Performance at slaughtering of Marchigiana beef cattle

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ABSTRACT: On a 766 heads sample of Marchigiana bullocks slaughtered in 2004-2006 at Senigallia's Slaughterhouse main performance at slaughtering were recorded: identity, personal data, live weight, right hoof, right fore and hind limbs, head, tongue, skin, head skin, gross stomachs, empty rumen, gross intestines, stomach fat, thickness of skin, carcass and half weights, limb girth, SEUROP carcass and fatness scoring (using 3 subclasses). Average daily gain (ADG) and percentages were computed. All statistics were performed on 726 males: means, correlations, multivariate analysis, variance components, heritability. Average slaughtering data were: age 598.8 ± 78.6 d, live weight 681.6 ± 81.1 kg, live ADG 1.154 ± 0.175 kg/d, carcass weight 424.9 ± 54.9 kg, gross dressing 62.29 ± 2.08%, net dressing 68.89 ± 1.89%, carcass ADG 0.719 ± 0.116 kg/d. Phenotypic correlations of live weight with SEUROP carcass evaluation and fatness have been equal to 47% and 26% while the correlations between ADG, SEUROP and fatness carcass evaluation have been equal to 41% and 37%. Following heritabilities were estimated: carcass weight 0.29, skin 0.62, head 0.34, SEUROP carcass evaluation 0.48.

Key words: Beef Cattle, Marchigiana breed, Performance at Slaughtering.

INTRODUCTION - Marchigiana is one of the main Italian beef cattle breeds and consists of about 50,000 herdbook registered heads. Former researches on slaughtering performance of Marchigiana date back to 1960-82, and more recent works (Falaschini, 1992; Falaschini, 1997); this work aims to update the picture of Marchigiana performance and to verify which traits may be recorded at slaughtering to be used in the selection of beef cattle breeds.

MATERIAL AND METHODS – In 55 data-collecting-days 766 Marchigiana males were recorded, born from 156 sires raised in more than 140 small-medium sized farms. Collected traits were: identity and personal data, live weight, right hoof, right fore and hind limbs, head, tongue, skin, head skin, full stomachs, empty rumen, full intestines, stomach fat, thickness of the skin, weight of carcass (cw) and half, limb girth, SEUROP carcass (recodified S=6 to P=1) and fatness scoring, using both 3 subclasses in each class. Following traits were computed: age at slaughter, live-net-weight, live weight ADG (lwADG), carcass ADG (CDG), live-net-weight ADG (lnwADG), dressing yield, net dressing yield, percentage of single or aggregate traits on live weight, bones ((hoof * 4)+(fore limbs * 2)+(hind limbs * 2)), entrails (full stomachs + fat of the stomach + full intestines). In data analysis only 726 males aging between 14 and 24 months and weighing at least 500 kg were considered. Relationship matrix includes 4812 animals. Following analysis were performed: distribution of collected and derived traits, correlations, GLM analysis on the main environmental factors, - all using SAS (SAS, 2000); variance components, heritability and genetic correlations were estimated using BLUP-animal model (BLUP-AM) of MTDFREML (Boldman, 1995) software, single trait for heritabilities, multi trait for genetic correlations.

RESULTS AND CONCLUSIONS – At slaughtering following means ± STD were found (Table 1): age 598.8±78.6 d, live weight (lw) 681.6±81.1 kg, lw ADG 1.154±0.175 kg/d. Most of cattle, mature, aged, according to a bimodal distribution, 18-20 or 23-24 months. Significant differences were found in weight same age and vice-versa in age similar weights. lwADG ranges from 0.697 to 1.687.
Comparing to previous researches dated 1962-1980 (Guidi, 1985) Marchigiana shows a progressive improvement in lw from 522 kg at 535 d of age in 1962-64, to 623 kg at 510 d in 1980 (a progeny test) to 682 kg at 600 d today, due to the evolution of market requirements and of prices; ADGs also improved: lwADG 0.983 (1962-64) vs 1.154 (actual) kg/d and CDG: 0.602 vs 0.720 kg/d. Avg carcass weight raised 105 kg (320 vs 425 kg) since 1962 and is also heavier than in 1980 (391 kg).

