

DIFFERENT TIMES OF SUPPLYING A DIET RICH IN FISH OIL IN FATTENING RABBITS AND HIS IMPLICATION ON MEAT QUALITY

LAMANNA ML*, COSSU ME, PICALLO A, GAMBETTI P. AND TORASSO P.

Departamento de Producción Animal, Facultad de Agronomía, Universidad de Buenos Aires. Av. San Martín 4453. CABA. Bs.As. Argentina.

*Corresponding author: lamanna@agro.uba.ar

ABSTRACT

Rabbits allow through changes in diet, get changes in the lipid profile of meat. Different strategies are used to achieve an improvement in the content of omega 3 fatty acids and the omega-6/3 ratio (use of flax, chia, fish oil) modifying its physical, chemical and sensory quality. The aim of this study was to evaluate sensory and physical quality of rabbit loin using different periods of supplying a diet with fish oil to modify the lipid profile. Thirty (30) rabbits (NZxC,45 days age) were bred for 30 days (10 animals/treatment). Two diets were used, commercial feed and the same diet with addition of fish oil (1.8%). Treatments were: control (C) commercial feed; initial fish (IF), fish oil diet provided from 45 to 60 days of age + C diet from 60 to 75 days age, and final fish treatment (FF) conversely to previous. After slaughtering (24h) loin muscle were used to determinate pH (Testo230), color (CIELAB system, MinoltaCR300) and fatty acid composition. Loins were cooked in a double contact grill (71°C±1°C in the centre of the sample). Samples were analyzed by an analytical panel of 8 trained assessors. The following descriptors were evaluated: overall color; intensity and typicity of odor/flavor; fat taste and juiciness, using an unstructured linear scale of 10cm. Statistical analysis was performed using the Proc Mixed of SAS (2004) for univariate ANOVA. Differences between treatments were analyzed by Tukey test (p<0.05). No differences were found for productive parameter, slaughter weight and carcass yield (%), nor pH and color parameters (p>0.05). Sensory results were similar for color, odor, off-odor and characteristic odor, but smell-taste variables like characteristic flavor and off-flavor were influenced by diets. Control diet had higher 'rabbit flavor', followed by IF but they were not different on off-flavor parameter (p>0.05). FF had more off-flavor and less characteristic flavor. Treatments with fish oil (IF and FF) had a lower ratio n6/n3 with higher content of EPA and

508





UAEM Universidad Autónoma
del Estado de México

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

DHA than control. The early assignation of fish diet improved the n6/n3 ratio without negative effects on the sensory and physical meat quality, neither the productive parameters.

Key words: ratio n6/n3, sensory, EPA, DHA.



509



Congreso Americano
de Cunicultura
2014



SAGARPA
SECRETARÍA DE AGRICULTURA,
GANADERÍA, DESARROLLO RURAL,
PESCA Y ALIMENTACIÓN



COMECYT
CONSEJO MEXIQUENSE DE CIENCIA Y TECNOLOGÍA

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

INTRODUCTION

It is widely recognized the beneficial effects of omega-3 family fatty acids in human health. In animal nutrition, different sources of omega-3 are used to achieve a favorable change in the meat lipid profile (flaxseed, chia seed, oil fish, fish and algae meals). The lipid composition of rabbit meat greatly affects its organoleptic properties by modifying flavour and juiciness (Ouhayoun et al., 1987, Cambero et al., 1991, Parigi Bini et al., 1992).

Also, diet supplementation with sources of omega 3 fatty acids represent an increase in the cost such affect the sustainability of production. One alternative could be the supplying of an enriched omega 3 diet for short periods of time. Barro et al. (2006) found that the minimum feeding time required to achieve substantial fatty acid (FA) modification in thigh and loin meat was one and two weeks before slaughtering respectively. ~~Others authors were worked~~ In pigs, only twenty days were required to increase significantly the amounts of omega 3 FA into animal's products (Romans et al., 1995; Kouba et al., 2003). These studies showed that short term diet manipulation can be a practical reality for meat industry.

