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Monterufoli Pony Morphological Characterization and Standard Breed Updating

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ABSTRACT

The Monterufoli pony is an endangered Tuscan breed-population, and the aim of this work is the domestic biodiversity conservation. This pony derives from the province of Pisa and in the past was an appreciated driving equine. It derives from wild extinct equines that lived in central Tuscany and has Maremmano, Tolfetano and Oriental ancestors. The selection and the improvement of this population began in the early 1900. Up to now Braccini published the most complete "standard breed" in 1947. Since the 60's the reduction of Monterufoli pony population began and this equine risked extinction. In the 80's local and state breeders re-introduced this pony in some areas of Tuscany. The standard breed was updated in this study, and a comparison between males and females was performed. The average sizes were: height at withers of 135.0 ± 1.7 and 128.6 ± 1.7 , thorax circumference of 162.4 ± 3.7 and 163.5 ± 4.0 , front shank circumference of 17.9 ± 0.3 and 16.2 ± 0.4 , for males and females, respectively. The measures of adult females were estimated by ANOVA considering three different classes of age (3-4, 5-6 and over 6 years old). Thorax height, Croup length and bi-ischium height were higher in over 6 year old females. All ponies had dark coat. Monterufoli ponies showed the phenotypical features of the breeds that contributed to improve the local population: over 80% of population had convex nose typical of Maremmano and Tolfetano horses. The comparison between the 1947 standard breed and the actual standard breed showed that the "old" Monterufoli pony was more dolicomorphic than the modern pony.

Keywords: Biometrics, Breed standard, Body Index, Monterufoli Pony, Morphological characteristics.

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INTRODUCTION

This work deals with the preservation of local animal genetic resources, and gives special attention to the Monterufoli pony morphological and somatic characterization. This equine derives from the homonym area in the Pisa province, and its origin goes back to 1913, when

the Countess Wrangler Della Gherardesca began the selection of local ponies with Maremmano, Tolfetano and Oriental horses (Arzilli, 2006). Maremmano horse promoted the breed enlargement, while small-sized Tolfetano and Oriental horses given to the breed frugality and

endurance (Braccini, 1947; Gandini and Rognoni, 1997; Arzilli, 2006). The Monterufoli pony was adapted to a hard geopedological substrate, characterized by ophiolitic outcrops containing dangerous minerals for plants and animals. These limiting conditions furthered the development of poor pastures for the herbivorous. This natural environment determined some anatomical characteristics: the small size, the compact body, the very strong hooves (Tocci, 2015), and some typical deviation from the normal skeletal structure of legs.

In the 1947, Braccini described the morphological characters of this pony and the author developed the first “standard breed”. The technical and economic development and motorization allowed the end of animal traction, and the Monterufoli pony risked extinction. In the 80’s the recovery of this pony began, and some horse breeders, cooperated in the Monterufoli pony re-introduction. Now this equine is listed in the “Registro Anagrafico delle popolazioni Equine riconducibili a gruppi etnici locali” and it is included in the “Repertorio delle Risorse Genetiche Autoctone Animali della Toscana”, provided for the L.R. (Regional Law) 50/97. In the “Registro Anagrafico delle popolazioni Equine riconducibili a gruppi etnici locali” the Monterufoli pony standard breed are shown with height at withers, thorax circumference, and front shank circumference in males and females. In 1990 there were 59 Monterufoli ponies, now there are 283 individuals: 14 males, 71 mares and 198 foals, distributed in 108 farms (Aia, 2015). The Monterufoli pony main aptitudes are the saddle, especially for children and inexperienced adult riders, and the driving. The aim of the work is the biometrical and morphological characterization of the actual population, also estimated through the comparison with the historical measures of 1947, performed by Braccini, when the Monterufoli pony was widespread.

MATERIALS AND METHODS

For biometric characteristics and morphological evaluation, 40 animals, reared in 6 different farms, was chosen. Two state farms: “Corpo Forestale dello Stato” in Cornocchia (Si), and “Comunità Montana dell’Alta Val di

Cecina” in Pomarance (Pi), and four private farms in Livorno, Grosseto, Siena provinces. The biometrics were performed on 32 adult females, and in 8 6-year old stallions. The biometrics of these males were compared with the biometrics of 8 6-year old females. Female biometrics of different age (10 of 3-4 years old, 8 of 6 years old and 14 over 6 years old) were also compared. Finally, 10 3-4-years old and adult females’ biometrics and the body indices were compared with the homologous parameters studied by Braccini in 1947 in ten 3-4 years old females (Braccini, 1947). The Braccini materials and methods were the same used in this trial.

