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# Recording of body weight and body condition development of dairy cows with the aid of visual and technical methods

Dairy farmers know the strong influence of an ideal body condition on the first 100 days of lactation. Just through an optimal body condition the period of a negative energy balance can be as short as possible. The question is which opportunities are provided to the farmer to score the body condition of the cows. Therefore it was the aim of a diploma thesis to evaluate the techniques of automated body weight measurement, of body condition scoring and of back fat thickness (BFT) measurement on the dairy herd of the research farm Frankenforst.

## Keywords
**Dairy farming, body weight development, body condition, first 100 days, visual and technical evaluation**

## Abstract
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■■ A strongly increasing energy requirement for maintenance and performance as well as a limited intake capacity for dry matter leads to a negative energy balance for high performance animals at the beginning of lactation. The highest milk performance is usually reached in the first three to seven weeks whereas a maximum in the feed intake is first possible after eight to fifteen weeks. To bridge this period in the best possible manner, it is important to achieve an optimum body condition already at the end of the previous lactation. Animals that are too fat frequently have difficulties with calving and worse feed intake afterwards. This can then result in metabolism and fertility disorders. On the other hand, a cow that is too thin lacks the reserves for the start in the new lactation.

## Available measurement methods
To adapt the feeding to the requirements of the individual animal, the body condition of the animal must first be evaluated. Body weight measurement, body condition scoring (BCS) or back fat thickness measurement (BFT) are available to the practical user. In the past years, a research group tested the automatic BCS determination for dairy cows. However, this technique is not yet used in practice [1].

For the determination of the body weight, various animal scales are offered to the dairy farmers which are usually installed in a stationary manner in the return path from the milking parlour or in the concentrate feeder. By means of an antenna built into the scales, the individual cow can be identified with the aid of its transponder. The recorded weight, coupled with the animal number, is transmitted to a computer and can be evaluated with the aid of a programmed process.

The body condition scoring is a subjective method [2; 3] that evaluates the nutritional state based on visually and/or tactilely acquired exterior characteristics [4; 5; 6; 7; 8]. Here, the extent of the fat and muscle tissue that covers the various bone protrusions on the individual animals is estimated [9].

Various evaluation schemes are available to the evaluator for assigning grades. These were developed in various countries and differ to some extent in the grade scale used as well as in the descriptiveness.

An additional method for the estimation of the body condition is the measurement of the thickness of the fat on the back of the animal. Here, the thickness of the subcutaneous fat layer in the area of the back is determined with the aid of an ultrasonic instrument [8]. According to Staufenbiel (1997) [8], the thickness of the fat on the back reflects with high accuracy the body fat content of the cow. Correlations of 0.8 to 0.9 have been determined. The best measurement point is located in the sacral region of the cow. This lies on an imaginary line between the hip hump and ischium hump in the area of the last fourth and last fifth of the line, i.e. approx. a hand-width from the perceptible ischium hump [3; 8; 10; 11; 12].

The BFT measured value always includes the skin thickness. This is three to five mm at the sacral measuring point [13].

## Material und methods

The investigations described here were conducted in the period of December 2009 to March 2010 at the Frankenforst research farm of the Bonn University. The Holstein-Friesian herd, which was housed in a new, open, free stall barn with outside positioned feed alley and separate milking house, included 61 animals, 53 of which were included in the investigation.

The Body Weight (BW) of cows at Frankenforst was determined starting in December 2009 two times daily after the milking procedure by means of a stationary animal scale from the Insentec Company.

BCS according to [2] was performed in intervals of two weeks. For this BCS procedure, the evaluation takes place on a scale of 1 to 5 with subdivisions in 0.25 steps. Eight defined body locations were evaluated by means of manual contact and visual observation [2; 14]. The region around the lateral and spinal protrusions of the lumbar vertebrae, the area of pelvis and the onset of the tail were evaluated [2].

