PRECISION OF THE TGI 35 L AUSTRIAN ANIMAL NEEDS INDEX FOR ON-FARM ASSESSMENT OF ANIMAL WELFARE (WITH SPECIAL REGARD TO THE TGI 35 L FOR FATTENING PIGS)

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SUMMARY
In Austria animal welfare is assessed by an index system, the TGI 35 L Animal Needs Index, that is broadly accepted and in wide practical use. Its main field of application is the certification of animal products but it can also be used as a guide for the farmer to detect faults in the housing system and as an advisory tool by agricultural advisory agencies. The TGI 35 L is also included in animal welfare legislation. Since this assessment of animal welfare has major consequences, it is important to investigate the quality of assessment. In a current research project the Institute of Agricultural, Environmental and Energy Engineering is examining the precision of TGI assessments in housing systems for dairy cattle, calves, fattening pigs and laying hens. Furthermore, the validity of TGI assessments is being checked by correlating the TGI score with animal health and behavioural parameters. The investigations are also focusing on the development of further parameters for the assessment section under "Stockmanship" of the index to improve the assessment of human-animal relationship on farms. So far, precision of animal welfare assessments has been investigated in 127 houses for dairy cattle, calves, fattening pigs and laying hens in Austria. These TGI assessments gave a repeatability between persons over a range of 56 to 96% and a repeatability within persons over a range of 82 to 96%. The precision of assessment differed between the various sections of the assessment. The results of our studies show that precision of the assessment can be further improved as follows: 1) clarifying the descriptions of some of the criteria that have to be assessed, 2) intensive theoretical and practical training of the assessors, 3) regular exchange of experience between the assessors, and 4) improved co-operation and exchange of experience between the different controlling agencies.

*Keyword*s: animal welfare, TGI, ANI, animal needs index, on-farm assessment

INTRODUCTION
Health and welfare of domestic animals is a prominent issue in society and in all public discussions about animal production. Consumers are increasingly demanding livestock products that are produced with consideration to animals´ needs. Thus there is an urgent need to find reliable, valid and practical methods of assessing animal welfare on farms.

In Austria animal welfare is assessed by an index system, the TGI 35 L Animal Needs Index [Note: TGI, Tiergerechtheitsindex, is a synonym to the abbreviation ANI (Animal Needs Index), which is used in a lot of publications such Bartussek 1999; 2000; 2001a; 2001b]. It is broadly accepted by legislative authorities, farmers, controlling agencies, producer organisations and marketing chains. The TGI index system was firstly introduced in 1985 (Bartussek 1999b, 2001a) and includes the following five aspects that are considered essential for animal well-being:
1) affording movement and locomotion ("locomotion")
2) affording social interaction ("social interaction")
3) type and condition of flooring ("flooring")
4) light and air conditions ("light/air/noise")
5) stockmanship ("stockmanship")

The TGI system includes housing, climate, management and animal related parameters (e.g. condition of integument, condition of hooves). Table 1 gives an overview of the assessment sections and criteria assessed by the TGI scoring system. The sum of all points awarded in the five sections corresponding to the aspects 1-5 above gives the total TGI score. The better the housing system and management by the farmer the higher the TGI score. It is recognised that animals can compensate negative influences in one aspect (e. g. spatial restriction within the stable) by positive ones in another (e. g. outside

exercise). However, minimum standards have to be achieved in each section. If not, the farm is only given a provisional TGI score, and a fixed period of time is allowed to permit improvements before the TGI is scored again. TGI scoring systems exist for cattle, calves, fattening pigs, pregnant sows and laying hens (Bartussek 1995, 1996, 1999a, 2000, 2001b). In Germany a similar index (TGI 200) was derived (Sundrum *et al.* 1994). Even though the structures of both TGI systems differ considerably, assessment results are astonishingly similar (Schatz *et al.* 1997).

