn values of experimental diets



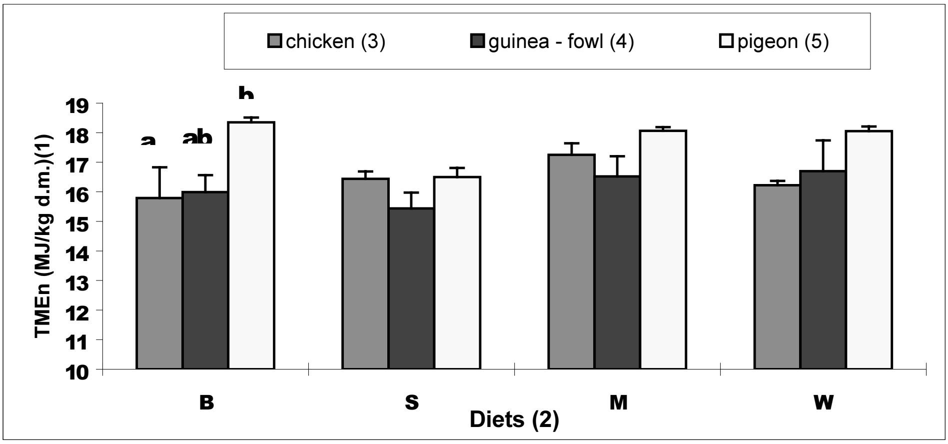
Columns represent Mean±S.D. (*Az oszlopok az átlagok és a hozzájuk tartozó szórás értéket jelölik.*) Values with different letters differ significantly (P<0.001). (*Az eltérő betűvel jelölt értékek szignifikánsan különböznek.*)

1. ábra: A kísérleti tápok AMEn tartalma

AMEn (MJ/kg sz.a.)(1), Tápok(2), Csirke(3), Gyöngytyúk(4), Galamb(5)

Figure 2

TMEn values of experimental diets



Columns represent Mean±S.D. (*Az oszlopok az átlagokat és a hozzájuk tartozó szórás értékeket jelölik.*) Values with different letters differ significantly (P<0.001). (*Az eltérő betűvel jelzett átlagok szignifikánsan különböznek.*)

2. ábra: A kísérleti tápok TMEn tartalma

TMEn (MJ/kg sz.a.)(1), Tápok(2), Csirke(3), Gyöngytyúk(4), Galamb(5)

DISCUSSION

The wet force feeding method proved to be suitable for the comparison of the energy utilization of chickens, guinea-fowls and pigeons. The main advantages of the procedure were it's accuracy, rapidity, furthermore did not require special cages for different bird species. However, because of the low food intake, the amount of excreta was small and consequently the proportion of endogenous losses became important. Therefore after correction with EELn, TMEn values should be derived with this method.

The EEL of pigeons and guinea-fowls were significantly lower than that of chicks. Therefore only slight differences were found between the AMEn and TMEn values of pigeons and guinea-fowls, while substantial differences exist between the AMEn and TMEn of chickens. It is hypothesised that greater feed consumption of broiler chicks may be responsible for their higher EEL, which have a depressing effect on the ability to metabolize dietary energy.

Pigeons utilized the ME values of experimental diets better than the two other species, irrespective of the composition of the diets. This result supports several previous reports (*Fisher and Shannon*, 1973, *Leeson et al.,* 1974, *Coates et al.,* 1977, *Siregar and Farrel,* 1980, *Vincze et al.,* 1994) that birds of different species are able to utilize different amounts of the total energy of the diet. Metabolic or digestive processes may be responsible for this. So further investigations needed on the digestibility of fats, protein, amino acids, carbohydrates and crude fibre among avian species. In this case ME values for each species could be derived from single standard determinations, that obtained with the chick, using correction factors based on the differences in nutrient digestibilities.

This work indicate the importance of determining species-specific differences in ME values of poultry feeds, which can improve the efficiency of nutrition.

ACKNOWLEDGEMENTS

The work was supported by a grant from the Hungarian Scientific Research Fund (OTKA). Project No.F022788.

REFERENCES

Begin, J.J. (1968). A comparison of the ability of the Japanese quail and light breed chicken to metabolize and utilize energy. Poult. Sci., 47. 1278-1281.

Coates, B.J., Slinger, S.J., Ashton, G.C. Bayley, H.S. (1977). The relation of metabolizable energy values to chemical composition of wheat and barley for chicks, turkeys and roosters. Can. J. Anim. Sci., 57. 209-219.

Fisher, C., Shannon, D.W.F. (1973). Metabolizable energy determinations using chicks and turkeys. Br. Poult. Sci., 14. 609-613.

Leesons, S., Boorman, K.N., Lewis, D. (1974). Metabolizable energy studies with turkeys: metabolizable energy of dietary ingredients. Br. Poult. Sci., 15. 183-189.

Mohamed, K., Leclercq, B., Anwar, A., El-Alaily, H., Soliman, H. (1984). A comparative study of metabolizable energy in ducklings and domestic chicks. Animal Feed Sci. and Techn., 11. 199-209.

Mutzar, A.J., Slinger, S.J., Burton, J.H. (1977). Metabolizable energy content of fresh plants in chickens and ducks. Poult. Sci., 56. 1893-1899.

Slinger, S.J., Sibbald, I.R., Pepper, W.F. (1964). The relative abilities of two breeds of chickens and two varieties of turkeys to metabolize dietary energy and dietary nitrogen. Poult. Sci., 43. 323-333.

Siregar, A.P., Farrel, D.J. (1980). A comparison of the energy and nitrogen metabolism of fed ducklings and chickens. Br. Poult. Sci., 21. 213-227.

Statgraphics Version 5.0 (1991). Statistical Graphics Corporation, Rockville, MD, USA.

Teeter, R.G., Smith, M.O., Murray, E. (1984). Force feeding methodology and equipment for poultry. Poult. Sci., 63. 573-575.

Vincze L., Jakab E., Szűts G., Dublecz K. Wágner L. (1994). The metabolizable energy content of poultry and pheasant diets. Proc. IXth European Poultry Conference. Glasgow, I. 535-536.

Corresponding author (*levelezési cím*):

Károly Dublecz
Pannon University of Agriculture, Georgikon Faculty, Department of Animal Nutrition,
H-8361 Keszthely, Deák F. u. 16.
Pannon Agrártudományi Egyetem, Georgikon Mezőgazdaságtudományi Kar,
Takarmányozástani Tanszék,
8361 Keszthely, Deák F. u. 16.
Tel.: 36-83-312-330, Fax: 36-83-315-105
e-mail: DUB10783@ella.hu