The individual body areas were classified separately and then an average value was formed which resulted in the overall grade for the condition of the dairy cow [4]. The animals were evaluated by visual observation and manual contact after the evening milking by three persons.

The BFT of the animals under investigation was determined with the aid of ultrasonographic representation. A stationary ultrasonic instrument of the type Echokamera SSD – 500 linear/convex scanner (1990) from the Eickemeyer® Company, Tuttlingen, Germany, was used. The instrument was equipped with a 5.0 MHz linear/convex scanner. Sonograms were recorded with the aid of the B-image technique.

The measurements were made every two weeks after the evening milking in the stationary scale installed at the operation since there was no other possibility for holding the animals still.

## Selected results and discussion

Animal scales with electronic identification and recording equipment are necessary to be able to acquire the body weight development. As in previous investigations by other authors, fluctuation also occurred for the investigations presented here in the animal weights between the individual measurements. This can be attributed mainly to the many different influencing factors such as, for example, the varying degree that the digestive tract is filled as well as the growth of the foetuses. Since the scales record the complete animal weight, no information can be derived from the weight data with respect to the fat or protein depositions. According to the statement of [15], the body weighing is therefore not suitable for the evaluation of the body fat content. The layout and therefore the comparison with an optimised curve is not possible since the animal weight is very different depending on the frame size, age and lactation of the cow. It should be noted that an algorithm has been developed from [16] that should correct the weight data for the known 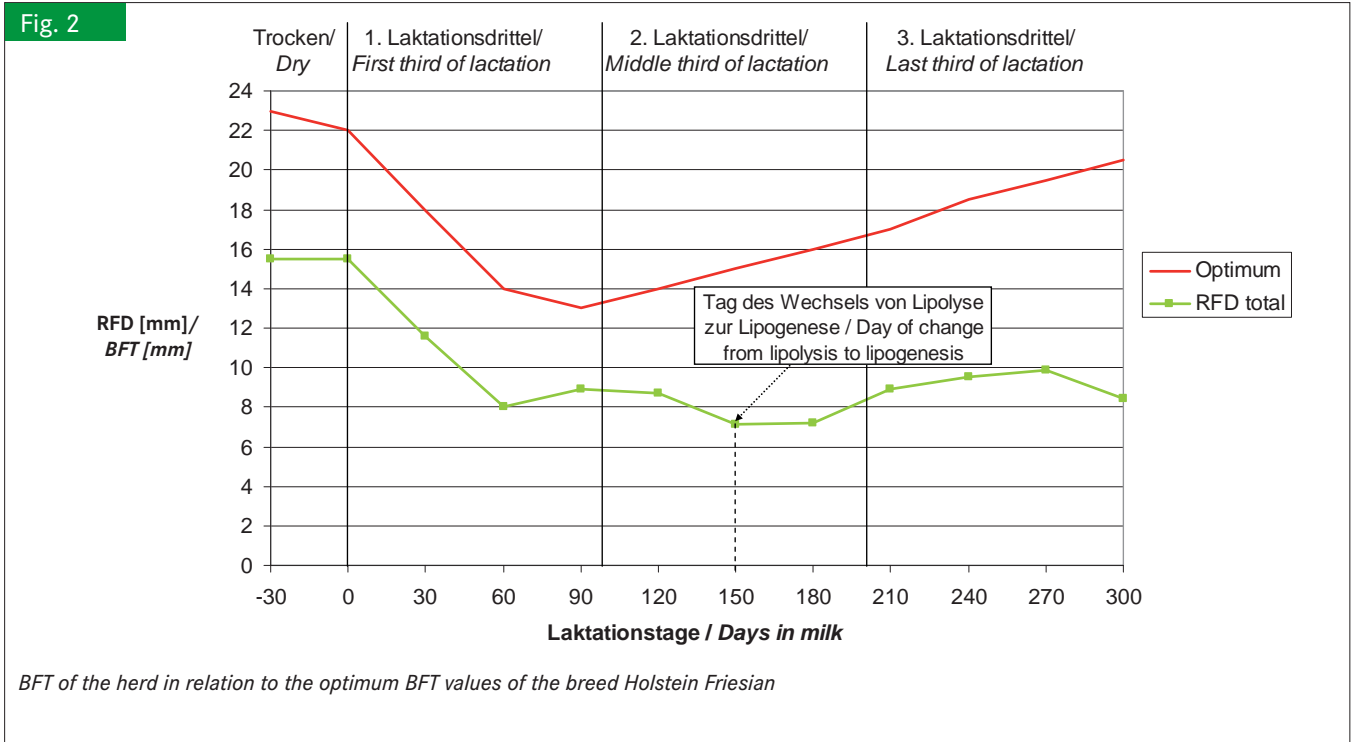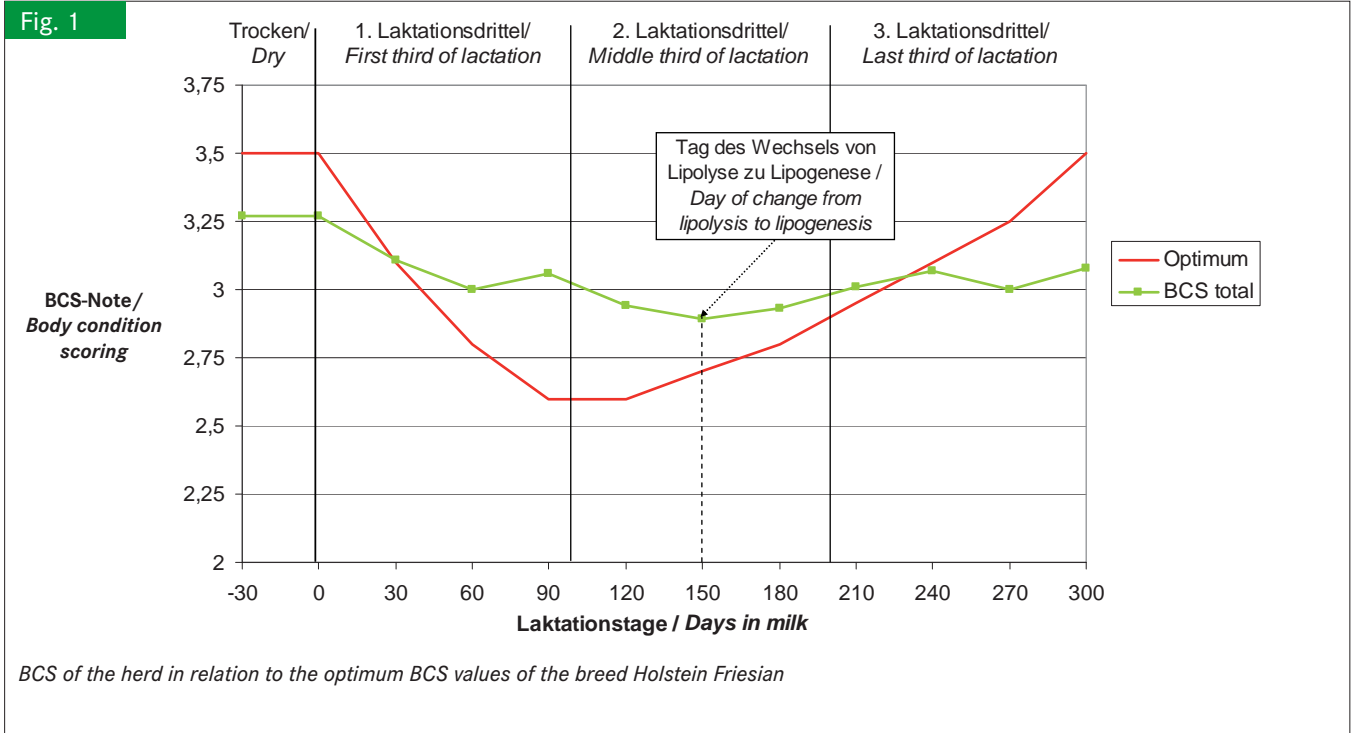influencing factors. In this manner, the significance of the weight data with respect to the condition can presumably be improved in the future. However, within the framework of this investigation, this new software was not available yet.