Table 1. Overview of the assessment sections and criteria of the TGI 35 L/1996 for cattle

Assessment sections	Columns						
	a	**b**	**c**	**d**	**e**	**f**	**g**
I. Locomotion	loose/group housing		tether systems				
	floor area	lying down, rising	stall size, boundaries	movement of tether	outdoor exercise [days/year]	pasture [days/year]	
II. Social interaction	floor area	herd structure	management of young	outdoor exercise [days/year]	pasture [days/year]		
III. Flooring	lying area						
	softness	cleanliness	slipperiness	activity area	outdoor yards	pasture, alpine pasture	
IV. Light, Air, Noise	daylight in animal house	air quality	draught in lying area	noise	outdoor exercise [days/year]	outdoor [hours/day]	
V. Stockmanship	cleanliness of stable	condition of equipment	condition of integument	cleanliness of animals	condition of hooves	techno-pathies	animal health

The TGI 35 L is in wide practical use in Austria. Since 1995 it has been mainly used in controlling animal welfare in organic farming housing systems with animal welfare currently be assessed on about 20,000 farms by about 150 trained assessors. A second field of application is the certification of "welfare-friendly" animal products on a private law basis (label "tierschutzgeprueft"). In 1995 four Austrian animal protection organisations founded a controlling agency that, for example in 1999, controlled 744 stables that housed 587,896 laying hens using the TGI 35 L (Bartussek 2001c). McDonalds Austria only uses eggs labelled with this trademark. Currently, the controlling agency is considering the introduction of this label for other animal products too. The prices that farmers receive for their products as well as subsidies depend on the result of the welfare assessment. The TGI 35 L can also be used as a guide for the farmer to detect faults in the housing system and as an advisory tool by agricultural advisory agencies. It is also included in animal welfare legislation of the Austrian Federal Provinces Salzburg and Tyrol.

As described above the assessment of animal welfare by the TGI 35 L has major consequences. So it is important to investigate the quality of this assessment tool. Over the last few years, the Institute of Agricultural, Environmental and Energy Engineering (ILUET) has examined the sensitivity (Schatz *et al.* 1997) and the precision of assessment of the TGI 35 L (Amon *et al.* 2001; Kummernecker 1999; Ofner 1999). Currently ILUET is validating the assessment quality of the TGI 35 L Animal Needs Index. Assessments were made on a much broader basis comprising housing systems for cattle, calves, fattening pigs and laying hens. Repeatability of the assessment between persons and within persons was investigated by the same method as in the first project. However, the present project goes much beyond measuring repeatability of assessments. The development of further parameters for the assessment section "Stockmanship" and the correlation between the TGI score and animal health and behavioural parameters are also essential parts of the project. The research project started in February 2001. This paper presents first results on precision of animal welfare assessments casting a closer look at the TGI 35 L for fattening pigs.

MATERIALS AND METHODS
Experimental design
Precision of animal welfare assessments by the "TGI 35 L 1995/96" Animal Needs Index was investigated in 127 houses for cattle, calves, fattening pigs and laying hens in Austria (see Table 2). The TGI assessments were made by 12 different groups of assessors each consisting of 3 persons.

Assessors are employed by 4 different Austrian controlling agencies. On each farm 3 experienced TGI assessors worked at the same time, but independently from each other. One month later, the same farm was once more assessed by the same 3 assessors. Thus, it is possible to calculate the repeatability of assessments and the error standard deviation between and within persons.

Precision of assessment

Precision is the closeness of repeated measurements of the same quantity to each other (Sokal & Rohlf 1995). The research project aims at investigating the precision of the total TGI score as well as the precision achieved in each section of an assessment by using the measures repeatability and error standard deviation. Methodology is described in detail in Amon *et al.* (2001) and Ofner *et al.* (2001).

Repeatability between and within persons. Repeatability ($\hat{w}$) describes the relative similarity of repeated measurements on one object compared with results obtained from measuring different objects (Essl 1987) and is thus a means for quantifying the quality of observations or measurements. Repeatability is influenced by the variance of the farm (s²(b)), the variance caused by the person carrying out the assessment (s²(p)) and the error variance (s²(ε)). A high repeatability between persons means different people assign the same TGI score for a given farm, and high repeatability within persons means the same assessor assigns similar TGI scores to the same farm one month after the first assessment.