The aim of this study was to evaluate the sensory and physical quality of rabbit loin using different periods of supplementation of a diet with fish oil, intended to modify the lipid profile.

MATERIALS AND METHODS

Thirty rabbits (New Zealand x Californian, 40 days aged) were placed in individual cages at the experimental Unit of the Animal Production Department of the Faculty of Agronomy, UBA. Two different diets were used, Control (C; commercial diet) and Fish (F; commercial diet + 1.8% of oil fish) randomly distributed in three treatments: Control (C) commercial diet from 40 to 75 days of age; Initial Fish (IF): fish oil diet provided from 45 to 60 days of age + C diet from 60 to 75 days of age, and Final Fish (FF), conversely to previous.

At 75 days of age rabbits were weight and slaughtered and the carcasses carcass yield was estimated. After 24 hours of refrigeration (chamber, 4±1°C) carcasses were transferred for analyses to the Meat Quality Laboratory of FAUBA. The pH value (Testo 230) and color parameters (L* (lightness), a* (redness), b* (yellowness) and C* as $\gamma(a^*2 + b^*2)$, Minolta Chroma Meter-CR300) were determined on right loin. The fatty acid composition was analyzed

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

by gas chromatography (Shimatzu 14B, flame ionization detector, fused-silica capillary column Restek SP 2560).

Left loins were cooked in a double contact grill (71°C±1°C in the centre of the sample). Samples were analyzed by an analytical panel of 8 trained assessors using an unstructured linear scale of 10cm. The following descriptors were evaluated: overall color; intensity and typicity of odor/flavor; fat taste and juiciness.

Statistical analysis was performed using the Proc Mixed of SAS (2004) for univariate ANOVA. Differences between treatments were analyzed by Tukey test (p<0.05).

RESULTS AND DISCUSSION

Table 1 presents the effect of treatments on carcasses yield (%) and meat quality parameters. Not differences were found on carcasses yield for the different treatments (p<0.05), and the values were similar to those shown by Gigaud and Combes (2008). Also meat quality parameters, pH and color, were similar for C, IF and FF. These results would suggest similar physical quality of meat for the two diets and showed no differences due to the treatments.

511

Table1: Effect of treatments on rabbit carcass yield (%) and meat quality parameters of loin

	Treatments			Prob.	DSM	R ²
	C	IF	FF			
Carcass Yield %	57.7	56.5	57.1	NS	2.05	0.09
pH	5.80	5.74	5.67	NS	0.24	0.06
<i>Color</i>						
L*	52.7	53.4	53.6	NS	1.93	0.06
a*	5.91	5.03	5.73	NS	1.23	0.12
b*	-1.09	-1.61	-0.39	NS	1.88	0.09
C	6.19	5.46	5.92	NS	1.42	0.06



UAEM Universidad Autónoma
del Estado de México

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

Table 2 showed the fatty acid profile of right loin rabbits according with the three treatments. The C14:0, C18:1 (cis9) and MUFA content (% FA tot) were not significantly different.

The PUFA content was higher ($p < 0.0001$) in the two diets with fish oil (IF and FF treatments) compared to the control while SFA concentration was higher in the control diet ($p < 0.0001$). Moreover, fish oil treatments showed lower thrombogenic index respect control diet (0.75 vs 0.88 respectively), due to the higher omega 3FA concentration. Similar results were found for Dal Bosco et al. (2004) using flaxseed in rabbit's diets.

Treatments including fish oil achieved higher PUFA and omega 3 FA and lower n-6/n-3 ratio than the control treatment. The highest concentration of omega 3 family fatty acids was not due to changes in the level of linolenic acid (18:3 n-3), but was due to increases in the content of EPA and DHA, supplied already performed by fish oil. No differences were found according to the feed time of the diet with fish oil. Gigaud and Combes (2008), obtained similar results when the omega 3 enriched diets were fed only in the finish period; in this case, the only fifteen days supplementation was enough to increase omega 3 FA concentration in rabbits meat, regardless of the time of supply.