In this study the following body measures were taken: heights at withers, at croup, and thorax; head lengths (arc and chord in the profile), thorax, trunk, croup, front shank, front leg, neck, back, kidney region, shoulder, arm, forearm, thigh, gaskin, fetlock; head, breast, thorax and pelvis widths (bi-iliac, bi-trochanter and bi-ischium); thorax, front shank, and hind shank circumferences (Catalano, 1984). The height at withers and the height at croup were measured by stick, the body widths with a caliper, and the body lengths and the circumferences were measured by tape measure. Moreover the following Body Indices were calculated: Height Thoracic Index (HTI) = height of thorax/height at withers x 100; Corporal Index (CI) = length of trunk/thoracic circumference x 100; Lateral Body Conformation (LBC) = height at withers/length of trunk x 100; Lateral Trunk Conformation (LTC) = thoracic height/length of trunk x 100; Thoracic Circumference Index (TCI) = thoracic circumference/height at withers x 100; Transversal Body Conformation (TBC) = length of thorax/height at withers x 100; Dactyl-Thoracic Index (DTI) = front shank circumference/thoracic circumference x 100; Thoracic Index (TI) = length of thorax/height of thorax x 100; Relative Length Trunk (RLT) = length of trunk/height at withers x 100 (Meregalli, 1980; Catalano, 1984; Meregalli and Giorgetti, 1996). The Monterufoli Pony measures and body indices were compared through GLM for Unbalanced ANOVA with JMP statistical software JMP 10 (SAS Institute, 2013) considering as fixed factor the sex. Same statistical model was used for the female’s body measures and body indices considering three different class of age, and for the differences

between the actual and the historical (1947) female measures and body indices. Means were compared with t student test, and when the factors were more than two were compared with Tukey test. Furthermore, in all females and males, the percentage frequency of morphological characteristics were calculated.

RESULTS

Males were taller than females (table 1), which showed lesser height at withers and height at croup. Males also showed higher thorax length and front shank circumference. Thorax height, thorax width, thorax circumference, trunk length, croup length, bi-iliac width, bi-ischium width, breast width, leg length and front shank length were homogeneous between females and males. Head width, neck length, fetlock length were higher in males and back length was higher in females. Head width, neck width and fetlock length were higher in males. Back length was higher in females (table 2). Dactyl-thoracic Index (DTI)

and the Thoracic Index (TI) were higher in males (table 3). In table 4, the variance analysis showed that the 3-4 years old females were well developed; only bi-ischium ended the full development in 6 years old females, while thorax height and croup length reached the maximum develop in over 6 years old females.

The zoognostic measures (table 5) and the body indices (table 6) didn't show significant variations.

In table 7 and 8 some measures of the modern Monterufoli pony were compared with the same measures of Monterufoli pony studied by Braccini in 1947, when this equine was widespread. The modern 3-4 years old females have shown similar height at withers, higher thorax circumference, and higher head length than the homologous historical data (table 7). CI and TCI were higher in modern equines. The height at withers of adult females of 1947 was higher than the same measure of modern equines (table 8).

Table 1: Measures and Body Index (BI) of females and males

Parameter (cm)	Females	Males	Sig.	RSD
Height at withers (cm)	128.6	135.0	*	4.9
Height at croup (cm)	129.4	137.8	**	5.1
Thorax height (cm)	59.4	60.0	N.S.	4.4
Thorax width (cm)	35.5	39.0	N.S.	3.7
Thorax length (cm)	81.1	87.9	*	5.7
Trunk length (cm)	133.3	137.8	N.S.	8.8
Croup length (cm)	43.5	45.2	N.S.	3.8
Bi-iliac width (cm)	44.8	47.2	N.S.	3.5
Bi-trochanter width (cm)	43.2	47.2	**	1.8
Bi-ischium width (cm)	17.1	20.0	N.S.	2.2
Front shank circumference (cm)	16.2	17.9	**	0.9
thorax circumference (cm)	163.5	162.4	N.S.	10.5
Breast width (cm)	31.8	34.2	N.S.	4.4
Leg length (cm)	75.3	37.9	N.S.	5.8
Front shank length (cm)	20.2	20.8	N.S.	5.7

N.S.= Not Significant; *=P<0.05; **=P<0.01

Table 2: Body Index (BI) of females and males

Parameter (cm)	Females	Males	Sig.	RSD
HTI	46.0	44.5	N.S.	2.7
CI	82.0	85.0	N.S.	7.4
TBC	63.0	65.2	N.S.	4.4
LTC	42.0	43.6	N.S.	3.7
DTI	9.8	11.0	**	0.6
TI	133.9	146.5	*	7.6
RLT	105.4	102.3	N.S.	7.0