Error standard deviation between and within persons. Differences in the TGI scores can be caused by differences between farms, by differences in the assessment of the same farm by different assessors or by differences in the assessment process. The error standard deviation s(ε) is the estimated standard deviation of the TGI scores on a given farm and is an absolute measure of the differences in the TGI scores that can be exclusively traced to the assessment, i.e. to the assessor or to the assessment process. It is therefore a very suitable measure of the precision of the assessment.

Statistical analysis

Data were analyzed by using PROC VARCOMP METHOD=TYPE1 in SAS (Release 6.12).

RESULTS AND DISCUSSION

Repeatability and error standard deviation were different in the TGI versions for different species (table 2). Repeatability between persons of the total TGI score was situated within a range of 56 to 96 %, repeatability within persons was in the range of 82 to 96 %. The error standard deviation between persons was situated within a range of 1.15 to 2.52 TGI points, error standard deviation within persons within a range of 1.15 to 1.77 TGI points. The differences in precision between the TGI versions for different species may be caused by differences in the experience of the assessors in the application of the single versions. For example, due to the Austrian agricultural structure the TGI for cattle is the most applied TGI version. A more intensive co-operation between the controlling agencies would also help to improve the precision of assessment.

Table 2. Repeatability and error standard deviation between and within persons of the total score of the TGI 35 L Austrian Animal Needs Index

TGI version for:	Assessed farms [n]	Repeatability		Error standard deviation [TGI points]	
		between persons	within persons	Between persons	within persons
cattle	70	0.96	0.96	1.15	1.15
calves	17	0.97	0.97	1.13	1.04
fattening pigs	20	0.81	0.82	1.81	1.77
laying hens	20	0.56	0.86	2.52	1.42

TGI assessments of houses for fattening pigs gave a repeatability between persons of 81% and within persons of 82%, that can be designated as medium to high value. It can also be derived that the assessor hardly influences the result of the welfare assessment. The error standard deviation between persons was 1.81 TGI points and within persons 1.77 TGI points. With a confidence interval of 95%, 95% of all TGI scores lie in the area of "true TGI score ± 2 s(ε)". i.e., if 100 assessors assessed the TGI score on one farm, only 5 assessments would show a larger deviation from the true TGI score than ± 3.62 and ± 3.54 points respectively.

The precision of assessment differed between the sections of assessment. This fact is described in detail in Ofner *et al.* (2001) for the TGI 35 L for cattle and in table 3 of this paper for the TGI 35 L for fattening pigs. "Locomotion" and "social interaction" showed high repeatability and can therefore be assessed with high precision. "Flooring" and "light/air/noise" showed medium repeatability. "Stockmanship" had a low repeatability. High repeatability goes along with low error standard deviation and vice versa.

The differences differences in precision between the various sections can be traced to the criteria that have to be assessed, to the experience of the assessors and to the co-ordination between the assessors. If criteria can be measured objectively repeatability is high. If they also have a qualitative component repeatability is lower. However, animal welfare is a complex phenomenon that cannot be fully described only by objective criteria. Qualitative criteria are very important for a comprehensive assessment of animal welfare and should, therefore, not be excluded from the TGI system.

In conclusion the following measures should be implemented to further reduce the error standard deviation:
- improve the descriptions of the criteria that have to be assessed (e. g. technopathies, cleanliness)
- intensive theoretical and practical training of the assessors (to accompany existing training manuals)
- regular exchange of experience between the assessors
- improved co-operation and exchange of experience between the controlling agencies

Table 3. Repeatability and error standard deviation between and within persons of the TGI 35 L for fattening pigs in the five sections of assessment (n = 20 assessed farms)

Assessment section	Repeatability		Error standard deviation [TGI points]	
	between persons	within persons	between persons	within persons
Locomotion	0.82	0.82	0.41	0.40
Social interaction	0,82	0.83	0.52	0.50
Flooring	0.64	0.62	0.76	0.78
Light/Air/Noise	0.61	0.70	0.77	0.67
Stockmanship	0.40	0.52	0.93	0.83

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