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VISUAL IMAGE ANALYSIS TO ESTIMATE MORPHOLOGICAL AND WEIGHT MEASUREMENTS IN RABBITS

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Abstract: Visual Image Analysis (VIA) has been evaluated to estimate morphological traits and weights of live rabbits and carcasses to improve the body conformation of the new breed Leprino di Viterbo. The reliability of VIA was firstly tested on a sample of 30 does. Then, a total of 365 animal (130 additional does and 205 rabbits at slaughtering weight of kg 2.5) was utilised to calculate some surface traits and correlations between live and carcass weights that were later validated over a new sample of 112 rabbits (37 does and 75 fattened). VIA gave very good results to evaluate morphological and weight measurements. Maximum observed individual difference between data measured by metre and by VIA was only 3.6%. Since standard error (SE) of VIA was lower than SE of metre (0.06 and 0.33 respectively), VIA was considered more reliable than the instrumental measurement. A new parameter, Body Side Surface, was made available by the Image Analysis to estimate Live Weight and Carcass Weight efficiently. Correlations were high (P<0.01) both in does (R^2=0.87 for live weight equation) and at slaughter time (R^2=0.82 and 0.76 for live and carcass weight equations, respectively). It was concluded that VIA is a viable, quick and practical mean to measure and select for weight and morphological traits as head length, ear length, body length and body side surface.

Key words: Visual image analysis, morphology, body weight, carcass, rabbit.

INTRODUCTION

Visual Image Analysis (VIA) has been demonstrated as a very practical and easy mean to estimate morphological measurements in different domestic species (Filippi Balestra *et al.,* 1994; Negretti *et al*., 1995; Borggard *et al*., 1996; Kuchida *et al*., 1996; Sakowski *et al*., 1996; Tözsér *et al*., 2000; White *et al.,* 2004; Negretti and Bianconi, 2005). The system is quicker and more reliable than both, subjective linearized descriptive type traits and even instrumental measurements, showing a lower standard error. Moreover it allows easy recording of an electronic permanent archive.

New measurements as angles and surfaces are made possible too, thus increasing the number of parameters to be utilised with selective purposes. Reliable weight estimations (Negretti and Bianconi, 2001; 2002; 2004) are also possible, both on live and carcass weight of different species.

A trial was planned to test the possibility of introducing VIA body measurements in rabbits, considering that biased data could be produced by measurement errors due to the small dimensions of the animals and by the peculiar problem that could rise depending on the presence of the fur.

The purpose of this work was to obtain reliable data to improve the morphological selection of a new Italian breed named Leprino di Viterbo, that is selected to be raised in the open air without any pharmacological treatment, any suspected animal being stamped out (Finzi, 2004).

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MATERIAL AND METHODS

VIA records of rabbits body traits were performed according to a computerised image analysis previously described (Negretti and Bianconi, 2003; Negretti *et al*., 2003; 2004). The opto-informatic system was composed by the following instruments (Figure 1): a digital camera Nikon Coolpix 800, 2.2 million pixels resolution; a laser telemeter Würth WDM 02 allowing continuous distance measurements every 0.5 sec, with an action range between 0.3 and 30 m and a measurement definition of ±5 mm; an image analysis software (Image Tool, 2000) compatible with a personal computer.

The laser allowed measuring directly the distance and calculating the real morphologic parameters (Negretti and Bianconi, 1999). This was an improvement in comparison with a 35 cm reference unit, previously used, that was set at the level of the back of the animals to calculate the dimensions independently from distance.

Animals came from a farm in the open air with quick elimination of any rabbit not perfectly healthy. In terms of breed development, sires with chosen morphological traits were selected from better performing does.

The reliability of VIA, was firstly tested on 30 Leprino di Viterbo does, where body length (BoL), head length (HeL) and ear length (EaL) were measured both by a rigid metre and by VIA and the results were compared.

VIA software allows to calculate surfaces when the perimeter, as in images, is well defined. Body side surface (BSS) was measured, and expressed in cm^2, on 130 does and 205 rabbits at slaughtering weight (2.5 kg live weight at about 11-12 weeks of age). This parameter, that can be easily obtained only by VIA, was then utilised to calculate indirectly live (LW) and carcass weight (CW) (Blasco and Ouhayoun, 1996). Regression equations were calculated. The reliabilities of the obtained equations were then tested on a new sample of 37 does and 75 rabbits at slaughter time. SAS (2003) was used for statistical analysis and GUM ISO (2000) for repeatability.