N.S.= Not Significant; *=P<0.05; **=P<0.01

Table 3: Biometrics of some zoognostic regions of adult females and males

Parameter (cm)	Females	Males	Sig.	RSD
Head width	19.0	20.5	*	0.7
Head arc	57.9	59.1	N.S.	2.9
Head chord	52.0	52.6	N.S.	2.4
Neck length	58.0	72.6	**	4.3
Ear length	13.5	14.2	N.S.	0.7
Back length	59.8	41.4	*	13.2
Kidneys region length	21.8	20.1	N.S.	5.9
Shoulder length	54.0	56.3	N.S.	5.9
Arm length	34.0	32.6	N.S.	2.6
Forearm length	37.6	30.6	n.s	6.6
Front cannon length	20.2	20.8	N.S.	5.7
Thig length	51.2	49.4	N.S.	5.5
Gaskin length	43.7	37.9	N.S.	5.8
Fetlock length	8.0	10.0	*	0.7

N.S.=Not Significant; *=P<0.05; **=P<0.01

Table 4: Measures of females

Measures (cm)	3-4 y. old	5-6 y. old	>6 y. old	Sig.	RSD
Height at withers	129.4	129.7	133.5	N.S.	6.60
Height at croup	130.2	131.6	133.8	N.S.	6.61
Thorax height	55.3 B	60.6	62.1 A	*	4.42
Thorax width	34.1	35.0	35.4	N.S.	4.02
Thorax length	82.3	88.0	87.0	N.S.	9.75
Thorax circumf.	160.7	165.3	169.8	N.S.	2.21
Trunk length	136.6	134.5	145.4	N.S.	8.72
Croup length	43.8	41.3 B	45.8 A	*	3.46
Bi-iliun width	44.4	45.5	47.6	N.S.	3.80
Bi-trochanter width	43.0	44.2	45.0	N.S.	3.76
Bi-ischium width	15.7 B	18.5 A	20.0 A	**	5.49
Front shank circumf.	17.2	16.5	18.4	N.S.	1.45
Hind shank circumf.	21.0	21.7	21.9	N.S.	0.85
Leg length	74.0	79.0	76.5	N.S.	4.96
Breast width	32.0	34.7	33.5	N.S.	3.95
Front shank length	19.0	20.2	19.6	N.S.	3.69
Ear length	14	13.5	11.9	N.S.	1.31

A, B (P 0.05) N.S.=Not Significant; *=P<0.05; **=P<0.01

Table 5: Biometrics of zoognostic regions of females

Measures (cm)	3-4 y. old	5-6 y. old	>6 y. old	Sig.	RSD
Head width	19.0	18.0	18.7	N.S.	0.97
Head profile (arc)	56.7	57.9	60.4	N.S.	3.91
Head profile (chord)	49.7	52.5	52.7	N.S.	2.50
Neck length	59.7	57.1	60.6	N.S.	6.21
Back length	56.8	55.5	56.3	N.S.	14.07
Kidneys region length	20.8	18.9	23.1	N.S.	6.21
Shoulder length	61.3	58.2	61.1	N.S.	6.21
Arm length	32.3	33.4	32.0	N.S.	2.81
Forearm length	32.7	33.0	33.5	N.S.	7.36
Front shank length	19.0	20.2	19.6	N.S.	3.69
Thig length	47.0	50.0	47.7	N.S.	4.63
Gaskin length	38.8	42.5	39.4	N.S.	6.88
Fetlock length	8.5	8.5	8.8	N.S.	1.00

N.S.= Not Significant

Table 6: Somatic indices of females

Parameter	3-4 y. old	5-6 y. old	> 6y. old	Sign.	RSD
HTI	43.7	46.9	46.5	N.S.	2.59
CI	85.8	80.9	84.9	N.S.	7.04
LBC	93.5	94.7	92.4	N.S.	6.31
LTC	39.8	43.4	42.4	N.S.	4.20
TCI	126.0	128.0	127.3	N.S.	7.21
TBC	54.9	68.6	65.0	N.S.	13.84
DTI	8.0	8.4	9.3	N.S.	4.44
TI	148.4	149.1	139.1	N.S.	18.97
RLT	107.4	106.1	108.6	N.S.	7.31

N.S.= Not Significant

Table 7: Comparison between actual and historical biometrics of 3-4 y. old females

Parameter	Year 1947	Today	Sign.	RSD
Height at withers	131.3	124.4	N.S.	6.427
Thorax circum.	145.5	160.7	**	8.226
Trunk length	138.5	136.5	N.S.	8.648
Front shank circum.	16.2	16.9	N.S.	0.645
Head length	50.5	55.8	**	3.202
CI	95.2	85.2	**	5.725
RLT	105.4	107.2	N.S.	5.768
LBC	94.9	93.7	N.S.	5.035
TCI	110.8	125.6	**	5.996
DTI	11.2	10.5	N.S.	0.862

