Influence of weaning age (28 *vs.* 63 d) on quantitative and qualitative carcass traits of rabbits

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RIASSUNTO – Influenza dell'età di svezzamento (28 *vs.* 63 d) sulle caratteristiche quanti-qualitative delle carcasse di coniglio. *Centonovantadue conigli sono stati equamente suddivisi in due gruppi sperimentali e svezzati rispettivamente a 28 e 63 giorni, e tutti macellati a 83 giorni di età. Dopo sezionamento delle carcasse, sulla carne ottenuta dallo spolpo dell'arto posteriore sinistro di 18 conigli per gruppo è stata determinata la composizione chimica, macro e microminerale, nonché quella acidica dei grassi da cui è stato possibile calcolare gli indici di aterogenicità e trombogenicità. I risultati ottenuti evidenziano le migliori qualità dietetico-nutrizionali delle carni dei conigli svezzati a 28 d: in particolare, sono stati più elevati i contenuti di ferro (1,25* vs. *0,93; P<0,01) e più favorevoli gli indici di aterogenicità (0,68* vs. *0,75; P<0,01) e trombogenicità (1,04* vs. *1,14; P<0,01).*

Key words: rabbit, weaning age, meat quality.

INTRODUCTION – Nowadays there is an increasing interest towards breeding systems, also for rabbit meat production, that are more mindful of animal welfare through an attenuation of the productive cycles intensity. These particular rearing techniques provide a delaying of the weaning age to reduce young rabbits stress. The present experiment is part of a wider research (Pinna *et al.*, 2004; Marongiu *et al.*, 2004) conducted in a sardinian farm in which rabbits are usually weaned at about 60 days of age. Surely this managerial choice could be considered rather questionable but from a scientific point of view could also represent the occasion to examine the productive performance of rabbits submitted to such a late weaning. The final part of the survey, regarding the carcass composition and the meat chemical-nutritional characteristics, was carried out through the comparison of two groups of rabbits weaned at 28 and at 63 days of age respectively.

MATERIALS ANS METHODS – One hundred ninety two rabbits (New Zealand White x Californian) were equally divided in two groups weaned at 28 (W28) and 63d (W63) respectively. All the rabbits were fed *ad libitum* the same diets and slaughtered at 83 d of age. After dissection (Blasco *et al.*, 1993) and meat to bone ratio determination, from 18 carcasses of W28 and 18 of W63 group the left hind legs were isolated and the meat was milled for moisture and ash analysis (AOAC, 2000). Fat was analysed according to Folch *et al.* (1957) and the protein content was calculated by difference. Hydroxyproline (ASPA, 1996) allowed to determine the collagen content (Sorensen, 1981). Meat samples were frozen at -18°C prior mineral analysis. The mineralization in Microware ETON D (Millistone) was performed using an Atomic Absorbance Spectrometer (SpectrAA220, Varian). Fatty acid composition was determined after extraction (Folch *et al.*, 1957) and metilation (Christies, 1989), by using a GC ThermoQuest series 8000Top (column Omega-Wax 320cm X 0.25µm Supelco). The n6/n3 ratio as well as the atherogenic (IA) and thrombogenic (IT) indexes were calculated from the fatty acid composition, as suggested by Ulbricht and Southgate (1991). The results were analysed by ANOVA (SAS, 2000) using the model: $Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$, where Y is the single observation, μ the general mean, α the age at weaning effect (i = 28 or 63 d), ε the error.

RESULTS AND CONCLUSIONS – Table 1 shows the average composition and the meat to bone ratio of carcasses. Resulting data about W28 group appear in agreement with other studies considering similar carcass traits (Pla *et al.*, 1998; Parigi-Bini *et al.*, 1992a). In W28 carcasses the fat percentage was significantly higher while the bone percentage significantly lower when compared to W63 carcasses (4.3 *vs.* 2.4%, P<0.01; 11.3 *vs.* 13.4, P<0.01). Consequently, also the meat to bone ratio was significantly higher in W28 group (7.54 *vs.* 6.28, P<0.01).

Table 1. Average composition and meat to bone ratio (M/B) of carcasses.

	n	Fat %	Muscle %	Bone %	M/B
W63	96	2.4^{B}	84.2	13.4^{A}	6.28^{B}
W28	96	4.3^{A}	84.4	11.3^{B}	7.54^{A}

A, B: P<0.01.

According to that, the meat chemical composition (table 2) showed significant differences for fat, higher in W28 rabbits. At this regard, it seems appropriate specify that it was not possible to measure the solid feed intake of suckling rabbits (allowed to consume the same diets of the mothers). On the other hand, the feed intake of W28 group was significantly higher in the period 64-83 d (113 *vs.* 89 g/d; P<0.05). Our data are anyhow in agreement with those reported by other authors (Parigi-Bini *et al.*, 1992b; Nizza and Moniello, 2000). Although collagen content was higher in W28 rabbits, there were not significant differences between groups.