SEUROP carcass conformation avg score was slightly over “U” (recodified: 4.15±0.70), classing 48.5% in U and 33% in E, confirming good muscle development of Marchigiana. Covering fat avg score was 2.38±0.43, 63% of heads scored around “2”, 33.8% around “3”. Carcasses appear to be appreciated by the Italian market, according to SEUROP conformation and fat covering, even if slightly lower than optimum. Among the anatomic parts removed from carcass quite interesting are percentages on lw of skin (8.49±0.75%) and head (5.53±0.38%); these traits can be used to improve carcass yield.

Weight is slightly correlated with age (lw:0.275; cw 0.231), highlighting large variability of management; ADG result strongly and negatively correlated with age (ADG: -0.671, CDG: -0.645), both among and within farms, confirming previous results on growth curves and trends of Italian beef cattle breeds (Pilla, 1981; Giorgetti, 1995). On the opposite carcass SEUROP is not correlated with age (-0.068 N.S.), suggesting different relationship with genetics, management and feeding levels; it is correlated both with weights (cw: 0.534) and CDG (0.469), while carcass fat covering is more strictly related with CDG (0.356) than with weights (cw: 0.250), showing evident relation with feeding levels. Skin and head % on lw show negative relationship with carcass weight (-0.342 and -0.450 resp., showing decreasing incidence), with SEUROP and less significant with age and fatness scoring.

In GLM analysis most of environmental factors usually recorded in-field were considered; main of them showed effects influencing slaughtering traits: age on weights and ADG; lw on skin, head, and fat covering; farm and month of slaughtering on weights, ADG, SEUROP and fatness scoring; parity of dam on weights and ADGs; carcass fat on skin percentage. Significant factors, as reported in Table 3 with 1 to 3 stars, were considered in the models (BLUP-AM) to estimate variance components and heritabilities, as following equations:

Lw, cw: \[ y_{ijkl} = \mu + b_1 \times \text{Age}_{ijkl} + b_2 \times \text{Age}^2_{ijkl} + \text{Farm}_{i} + \text{Parity}_{j} + \text{SM}_{k} + a_{l} + e_{ijkl}; \]

ADG, CDG: \[ y_{ijkl} = \mu + b_1 \times \text{Age}_{ijkl} + \text{Farm}_{i} + \text{Parity}_{j} + \text{SM}_{k} + a_{l} + e_{ijkl}; \]

SEUROP: \[ y_{ijkl} = \mu + b_1 \times \text{Age}_{ijkl} + \text{Farm}_{i} + \text{Parity}_{j} + \text{SM}_{k} + a_{l} + e_{ijkl}; \]

Fatness Scoring: \[ y_{ijkl} = \mu + b_1 \times \text{lw}_{ijkl} + \text{Farm}_{i} + \text{SM}_{j} + a_{l} + e_{ijkl}; \]

Skin: \[ y_{ijkl} = \mu + b_1 \times \text{lw}_{ijkl} + b_2 \times \text{FatCovering}_{ijkl} + a_{l} + e_{ijkl}; \]

Head: \[ y_{ijkl} = \mu + b_1 \times \text{lw}_{ijkl} + b_2 \times \text{lw}_{ijkl} + a_{l} + e_{ijkl}; \]

