

EFFECT OF GRADED LEVEL OF FAT SUPPLEMENTATION ON THE GROWTH PERFORMANCE IN THE RABBITS

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Abstract: Fifty Soviet Chinchilla kits (28 d old) were fed diets supplemented with 0,2,4,6 and 8 % palmolein oil up to 84th day of age. Live weight gain and feed conversion ratio (FCR) increased linearly and significantly ($P<0.05$) with fat supplementation. Highest body weight and best feed conversion ratio was recorded (2287 g and 2.98) with 8 % fat supplementation. Per cent increases in daily gain and FCR were 4.04 and 0.98 with each per cent addition of palmolein oil. Significant ($P<0.05$) improvement was observed for digestibility of crude protein, ether extract whereas the digestibility of crude fibre decreased with fat supplementation. Carcass composition of rabbit revealed no change with palmolein oil supplementation. Cost: benefit ratio was highest (0.33) with 2 % fat supplementation.

Key words: Fat supplementation, rabbits, cost/benefit ratio.

INTRODUCTION

Energy concentration is one of the main variables in the formulation of diet for growing/ fattening rabbits. During the growth period rabbits can grow well on a wide range of dietary fibre level. (DE BLAS *et al.*, 1986) The range of fibre and energy level can be extended by means of fat supplementation to the diet allowing either an increase in the fibre level or a rise in the energy concentration of the low fibre diets. ARRINGTON *et al.* (1974) showed an improvement in both live weight gain and feed conversion ratio (FCR) by fat supplementation while others (LEBAS, 1979; CORREGAL and EIKO, 1983) reported no significant effect. TELEKI and DARWISH (1970) reported higher digestibility

coefficients by fat supplementation while LEBAS (1979) reported no improvement. SANTOMA *et al.* (1987) reported decreased feed intake, improved energy intake and feed conversion ratio but no effect on growth rate in rabbits fed fat supplemented diet. The difference in performance may be due to different fat sources and levels, fibre types or level and production potential of the rabbit (SANTOMA *et al.*, 1987). SANZ *et al.* (1996) reported improvement in the digestibility of dry matter (DM) and ether extract (EE) with fat supplementation (soya bean lecithin and lard) in growing finishing rabbit. MAERTENS (1998) reviewed that growth rate of fryers is commonly not influenced by dietary fat addition but, due to the increased energy density, a more favourable feed efficiency is obtained. The present experiment was designed to find out an optimum level of fat supplementation in the rabbit diet by considering the cost: benefit ratio.

MATERIALS AND METHODS

Fifty Soviet Chinchilla kits (28d old) were divided into five groups with equal sex ratio (5 M+5 F). They were fed five experimental diets in mash form prepared by adding palmolein oil to the control diet at 0,2,4,6 or 8% level. Palmolein is a vegetable oil extracted from the fleshy covering of palm trees (*Elaeis Guinness*). The composition of the control (F₁) diet was white clover hay 28, maize 25, soyaflakes extruded 15, sunflower cake 5, groundnut cake 5, fish meal 5, rice bran 10, molasses 5, common salt 1 and mineral + vitamin mixture 1 % respectively. Rabbits were kept in individual cages and offered *ad lib* feed and water for an experimental period of 56 days .The experiment was conducted during the month of June - July having an average minimum temperature 22.9°C, maximum-30.6°C, relative humidity 62.6-75%; this period was comparatively warmer than other seasons of the year. Weekly body weight and daily feed intake were recorded. Cost of diet (Rs/Kg) was calculated as per prevailing market rates of the ingredients and it increased with the level of fat supplementation. At the end of the feeding trial, a digestibility trial was conducted on 25 animals, with 5 animals in each group, for a period of 5 days. Feed, faeces, and carcass samples were analysed for proximate principles, calcium (AOAC, 1990), phosphorus (GUPTA *et al.*, 1992) and fibre fractions (GOERING and VAN SOEST, 1984). All the rabbits were slaughtered at 84

days after 12 hours of fasting to assess dressing percentage, including hot carcass plus organs, excluding lungs, the entire viscera, and offals. Carcass samples used for proximate analysis were collected from thigh muscles. The cost: benefit ratio was calculated by considering the cost of kit, medicine, feed, management, dressed meat and skin. Data was analysed using randomised block design (SNEDECOR and COCHRAN, 1967).