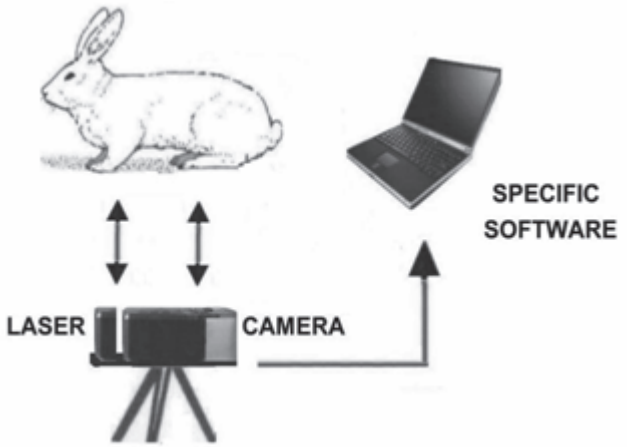

Figure 1: Scheme of the VIA recording.

RESULTS AND DISCUSSION

Observed individual differences between metre and VIA measurements were small. Some data coincided perfectly and the maximum individual differences observed for BoL and HeL were only 2.6% and 3.4% respectively. As a consequence correlation coefficients between VIA and meter measurement were very high (R^2=0.92, 0.99 and 0.95 for BoL, HeL and EaL respectively; P<0.01). To show the reliability of VIA, measurements of EaL are reported in Figure 2. Considering that it gave relatively the worst results in comparison with the measurements for BoL and HeL., nevertheless the observed maximum individual difference between data measured by metre and VIA was only 3.6%.

When repeatability was considered, repeating ten times the same measurement with both systems, Uncertainty of Repeatability (Urip) was 0.06 and 0.49 for HeL and 0.09 and 0.81 for EaL with VIA and metre, respectively. This shows that VIA is a more reliable measurement. The observed standard errors were 0.09 and 0.39 for HeL and 0.10 and 0.98 EaL with VIA and metre, respectively.

Results confirmed the goodness of VIA also when rabbit morphological traits are considered. The smaller dimension of the animals and the presence of fur, due to its homogeneous length, do not impaired the estimate of measurements. Ear length was considered as a trait to be increased to favor thermoregulation when selecting Leprino di Viterbo as a new rabbit breed fit to open air keeping in Mediterranean hot summertime area. Body length was selected for longer loins (Finzi, 1990; Finzi *et al.*, 1997). The results showed that VIA measurements are a viable mean to select for these parameters.

Correlation between live weight and lateral body surface (BSS) in adult does was very high. The calculated equation to estimate live weight (LW) knowing the BSS, expressed in cm^2, was LW = – 4.72 + 0.014 BSS (R^2=0.87; P < 0.01). When such equation was tested on a new sample of does and when both estimated and measured weights were compared (Figure 3), a difference lower than 3% was observed on 65% of the sample, while the remaining 35% showed an error lower than 5%.

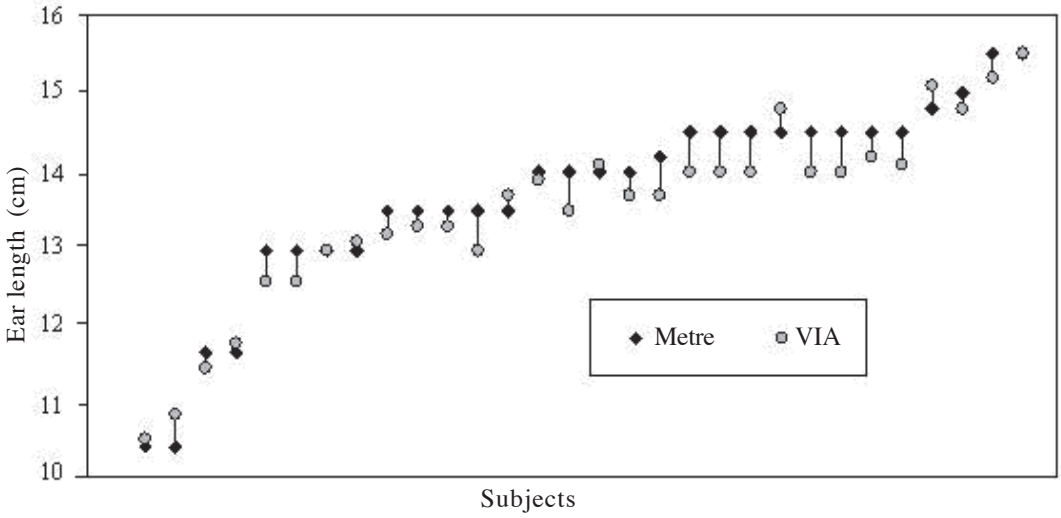

Figure 2: Comparison between metre and VIA measurements taken for Ear Length in adult does. (Subjects are reported on x-axis according to increasing values of metre measurements. Where one symbol only is reported, both metre and VIA data do coincide).

