Welfare assessment: correlations and integration between a Qualitative Behavioural Assessment and a clinical/ health protocol applied in veal calves farms

Marta Brscic[1], Francoise Wemelsfelder[2], Elena Tessitore[1], Flaviana Gottardo[1], Giulio Cozzi[1], Cornelis G. Van Reenen[3]

[1]Dipartimento di Scienze Animali, Università di Padova, Italy

[2]Sustainable Livestock Systems, Scottish Agricultural College, Edinburgh, United Kingdom

[3]Animal Sciences Group, Wageningen University and Research Centre, Lelystad, the Netherlands

Corresponding author: Marta Brscic. Dipartimento di Scienze Animali, Università di Padova. Viale dell'Università 16, 35020 Legnaro (PD), Italy - Tel. +39 049 8272660 - Fax: +39 049 8272669 - Email: marta.brscic@unipd.it

ABSTRACT - This study is aimed at finding correlations and possible integration among Qualitative Behavioural Assessment (QBA) and a specific protocol of clinical/health evaluation. Both welfare assessment methods were based on direct animal observation and were applied in 24 Italian veal calves farms at 3 weeks (wks) of rearing. Principal component analysis (PCA) summarized 20 QBA descriptors on two main components (PC1 and PC2) with eigenvalues above 4 and explaining 29.6 and 20.3% of the variation respectively. PCA on residuals obtained after correcting for housing condition yielded highly similar results, indicating that the rearing environment of the calves was not an important determinant of the observer reliability of QBA. A relationship was found between QBA PC2 and the presence of signs of cross-sucking recorded during the clinical visit (presence PC2=1.11 *vs.* absence PC2=-1.55, P<0.001). There were no other relations between the quantitative clinical measures and QBA PC's. The frequency of farmer, veterinarian, or industry technician visits to the veal unit significantly affected QBA PC1 and PC2 scores. These results suggest that the 2 methods provide complementary types of information and can each make valid a contribution to an integrated animal welfare monitoring scheme.

Key words: Veal Calves, Welfare Assessment, Qualitative Behavioural Assessment.

Introduction - Farm animal welfare has multidimensional aspects, therefore ideally a multidisciplinary approach would be required for its assessment, including long lists of animal parameters plus environmental, societal and economical issues (McGlone, 2001). Complexity and cost make this approach unrealistic for an on-farm evaluation suggesting the need for a validated feasible and reliable tool. Most of the welfare assessment methods developed so far consisted of resource and environmental rather than animal status descriptors (Botreau *et al*., 2007). One of the difficulties in developing a scientifically sound tool that truly reflect animals conditions is the choice, aggregation and/or integration of parameters (Spoolder *et al*., 2003). The aim of the present study was to compare two different animal-based methodologies applied on veal calf farms. This cattle category faced a major change in rearing conditions over the last years, but it is still subject of criticism concerning welfare conditions. We investigated the relationships between Qualitative Behavioural Assessment (QBA) method, defined as the integration of different aspects of an animal's dynamic style of interaction with the environment (Wemelsfelder *et al*., 2008), and a quantitative clinical/health evaluation, as well as the effects of early stage housing conditions and management practices on both qualitative and quantitative welfare measures.