Table 2. Chemical composition of meat.

	n	Moisture %	Ash %	Protein %	Total Fat %	Collagen mg/100g
W63	18	71.79±1.65	1.47±0.11	24.11±2.91	2.63^{b}±0.69	47.66±5.06
W28	18	72.32±2.15	1.44±0.18	23.22±3.42	3.02^{a}±0.73	49.10±6.52

a, b: P<0.05

With regard to the macro and micro mineral meat composition (table 3), in agreement with the values reported by Parigi-Bini *et al.* (1992b), the most important differences consisted in Iron (1.25 *vs.* 0.93 mg/100g, P<0.01), Copper (0.17 *vs.* 0.14 mg/100g, P<0.05) and Manganese (0.03 *vs.* 0.02 mg/100g, P<0.05) contents, significantly higher in W28 rabbits.

Table 3. Mineral composition (mg/100g) of meat.

	Ca	P	Na	Mg	Fe	K	Se	Cu	Mn	Zn
W63	10.91	212.78	60.22	31.35	0.93^{B}	440.81	24.54	0.14^{b}	0.02^{b}	1.58
n=18	(1.90)	(25.28)	(5.86)	(2.73)	(0.07)	(29.03)	(3.74)	(0.04)	(0.004)	(0.23)
W28	10.33	210.42	62.42	30.78	1.25^{A}	432.90	24.27	0.17^{a}	0.03^{a}	1.59
n=18	(1.38)	(30.87)	(6.24)	(2.91)	(0.10)	(27.02)	(3.12)	(0.03)	(0.006)	(0.25)

(...) standard deviation; A, B: P<0.01; a, b: P<0.05

Table 4 shows the meat fatty acid (FA) composition as well as the atherogenic and thrombogenic indexes by weaning age. The W63 rabbits meat, looking at FA expressed as percentage of total determined FA, showed significantly higher saturated FA (SFA, 43.0 *vs.* 40.3%, P<0.05) and lower monounsaturated FA contents (20.3 *vs.* 23.7%, P<0.01). This could be presumably due to the longer lasting milk intake in W63 rabbits. As a matter of fact does milk, in terms of FA composition, consists for about 80% in SFA (Castellini *et al.*, 2004). There were not differences in total polyunsaturated FA content while higher C18:2 and C18:3 (P<0.05) levels were found in W28 group. This could be explained by the earlier and more conspicuous vegetable feed intake performed by the W28 rabbits, considering that the origin of these fatty acids are not endogenous but it is the result of diet: cereals particularly provides linoleic acid and lucerne linolenic acid . Our fatty acid profile data appear in accordance with those recently reported by Ramirez *et al.* (2005). Finally, W63 group also displayed less favourable atherogenic and thrombogenic indexes.

Table 4. Fatty acid composition (mean and standard deviation) of meat.

	W63 (n=18)	W28 (n=18)	W63 (n=18)	W28 (n=18)
Total FA, g/100g	1.82^{B}±0.15	2.17^{A}±0.14	-	-
	mg/100g of meat		*% of total FA*	
C14:0	47.01^{B}±4.44	54.72^{A}±4.03	2.58±0.29	2.77±0.32
C16:0	584.9^{B}±40.2	658.6^{A}±59.44	32.15±4.81	33.34±4.17
C18:0	137.9^{b}±11.33	151.6^{a}±17.37	7.57±2.55	7.68±1.58
C20:0	7.14^{a}±1.63	6.43^{b}±1.52	0.39±0.09	0.33±0.08
C22:0	5.78±0.94	5.15±1.34	0.32±0.12	0.26±0.10
SFA	782.8^{B}±71.33	876.6^{A}±70.14	43.01^{a}±3.06	40.30^{b}±2.51
C18:1	359.7^{B}±32.55	502.8^{A}±41.70	19.74^{B}±1.36	25.44^{A}±2.91
C20:1	7.87±0.89	7.99±0.78	0.43±0.02	0.40±0.05
C22:1	3.08^{B}±0.65	4.37^{A}±0.63	0.17^{B}±0.02	0.22^{A}±0.03
MUFA	370.6^{B}±32.59	515.1^{A}±42.45	20.34^{B}±1.36	23.69^{A}±1.11
C18:2	603.7^{B}±47.46	708.9^{A}±48.93	33.17±4.95	35.91±4.09
C18:3	63.16^{B}±5.24	73.36^{A}±3.57	3.47^{b}±0.21	3.72^{a}±0.40
PUFA	666.8^{B}±58.2	782.3^{A}±52.38	36.64±2.03	36.01±3.24
n6/n3	9.56±1.22	9.66±1.93	-	-
IA	0.75^{A}±0.03	0.68^{B}±0.02	-	-
IT	1.14^{A}±0.04	1.04^{B}±0.06	-	-

Between columns: A, B: P<0.01; a, b: P<0.05.

In conclusion, an extremely delayed weaning, besides being surely not convenient in terms of farm economy, seems also related to a meat product with dietary-nutritional characteristics less corresponding to the modern requirements of consumers, mainly focused on the well known relationship of meat fat composition with human cardiovascular diseases.

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