The BCS procedure is easy to learn and can be applied without technical aids or investments. For the evaluation of the grades obtained, the observer can perform a comparison with an optimised curve. For the animals investigated, it was possible to produce a typical condition progression over the lactation with the aid of BCS (**figure 1**). According to [4], this method represents a suitable instrument for the examination of the energy budget and the associated feeding management. The subjectivity of this procedure is to be considered as critical. According to [9], the condition grade in the progress of the lactation should not fall under 2.5. This value was maintained in this investigation. However, it is questionable whether the maintaining of the minimum value is based on the actual low weight decrease of the animals or on the observers not utilising the grade scale.

After a short introduction, BFT measuring is a simple and quickly learned method. On the negative side of the ledger are the considerable procurement costs of an ultrasonic instrument. In the investigation, a typical progression of the condition for the duration of the lactation could be produced for all animals (**figure 2**). Similar to the BCS procedure, a comparison with an optimised curve can also be performed here. However, for this comparison, the measured values recorded lie under the strived for optimised curve.

According to [7], the BFT measurement is a suitable method for quantifying the body energy content and for displaying the changes.

In **table 1**, the three applied procedures are finally displayed in a utility value analysis complete matrix taking into consideration relevant practice evaluation criteria.

Fig. 1



BCS of the herd in relation to the optimum BCS values of the breed Holstein Friesian

Fig. 2



BFT of the herd in relation to the optimum BFT values of the breed Holstein Friesian

## Conclusions

In the comparison of the applied condition determining methods, agreement was nearly reached in the average condition progression of the herd in the course of lactation. A reduction in the condition at the beginning of lactation can be seen for all applied procedures. The herd reached its minimum condition according to the body mass weighing as well as for the application of the BCS or the BFT method on the 150th day after the calving. Valid for all three applied procedures is that the significance of the condition evaluation is higher at the herd level than at the level of the individual animal.

All three procedures have advantages and disadvantages. The decision as to which evaluation method to apply in practice is dependent on the barn circumstances, the preferences of the farm manager and the technical installations as well as the willingness to invest.

Based on the condition, metabolism problems in the course of lactation, performance declines and fertility problems can be

*Evaluation of the applied methods of body-condition quantification*

| Bewertungsmerkmal/<br>*Assessment criteria* \ Methode der Konditionsbeurteilung/<br>*Methods of body-condition quantification* | Körpermassewägung/<br>*Body weight measurement* | BCS/<br>*Body condition scoring* | RFD/<br>*Back fat thickness measurement* |
|---|---|---|---|
| Kapitalbedarf/*Capital needs* | ++ | +/- | +++ |
| Einarbeitungsaufwand/*Costs for familiarisation* | +/- | ++ | ++ |
| Zeitaufwand/*Expenditure of time* | +/- | ++ | ++ |
| Genauigkeit/*Accuracy* | +/- | + | ++ |
| Automatisierbarkeit/*Potential of automatisation* | ++ | + | +/- |
| Praxistauglichkeit/*Suitability for daily use* | ++ | +++ | + |

+++ sehr hoch/ *very high*, ++ hoch/ *high*, + gering/ *low*, +/- kein(e)/ *none*

recognised in a timely manner. The regular application of condition evaluation with the object of achieving optimum condition can counteract these factors. In operations with performance groups and different TMR offers, the animals can be regularly assigned to the appropriate groups in this manner. Especially scales with a connected selection unit would offer an advantageous solution for this purpose.

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