512



Congreso Americano
de Cunicultura
2014



SAGARPA
SECRETARÍA DE AGRICULTURA,
GANADERÍA, DESARROLLO RURAL,
PESCA Y ALIMENTACIÓN



COMECYT
CONSEJO MEXIQUENSE DE CIENCIA Y TECNOLOGÍA

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

Table 2: Level of fatty acids (% of total fatty acids) in muscle tissue of right loin.

Item	Treatments			Prob.	DSM	R ²
	C	IF	FF			
C14:0	1.76	1.82	1.78	NS	0.32	0.01
C16:0	25.3 b	23.1 a	23.8 ab	0.0046	1.46	0.4
C18:0	7.02 b	6.01 a	6.64 ab	0.0145	0.80	0.33
C18:1 cis9	24.2	23.8	22.5	NS	2.36	0.14
C18:2 n-6	28.5 a	31.6 b	29.2 a	0.0071	2.35	0.38
C18:3 n-3	2.28	2.68	2.38	NS	0.41	0.24
C20:4 n-6	2.45 ab	1.76 a	2.59 b	0.0275	0.77	0.29
C20:5 n-3	0.33 a	0.57 b	0.75 c	<0.0001	0.18	0.62
C22:6 n-3	0.25 a	1.19 b	1.38 b	<0.0001	0.30	0.84
SFA	34.2 a	30.9 a	32.2 ab	<0.0001	1.10	0.73
MUFA	28.7	28.78	27.7	NS	1.62	0.14
PUFA	34.0 a	38.7 b	36.7 c	<0.0001	1.60	0.72
n-6	31.0 a	33.6 b	31.0 a	<0.0001	1.89	0.43
n-3	2.95 a	4.45 b	4.58 b	<0.0001	0.56	0.76
n-6 / n-3	10.7 a	7.62 b	6.8 b	<0.0001	1.32	0.75
Trombogenic index	0.88 a	0.7 b	0.75 b	<0.0001	0.06	0.78

SFA: Saturated Fatty Acid. MUFA: Monounsaturated Fatty Acid, PUFA: Polyunsaturated fatty acid.
Means with different letters differ significantly at p<0.05.

In the sensory analysis, were not found any differences (p <0.05) on color, odor, rabbit typical odor, rabbit typical flavor, juiciness and fat taste parameters (table 3) but Control diet flavor intensity was higher than in fish oil diets (p < 0.05). The fish oil addition in diets resulted in more off flavor only in the FF treatment while IF treatment was similar to the Control diet

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

	Treatments			Prob.	DSM	R ²
	C	IF	FF			
Color	4.33	3.33	4.1	NS	1.42	0.17
Odor intensity	6.06	5.87	4.78	NS	1.98	0.05
Rabbit typical Odor	3.97	2.83	4.13	NS	1.79	0.19
Rabbit typical flavor	0.73	1.23	1.41	NS	1.68	0.06
Flavor intensity	5.4 a	3.7 b	3.13 b	0.0226	1.96	0.12
Off flavour	0.64 a	0.65 a	2.95 b	0.0022	2.23	0.12
Juiciness	3.6	5.46	4.61	NS	2.56	0.16
Fat taste	1.5	1.74	0.81	NS	1.56	0.12

The strategy of supplementation with fish oil diets at the beginning of the fattening period resulted in meat with a higher content of omega 3 FA and less omega 6/3 ratio (30% less) respect to the control, without negative effects on sensory evaluation. Conversely, the supplementation at the end of the fattening period, also allowed to improve the lipid profile but with greater presence of off flavor, significantly compromising its sensory quality.

CONCLUSIONS

The results obtained suggest that 15 days supplementation was enough to achieve an improvement in the meat fatty acids profile, reducing the omega 6/3 ratio, without affecting the physical quality of meat or productive performance. As the time of supply of the enriched diet could modify the sensory quality of the meat, seem advisable to offer the diet in the first phase of the fattening period.