Chemical composition of the experimental diets are in Table 1, ether extract level changes from 1.64-9.73 % due to palmolein oil supplementation. Among fibre fractions ADF, NDF, cellulose (ADF-AD lignin) and hemicellulose varied in fat supplementation.

Table 1: Chemical composition and cost of experimental diets (dry matter basis).

Nutrient	F ₁	F ₂	F ₃	F ₄	F ₅
Dry matter	92.96	93.40	94.38	93.01	94.00
Crude protein	20.50	20.51	20.74	20.35	20.81
Crude fiber	12.29	12.07	12.55	12.83	12.04
Ether extract	1.64	3.70	5.66	7.53	9.73
Ash	9.68	9.16	9.51	9.07	9.52
Calcium	1.10	1.22	1.21	1.23	1.33
Phosphorus	0.34	0.21	0.25	0.25	0.22
NDF	41.25	36.44	33.77	32.15	31.90
ADF	21.22	20.34	18.19	17.29	16.75
Cellulose	14.45	13.72	11.75	10.96	10.53
Cost of diet (Rs/kg)	5.67	6.25	6.83	7.41	7.99

NDF: Neutro detergent fiber, ADF: Acid detergent fibre. Rs: Rupees.

RESULTS AND DISCUSSION

Body weight at 84 days (Table 2) varied from 1926 g in F₁ to 2287 g in F₅ diet and was significantly ($P < 0.05$) higher in test groups as compared to the control group (F₁).

Average daily gain was 26.6 g in the control (F₁) diet, and increased linearly with each level of added fat. Additionally, in F₅ it was 33.2g. Percent increase in weight gain was 10.9, 15.41, 22.55 and 24.81 % in F₂, F₃, F₄ and F₅ diets respectively in relation to control (F₁). A regression equation was developed for per cent growth as the dependent variable (Y) and % fat as an independent variable (X).

$$Y = 2.44X + 6.22 \quad (n=50, R^2 = +0.30, P < 0.01)$$

With every percentage increase in fat supplementation, the live weight gain improved by 8.66%. The increase in weight gain with fat addition was due to an increase in the energy concentration of the diet which increased protein and fat utilization in the test diet (Table 3). FERNANDEZ and FRAGA (1996) reported a non-significant influence on the growth of fast growing rabbits, whereas ARRINGTON *et al.* (1974) reported improvement in weight gain in a rabbit breed (Dutch) showing slow growth. Fat supplementation resulted in better growth in a hot environment due to a higher energy intake in fat added diet (CERVERA *et al.*, 1997). This experiment was also conducted during the hot period of the year (June-July), and it might be the reason for better growth. Non-significant differences were observed for daily feed intake in different groups which is in contrary to the observations of FERNANDEZ and FRAGA (1996) who reported a decrease in feed

Table 2: Growth performance of broiler rabbit with diets containing different fat level.

	F ₁	F ₂	F ₃	F ₄	F ₅
Initial body weight (g)	433.00	431.00	431.00	431.00	429.00
Final body weight (g)	1926 ^a	2080 ^b	2150 ^b	2257 ^c	2287 ^c
Daily gain (g)	26.6 ^a	29.5 ^b	30.7 ^b	32.6 ^c	33.2 ^c
Daily feed intake (g)	98.60	98.70	101.00	102.10	99.20
Feed conversion ratio (FCR)	3.70 ^a	3.35 ^b	3.29 ^b	3.19 ^b	2.98 ^c
Per cent improvement					
Weight gain / unit fat	-	5.45	3.85	3.76	3.10
FCR / unit fat	-	4.73	2.77	2.30	2.43

Means in the same row with different superscripts differ significantly. $P < 0.05$.