Material and methods - The two welfare assessment protocols were applied on 24 veal calves fattening units located in Northern Italy. In each farm, a batch of calves (188±82 allocated in 32±17pens) was evaluated at 3 wks of rearing by 1 trained observer, starting after morning milk distribution. The QBA was carried out first. Twenty qualitative descriptors for veal calves (eg. fearful, playful, relaxed, uneasy) were qualitatively scored on a scale from 0 to 125 mm after 20 min of animal behaviour observation (Wemelsfelder *et al.*, 2008). The other monitoring scheme consisted of an interview with the farmer and a clinical/health visit. The number of calves showing symptoms such as abnormal breathing, coughing, nose discharge, bloated rumen, skin infection, lameness, signs of bursitis, lower body condition, cross-sucking/urine-drinking and obvious sickness were recorded, as well as the number of pens with abnormal manure consistency (liquid, thick) and colour (white). Data were submitted to statistical analysis adopting GenStat (GenStat Committee, 2000) with farm as experimental unit. In order to summarise the 20 QBA descriptors, a Principal Component Analysis (PCA) was carried out. PCA was also performed on residuals of the QBA variables obtained after correction for housing condition (small groups with no use of crates, small groups with crates up to 8 wks, or large groups without separators). Clinical/health data were expressed as percentages of calves/pens exhibiting a given problem. Clinical measures showing a low frequency were transformed into binary measures (presence/absence). In order to study the relationship between the two assessment methods scores of principal components PC1 and PC2 obtained after PCA of QBA descriptors were correlated to clinical measures with the use of Spearman rank correlations, or related to binary data using them as fixed effects in a generalized linear model. The effects of housing conditions and management factors on both qualitative and quantitative measures were examined with ANOVA.

Results and conclusions - Principal component analysis was a helpful tool to summarise QBA descriptors. With the exception of the descriptor "calm", there was no cross-loading. Positive and negative mood descriptors had high loadings of opposite signs on PC1, whereas descriptors related to activity and boredom loaded strongly positively and negatively, respectively, on PC2.

Table 1.   First (PC1) and second principal component (PC2) scores of Qualitative Behavioural Assessment (QBA) according to the frequencies of visits of the technician, the veterinarian or the farmer to the veal unit at 3 wks of rearing. ([a,b]=P<0.05 within row).

| PC-QBA	Visitor	Frequency of visits				
		daily	> 2 times/wk	2 times/wk	1 time/wk	1 time every 2 wks
PC1[1]	Technician	-2.47[b]	2.45[a]	0.36[a]	2.00[a]	
PC1[1]	Veterinarian	-3.31[b]		-2.29[ab]	0.78[a]	1.18[a]
PC2[2]	Farmer	0.37[a]		-3.95[b]		

[1]*PC1 summarized positive mood descriptors (relaxed, friendly, sociable and happy) with positive **loadings and negative descriptors** (fearful, agitated,* tense, frustrated, uneasy, apathetic and distressed) *with negative loadings. High scores indicate high positive and low scores* indicate high negative mood.
[2]*PC2 summarized* activity descriptors (active, playful, lively, inquisitive and boisterous) with positive loadings and inactivity descriptors (depressed, indifferent and bored) with negative *loadings. High scores indicate higher activity levels while low scores indicate higher depression, indifference and boredom.*

Eigenvalues were 5.9 and 4.1 and variation explained were 29.6 and 20.3% for PC1 and PC2, respectively. PCA on residuals of QBA descriptors obtained after correcting for housing condition yielded highly similar results, indicating that the rearing environment of the calves was not an important determinant of the variation in QBA scores. This suggests that the reliability of QBA as a welfare assessment tool truly reflects the animal status (Wemelsfelder *et al.*, 2008). The clinical/health evaluation at 3 wks showed a relevant frequency of calves with respiratory problems (5.6% SE=0.98) and cross-sucking/urine-drinking signs (6.3% SE=2.22), and of pens with liquid, thick and white manure (13.2% SE=4.10, 4.7% SE=1.22 and 5.9% SE=2.15, respectively). However, a high variability between farms was observed. No significant correlations were found between QBA PC scores and clinical measures, other than that QBA PC2 was significantly affected by the presence of signs of cross-sucking (average scores of PC2 1.11 *vs.* -1.55 for calves that either did or did not exhibit cross sucking,