### Table 1. Performance in vivo and post-mortem of slaughtered cattle.

| Trait                          | Mean  | STD  | Min  | Max  | CV   | % on Live weight (lw) |
|-------------------------------|-------|------|------|------|------|----------------------|
| Age at slaughter (gg)          | 598.8 | 78.6 | 421.0| 730.0| 13.13|
| Live weight at slaughter (kg)  | 681.6 | 81.1 | 500.0| 995.0| 11.90|
| Net live weight (kg)           | 616.5 | 75.6 | 446.0| 895.0| 12.26|
| Carcass weight - cw (kg)       | 424.9 | 54.9 | 300.6| 648.2| 12.93|
| Dressing (%)                   | 62.29 | 2.08 | 55.22| 68.65| 3.33 |
| Net dressing (%)               | 68.89 | 1.89 | 62.22| 75.09| 2.74 |
| Lw Average daily gain (kg) lwADG| 1.154 | 0.175| 0.697| 1.687| 15.18|
| Carcass average daily gain (kg)CDG| 0.719 | 0.116| 0.422| 1.078| 16.19|
| SEUROP carcass evaluation      | 4.154 | 0.702| 2.000| 6.000| 16.90|
| Fatness scoring                | 2.383 | 0.429| 1.650| 3.250| 18.00|
| Skin weight (kg)               | 57.71 | 7.26 | 36.0 | 78.9 | 12.58 |
| Head with tongue (kg)          | 37.59 | 4.11 | 27.10| 51.45| 10.92|
|                               |       |      |      |      |      | 5.53±0.38            |
Following heritabilities were found: carcass weight 0.29; CDG: 0.28, skin. 0.62; head 0.34; SEUROP conformation 0.48. Following genetic correlations were found with carcass weight: lw 0.99, CDG 0.90, SEUROP 0.74, skin -0.58, head -0.45. Due to these values, carcass weight or CDG may be used alternatively. SEUROP may integrate the information of the first trait. Skin and head weight show negative genetic correlations, not close to 1, and can be used to improve efficiency in beef production, since skin economic value per kg is about 20% of carcass one, head has no value.

In the last twenty years, due to selection, Marchigiana developed to animals with high meat production-perform-ances, the “top of pyramid” of population, but wide variability in weights and ADG clearly shows that it is necessary to upgrade the “bottom” part, working on choice of sires, dams, and on management, particularly where low ADG shows risks of critic economic profits of farms. High improvements in bullocks productions are possible and assistance to breeders in genetics and feeding is required to fully express genetic potential.

In conclusion ADG and CDG can be considered good efficiency indicators of animals and farm; since the price of the commercial animals is based on carcass weight, CDG is an objective indicator of daily production value. Since carcass weight is always recorded and age can be computed, CDG can be always obtained in field. SEUROP conformation can be used implementing a finer classing system: 3 subclasses for each class. Skin weight can be easily recorded on automatic hide puller, upgrading existing equipments in slaughterhouses; head requires more time to be weighed. All these traits can be purposed in an integrated selection scheme to find out new blood lines of candidate calves to be performance tested and to confirm performance test results.

The Authors want to thank Mattatoio Comunale di Senigallia, Associazione Provinciale Allevatori Ancona.

The research was supported by Regione Marche

REFERENCES - Boldman K. 1995. A manual for use of MTDFREML. U.S.D.A.; Falaschini, A., Mondini, S., Filippini F., Trombetta, M. F., 1997. Valutazione al macello della progenie di tori Marchigiani sottoposti o meno al Performance Test. 2nd Italian Beef Cattle Congress, Rockhampton, Australia; Falaschini, A., Trombetta, M. F., 1992. Evoluzione delle performance in bovini di razze da carne: Marchigiana, Romagnola e Limousine. Taurus, Anno IV n. 1 :16-19; Giorgetti A., Franci O., Acciaioli A., Funghi R., Lucifer M., 1995. Effetto dell’età e della concentrazione energetica della dieta sulle performance in vita del Vitellone Chianino. ZNA 21:35-45; Guidi L., Mondini S., 1985. La razza bovina Marchigiana, passato- presente – futuro; Pilla A. M. 1981. La selezione della Marchigiana: risultati ed insegnamenti di una prova di progenie – 4 Razze, n° 5/6, 27; SAS 2000. S.A.S. Institute Inc., Ed. Cary (N.C.) U.S.A.