ACKNOWLEDGMENTS

We would like to thank the staff from ‘Three balance’ producer group for his unconditional cooperation. This project received financial support from UBACyT 2011-14 00958.

REFERENCES

- Barroeta, A. C. "Nutritive value of poultry meat: relationship between vitamin E and PUFA." *World's Poultry Science Journal* 63.02 (2007): 277-284.
 Cambero, Maria I., et al. "Lipid and fatty acid composition of rabbit meat: Part 2.— Phospholipids." *Meat science* 29.2 (1991): 167-176.





UAEM Universidad Autónoma
del Estado de México

V CONGRESO AMERICANO DE CUNICULTURA, MÉXICO 2014

Facultad de Medicina Veterinaria y Zootecnia, Asociación Científica Mundial de Cunicultura – Rama Americana
Secretaría de Desarrollo Agropecuario del Gobierno del Estado de México, Secretaría de Agricultura, Ganadería, Desarrollo Rural,
Pesca y Alimentación, Consejo Mexiquense de Ciencia y Tecnología

Dal Bosco, A., Castellini, C, Bianchi, L., Mugnai, C. Effect of dietary α -linolenic acid and vitamin E on the fatty acid composition, storage stability and sensory traits of rabbit meat. Meat Science 6, (2004), 407-413.

Gigaud, V. and Combes, S. The effect of decreasing omega 6/omega 3 ratio in feed on fatty acid content of rabbit meat to meet human dietary recommendations. 9th World Rabbit Congress, June 2008, Verona, Italy.

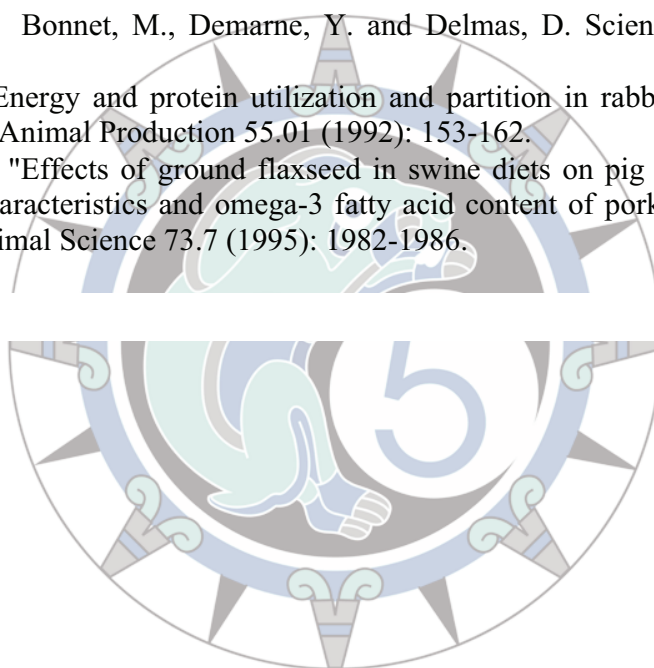
Kouba, M., et al. "Effect of a high-linolenic acid diet on lipogenic enzyme activities, fatty acid composition, and meat quality in the growing pig." Journal of Animal Science 81.8 (2003): 1967-1979.

Ouhayoun, J., Kopp, J. Bonnet, M., Demarne, Y. and Delmas, D. Sciences des Aliments, 7 (1987), p. 521

Parigi-Bini, R., et al. "Energy and protein utilization and partition in rabbit does concurrently pregnant and lactating." Animal Production 55.01 (1992): 153-162.

Romans, John R., et al. "Effects of ground flaxseed in swine diets on pig performance and on physical and sensory characteristics and omega-3 fatty acid content of pork: I. Dietary level of flaxseed." Journal of Animal Science 73.7 (1995): 1982-1986.

515



Congreso Americano
de Cunicultura
2014



SAGARPA
SECRETARÍA DE AGRICULTURA,
GANADERÍA, DESARROLLO RURAL,
PESCA Y ALIMENTACIÓN



COMECYT
CONSEJO MEXIQUENSE DE CIENCIA Y TECNOLOGÍA