N.S.= Not Significant; *=P<0.05; **=P<0.01

Table 8: Comparison between actual and historical biometrics of adult females

Parameter	Year 1947	Today	Sign.	RSD
Height at withers	139.9	132.3	**	6.106
Thorax circum.	160.0	168.5	*	8.787
Trunk length	144.7	142.5	N.S.	9.443
Front shank circum.	17.2	17.9	N.S.	1.441
Head length	54.4	59.6	**	3.956
CI	90.4	83.8	**	5.590
RLT	103.4	101.1	N.S.	22.620
LBC	96.9	93.0	N.S.	5.510
TCI	114.4	127.5	**	5.853
DTI	10.7	10.8	N.S.	0.737

N.S.=Not Significant; *=P<0.05; **=P<0.01

All ponies showed dark coat, and two females showed a reddish spots coat. The most part of evaluated equines showed conical head (90.6% and 100% for females and males respectively) and straight profile (87.5% and 83.3% for females and males respectively). The entirety of population showed dark and simple mane. The tail was always black; the 81.2% of females and the 83.3% of males showed smooth tail. The totality of females and the 66.6% of males showed inclined rump with low tail junction. Females and males showed a compact hoof, free from chipping and/or rings. These characteristics indicated though hooves. The hoof was black, and only a female (3.13%) showed a partially depigmented hoof. Only females were with coronet or fetlock (12.5 %); stars were in females and in males, in a percentage of 12.5 % in both sexes. Two males

(25.0 %) showed trace stars. Just males were unsound: 50% was knock-knees in front leg, and another 50 % was cow-hocked in hind limb.

DISCUSSION

Height at withers was comparable in females with the “standard breed” (<http://www.aia.it/>, 2015) and with Tocci *et al.*, (2007) biometrics. In males, this parameter was comparable with those of Gennero and Calcagni (1985) and Tocci *et al.*, (2007), higher than the actual “standard breed” (<http://www.aia.it/>, 2015), and lower than those of Arzilli (2006). Thorax circumference in both sexes was comparable with the same parameter reported in “standard breed” and in literature (Gennero and Calcagni, 1985; Arzilli, 2006; Tocci *et al.*, 2007). The males’ front shank circumference was comparable with AIA, Arzilli

(2006), and Tocci *et al.*, (2007) biometrics (2015), and lower than that of Gennero and Calcagni (1985) biometrics. The females' front shank circumference was lower than those of AIA and literature (Tocci *et al.*, 2007) biometrics. Higher thorax length and higher front shank circumference in males led to a higher Thoracic Index (TI) and to a higher dactyl-thoracic Index (DTI). Other indices were homogeneous between females and males, showing low sexual dimorphism. In a previous study (Tocci *et al.*, 2007) TI and DTI was similar. Low sexual dimorphism was also confirmed by the measures of the different somatic regions.

All tables 1 and 2 measures, the Body Indices in table 3, especially the CI, the relationship between the transversal and longitudinal measures, the legs and thorax conformation, the thorax width, showed a mesomorphic type (Catalano, 1984), with features typical of trotter equines (Meregalli, 1980). In females the maximum thorax development finished over 6 years old. This suggested a late somatic development of thorax, that is very important for the horse dynamic utilization. In account of this it's important a gradual use of the pony, that can be more exploited over 6 years old.

The ischium region (ischium width) ended the development between 5 and 6 years old, when many females foaled. In account of this, the mares showed a larger croup.

The results of table 5 and 6 reconfirmed that the majority of the zoognostic regions of Monterufoli pony ended their development in 3-4 years old equines, and that this pony showed a mesomorphic conformation.

The modern Monterufoli Pony was less dolicomorphic than the "old type". The comparison of these biometrics showed that the pony of 1947 was a meso-dolicomorphic type, suitable in speed and in endurance; in this period the Monterufoli pony was an important means of transporting (Tocci *et al.*, 2007).

CONCLUSION

The new biometrics partially meet the "standard breed" (<http://www.aia.it/>, 2015). The "modern Monterufoli" pony is lower (lower height at withers) than the equine of 1947 and has larger thorax circumference. The "Monterufolino" studied by Braccini was more

dolicomorphic, with higher CI than the modern pony.

The selection involves larger reproducers than those "re-introduced ponies" of 80's which relate the actual "standard breed" (<http://www.aia.it/>, 2015). The higher at withers and at croup heights showed a pony with morphology and biometrics more similar to the Monterufoli pony of 1947 when this equine was more common and valued. In the future, this trend can increase the interest of many horse breeders, which can exploit this pony for adult peoples and not only for children or inexperienced peoples.

The body structure of modern Monterufoli ponies can suggest other uses: in particular the corporal proportion and the development of thorax suggest a driving use. In the past the driving was the main aptitude of Monterufoli pony.

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