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intake, and an improvement in the feed conversion ratio but no effect on the growth rate with fat supplementation. However, CASTELLINI and BATTAGLINI (1991) observed higher live weight (3.2%) at the time of mating for those given a fat added diet than for those given a diet with a lower energy level. In contrast to the present observation, they observed a decrease in feed intake by 2.6% for each percentage increase in ether extract. The feed conversion ratio improved from 3.70 ± 0.04 in F_1 to 2.98 ± 0.01 in F_5 , and was significantly ($P < 0.05$) higher in test groups as compared to the control. The regression equation developed for FCR as a dependent variable (Y) and for the fat level as an independent variable (X) was:

$$Y = -0.08X + 3.62 \quad (n=50, R^2 = +0.21, P < 0.01)$$

MAERTENS (1998) concluded that fats are a real alternative for increasing the dietary energy content and favour feed conversion. Improvement in weight gain and the feed conversion ratio was higher at a lower level of fat supplementation but it decreased at higher levels of supplementation. This might be due to the optimum ratio

Table 3: Digestibility, carcass traits and composition in rabbit fed diets containing different fat level.

Parameters	F ₁	F ₂	F ₃	F ₄	F ₅
Dry matter	64.10	63.90	65.50	68.20	64.30
Crude protein	75.1 ^a	77.0 ^{ab}	77.4 ^b	78.1 ^b	78.1 ^b
Crude fibre	23.1 ^a	17.2 ^b	16.0 ^b	15.4 ^b	14.2 ^b
Ether extract	62.0 ^a	75.4 ^b	80.0 ^c	80.2 ^c	82.5 ^c
Carcass traits and composition (On DM basis)					
Dressing percentage	50.70	52.70	52.00	51.40	50.20
Dry matter	26.50	27.20	26.90	26.20	26.90
Crude protein	89.80	88.20	89.60	89.30	88.80
Ether extract	3.47	3.64	3.12	3.09	3.49
Total ash	4.57	5.18	5.54	5.19	5.28

Means in the same row with different superscripts differ significantly. $P < 0.05$.

of fat with other nutrients at lower levels which achieve maximum efficiency of energy utilization. Higher feed conversion in different treatments was due to the improved digestibility of crude protein CP and EE in the corresponding groups. KING (1981) found higher gains and feed efficiency when 5-8 % vegetable oil was added to a commercial diet.

Digestibility of nutrients (Table 3) indicated significant ($P<0.05$) influence of fat on the digestibility of organic nutrients except dry matter. Digestibility of CP was 75.1 % in F_1 . It increased with fat supplementation to 78.06 % in F_5 and, with the exception of F_2 , it was significantly higher ($P<0.05$) in test groups than in the control group. A similar observation was also reported by SANTOMA *et al.* (1987). Crude fibre digestibility was highest in F_1 (23.09%) and lowest in F_5 (14.18%), which decreased with fat supplementation. SANTOMA *et al.* (1987) reported no effect of fat supplementation on fibre digestibility, however, FORTUN-LAMOTHE (1997) reported that the effect of fat inclusion in the digestibility of fibre was not clear. Digestibility of ether extract improved significantly ($P<0.05$) with fat supplementation, being the lowest in F_1 (62.01%) and the highest in F_5 (82.54%). FERNANDEZ *et al.* (1994) reported that added fat has a synergistic

Table 4: Cost: Benefit ratio of different experimental diets.

Parameters	F_1	F_2	F_3	F_4	F_5
Cost of weaner rabbits (Rs)	10.00	10.00	10.00	10.00	10.00
Cost of feed (Rs)	31.30	34.50	38.60	42.40	44.40
Cost of medicine (Rs)	1.00	1.00	1.00	1.00	1.00
Work management cost (Rs)	13.00	13.00	13.00	13.00	13.00
Total input (Rs)	55.30	58.30	62.60	66.40	68.40
Cost of meat (Rs per Kg)	58.60	75.73	67.10	69.56	68.92
Cost of skin (Rs)	12.00	12.00	12.00	12.00	12.00
Total output (Rs)	70.60	77.73	79.10	81.56	80.92
Cost: benefit ratio	0.27	0.33	0.26	0.23	0.18

Rs: Rupees.

effect on the digestibility of dietary fat fractions, and the effect is less pronounced with dietary protein and fibre fractions. SANTOMA *et al.* (1987) and FORTUN- LAMOTHE (1997) also discussed similar results for fat digestibility.

Dressing percentage and carcass composition revealed non-significant differences among groups. The carcass composition data are in agreement with that of KULKARNI *et al.* (1995), who reported 26.48 % DM, 21.52 % CP and 1.43 % EE in fresh carcasses of soviet chinchilla rabbits. In contrast to our observation, MAERTENS (1998) reported higher fat in carcasses with fat supplementation.