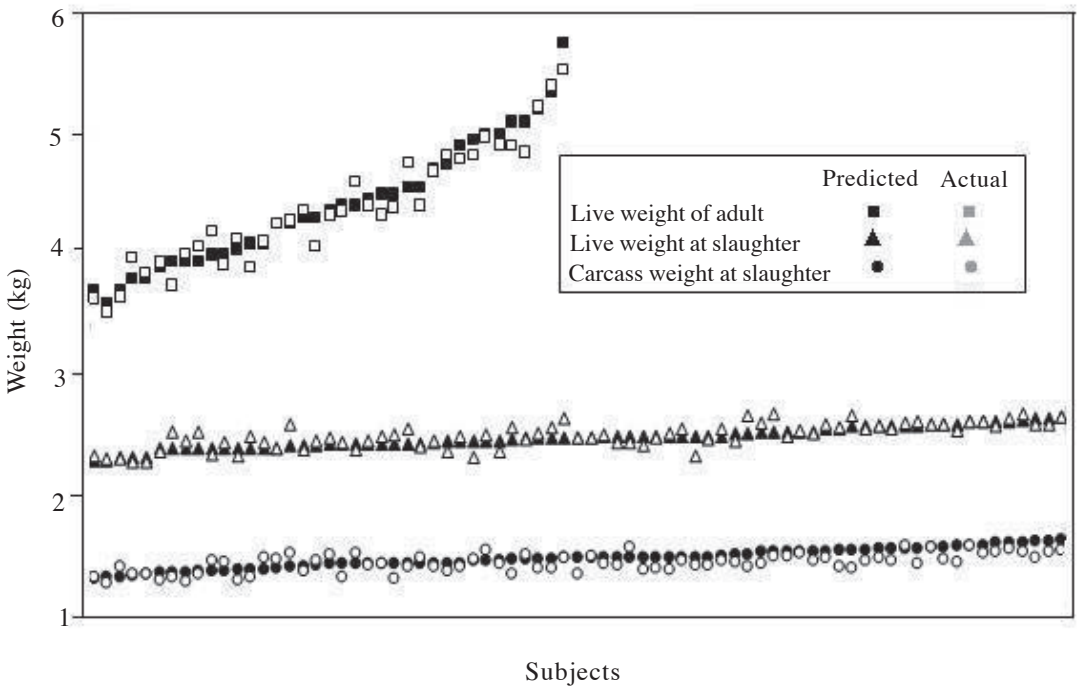

Figure 3: Viability of VIA measurements taken for live and carcass weights (subjects are reported on x-axis according to increasing values of metre measurements. Where one symbol only is reported, both metre and VIA data do coincide).

Similar results (Figure 3) were observed at slaughter time, where R^2 values were 0.82 and 0.76 ($P<0.01$) when BSS was correlated with live and carcass weight, respectively. For the obtained equation LW = –0.30 + 0.006 BSS, when such equation was tested on a new sample, an error lower than 3% for 80% of the sample was observed, lower than 5% for 10% of the sample and lower than 7% for the residual 10%.

When the calculated equation to estimate carcass weight, CW = – 0.67 + 0.00456 BSS, was applied on the new sample, it gave a difference lower than 5% for 65% of the new sample, and lower than 9% for the residual 35%. Estimating carcass weight from measurements of live rabbits was considered to be a main criterion for selective purposes.

Results can be considered satisfactory mainly for adult rabbits which have a considerably higher body weight. When all the data recorded were considered, as to say the previous ones summed with the ones utilized to check the equations, the new equations did not practically change:

Live Weight of adults LW (kg) = – 4.80 + 0.014 BSS (cm^2)

Live Weight at slaughter LW (kg) = – 0.30 + 0.006 BSS (cm^2)

Carcass Weight at slaughter CW (kg) = – 0.45 + 0.004 BSS (cm^2)

CONCLUSIONS

Visual Image Analysis appears as a very reliable system to evaluate rabbit morphology and to estimate body weight and carcass weight by mean of the equations that were validated on a new sample of animals. This type of analysis could be used efficiently as a quick, practical, directly computerized and more precise recording in comparison with metric measurements.

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