respectively, P<0.001). Signs of cross-sucking were related to higher levels of activity and liveliness, possibly due to the fulfilment of calves' need for sucking, and the prompt reaction to urinating pen-mates. However, cross-sucking is an abnormal behaviours that signifies social deprivation, coping stress or nutritional and environmental deficiency (Fraser and Broom, 1997) and so QBA assessors should perhaps be trained to more adequately include this abnormality in their evaluation. Analysis of variance showed that the frequency of visits of the technician or the veterinarian to the veal unit had a significant effect on QBA PC1 scores (Table 1). More fearful, agitated, tense, and frustrated animals were scored in farms with a daily occurrence of unfamiliar person visits, suggesting that the contact with the veterinarian or technician was perceived as negative. The finding support previous results by Lensink *et al.* (2001) that showed higher fearful reactions in calves receiving negative human contact, either by known or unknown people. Blood sampling for haemoglobin level checks and preventive medical treatments carried out on veal calves at the beginning of the fattening may be examples of such negative human-animal interactions.

Figure 1.   The effect of calf housing conditions at 3 weeks of rearing on 1) QBA descriptors *Active* and *Lively*, and 2) the predicted means of the % of calves coughing. Letters a and b=significant differences P<0.05 within descriptor or problem.
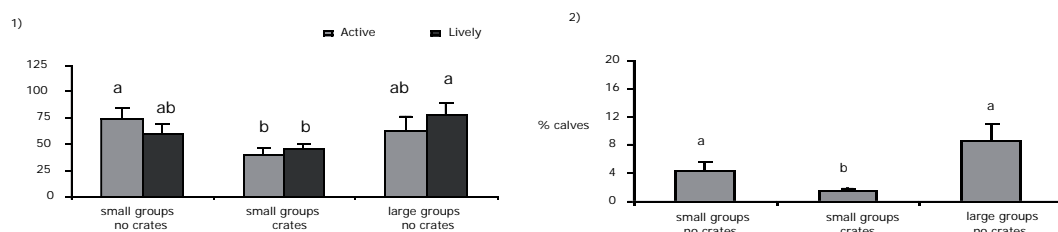
On the contrary, the significant effect of the frequency of farmer visits on PC2, where daily occurrence of farmer presence in the barn was associated with higher scores for active, playful, lively descriptors (Table 1) may reflect the calves' expectancy for feed by the stockman. Individual housing, used to prevent cross-sucking significantly affected QBA descriptors "active" and "lively", with lower average levels for farms where separators were adopted (Figure 1.1). The same housing solution had positive effects on respiratory problems with lower percentage of calves coughing (Figure 1.2). In conclusion, the lack of significant correlations between QBA and clinical animal-based measures indicates a low correspondence between the two assessment methods in this study. However, QBA was sensitive to factors that did not affect clinical measures. The two methods, therefore, appear to provide complementary information and may be suitable to be used in an integrative 'whole animal' welfare assessment tool.

References - Botreau, R., Bonde, M., Butterworth, A., Perny, P., Bracke, M.B.M., Capdeville, J., Veissier, I., 2007. Aggregation of measures to produce an overall assessment of animal welfare. Part 1: a review of existing methods. Animal 1:1179-1187. **Fraser**, A.F., Broom, D.M., (eds.) 1997. Farm animal behaviour and welfare. Wallingford, UK. **GenStat Committee**, 2000. In: R.G. Payne and G.M. Arnold (eds.) Reference manual. Procedure Library PL12, VSN International, Oxford, UK. **Lensink**, B.J., Raussi, S., Boivin, X., Pyykkonen, M., Veissier, I., 2001. Reactions of calves to handling depend on housing condition and previous experience with humans. Appl. Anim. Behav. Sci. 70:187-199. **McGlone**, J.J., 2001. Farm animal welfare in the context of other society issues: Toward sustainable systems. Livest. Prod. Sci. 72: 75-81. **Spoolder,** H., De Rosa, G., Hörning, B., Waiblinger, S., Wemelsfelder, F., 2003. Integrating parameters to assess on-farm welfare. Anim. Welfare. 12:529-534. **Wemelsfelder**, F., Knierim, U., De Rosa, G., Napolitano, F., Haslam, S., 2008. The development of qualitative behaviour assessment as an on-farm welfare inspection tool. Page 52 in Book of abstracts 4th Int. WAFL, Ghent, BE.