Cost: benefit ratio (Table 4) indicated higher input with fat supplementation. A similar trend was also observed with output. Cost: benefit ratio was highest in F₂ (0.33) and thereafter it deteriorated due to a higher input. These findings suggest that fat supplementation improved weight gain and feed efficiency in broiler rabbit by improving digestibility of protein and fat, whereas fibre digestibility was reduced. Considering the cost: benefit ratio, 2% supplementation of vegetable oil (palmolein) was found to be optimum in the diet of weaner broiler rabbit.

REFERENCES

- ARRINGTON L.R., PLATT J.K. AND FRANKE D.E. 1974. Fat utilization by rabbits. *J. Anim. Sci.*, 38: 76-80.
- AOAC. 1990. *Official methods of Analysis* 15th Edn. Vol 2 Association of analytical chemists, Washington, DC.
- CERVERA C., BLAS E., FERNANDEZ-CARMONA J. 1997. Growth of rabbits under different environmental temperatures using high fat diets. *World Rabbit Sci.*; 5:71-75.
- CORREGAL R.D., EIKO. 1983. Effect of the addition of vegetable oil to diets for growing rabbits. *Revista latino-americana de cunicultura* 1: 17-20.
- CASTELLEN, C. BATTAGLINI M. 1991. Influenza della concentrazione energetica della razione ed il ritmo riproduttivo sulle performance delle conigelle. *Atti IX Congr. Naz. ASPA*, 477-488.
- DE BLAS J.C., SANTOMA G., CARABANO R., FRAGA M.G. 1986. Fibre and starch levels in fattening rabbit diets. *J. Anim. Sci.*, 63:1897-1904.
- FERNANDEZ C. FRAGA M.J. 1996. The effect of dietary fat inclusion on growth carcass characteristics and chemical composition of rabbits. *J. Anim. Sci.*,

- 74: 2088-2094
- FERNANDEZ C., COBOS A., FRAGA M.J. 1994. The effect of fat inclusion on diet digestibility in growing rabbits *J. Anim. Sci.* 72: 1508-1515.
- FORTUN-LAMOTHE L. 1997. Effect of dietary fat on reproductive performance of rabbit does: A Review. *World Rabbit Sci.*, 5: 33-38
- GOERING H.K., VAN SOEST P.J. 1984. *Forage Fibre Analysis*. Agriculture handbook n° 379. USA, ARS Washington, DC.
- GUPTA P.C., KHATTA V.K., MANDAL A.B. 1992. *Analytical Techniques in Animal Nutrition*. CCS HAU, Hissar India.
- KING J.O.L. 1981. Fat levels in rabbit diets. *Br. Vet. J.*, 137: 203-208
- KULKARNI V.B., GUPTA K., BHATT R., MANUJA N.K. 1995. Carcass traits and meat composition of broiler rabbits. *Indian J. Anim Sci.*, 65: 599-601.
- LEBAS F. 1979. Nutrition et alimentation du lapin: les besoins. *Cuniculture* 6: 159-160, 207-208.
- NRC. 1977. National Research Council. *Nutrient Requirement of Rabbits*. National Academy of Science, Washington, DC.
- MAERTENS L. 1998. Fat in rabbit nutrition: A Review. *World rabbit Sci.* 6: 341-348.
- SANTOMA G., DE BLAS J.C., CARABAÑO R.M., FRAGA M.J. 1987. Effects of different fats and their inclusion level in diet for growing rabbit. *Anim. Prod.*, 45: 291-300.
- SANZ E., TORRES L., FONZ J. 1996. Effect of soya bean lecithin and the amount of fat on the digestibility of fat in growing finishing rabbits. *Nut. Abstr. Rev.*, 66: 4 (Abstr. No. 1833).
- SNEDECOR G.W., COCHRAN W.G. 1967. *Statistical Methods*. 6th Ed. Oxford and IBH Publishing Co. Calcutta.
- TELEKI M., DARWISH A.M. 1970. The effect of dietary fat on energy and protein utilization of rabbits. *Acta Agronomica, Academical Scientiarum Hungaricae*, 18: 93-98.
- XICCATO G. 1998. Fat Digestion. *The Nutrition of the Rabbit*. Editors C. de Blas and J. Wiseman CAB International.