Algorithms for Identifying Errors in Individual Feed Intake Data of Growing Pigs in Group-housing

J. J. Eissen, E. Kanis, J. W. M. Merks

Abstract. *The present study describes algorithms for identifying errors in feed intake data of pigs, recorded with single-space computerized feeding stations. Potential causes of errors are failed identification of pigs or an incorrect recording of feeder weight or time by the feeding station. Feed intake data of 250 pigs, divided into 30 groups, were analyzed. Data contained 385,329 records on visits of which 0.95% had no identification. Nine algorithms were developed to check data for errors caused by incorrect recordings. Algorithms focused on feed intake per visit, feeding rate per visit, or on the similarity of recorded feeder weights of subsequent visits. By using all nine algorithms, 6% of the visits were classified as being incorrect. The numbers of errors needs to be kept small, as it is impossible to adjust feed intake data without bias. Results indicated several instances where a feeding station functioned sub-optimally during a period of days or weeks. Frequent checking and correction of a feeding station function during recording would, therefore, reduce these errors. Expanding a feeding station's software with the editing system described herein would allow a daily check of recorded data for errors. Furthermore, frequent maintenance of feeding stations will probably reduce the number of incorrect recordings.*
Keywords. *Feed station monitoring, Swine feeding, Unidentified visits.*

The use of single-space computerized feeding stations for recording individual feed intake data of growing pigs in group housing has been the subject of several studies in recent years (e.g., De Haer, 1992; Labroue et al., 1994; Nielsen, 1995; Ramaekers, 1996). Feeding stations may be used for monitoring or controlling feed intake of pigs, or as part of scientific studies (Knap, 1995). Three common feed intake traits are feed intake, number of visits, and total visiting time per pig per day which can be used, for example, as selection traits in pig breeding programs (De Haer and De Vries, 1993; Von Felde et al., 1996; Labroue et al., 1997).

The functioning of feeding stations is not error-free (Knap and Van der Steen, 1994; De Haer et al., 1992; Nielsen, 1995; Ramaekers, 1996). In the literature, feed intake data from feeding stations were analyzed after errors had been adjusted for when recording was completed. It would be useful, however, to detect errors during recording to check and correct the functioning of a feeding station. The objective of this study was to develop algorithms to monitor feeding station operation by checking recorded feed intake data frequently for errors. Errors and algorithms to trace errors in feed intake data have not been described in literature, probably because feeding station software does not indicate where most errors occur. Hence, computerized algorithms to check feed intake data for errors were developed in this study, and criteria for these algorithms to identify errors were derived.

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Materials and Methods

Equipment and Recorded Data per Visit

Data on individual feed intake recorded by IVOG®-feeding stations (Insentec, Marknesse, the Netherlands) were studied. The feeding station consists of an unprotected single space feeder (containing a trough), a load cell to weigh the feeder, a reservoir above the feeder, and two antennas (De Haer et al., 1992). Each pig carries an ear transponder that is activated when it is recognized by the antennas. The entrance to the feeder is adjustable in height and width to prevent two pigs from occupying the station at the same time. Weighing of the feeder is continuous with an accuracy of ±10 grams within a range of 0 to 50 kg. If feeder weight drops below a preset minimum (e.g., empty feeder weight +8 kg of feed), the feeder is automatically filled with a preset amount of feed from the reservoir. Water was supplied outside the feeding station.

A feeding station records feeder weight and time at the beginning (start weight and time) and the end (final weight and time) of each visit, together with the identification number of the animal, pen number, and date. A visit starts when the antennas recognize the transponder of a pig. A visit ends when the station stops detecting the transponder, or when the station recognizes another 'stronger' transponder. The IVOG-feeding station starts recording a visit without identification when feeder weight drops considerably within a relatively short period, and no transponder is recognized by the antennas. An unidentified

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visit ends when feeder weight has been constant for a period or when a transponder is recognized by the antennas (Insentec, Marknesse, the Netherlands).

After each identified or unidentified visit, feed intake of the visit is computed as start weight minus final weight and duration is computed as difference (min.sec) between start time and final time. A data file in the computer controlling the feeding station stores all visits in chronological order, including fill-ups of the feeder. After collecting data from feeding stations, an extra column per visit was added to the data file for feeding rate per visit, which is feed intake divided by duration of a visit (g/min). Table 1 shows a fictive example of data on feed intake per visit.

Algorithms and Criteria to Identify Errors

Based on literature (Knap, 1995; De Haer et al., 1992) and the authors' own experiences with feed intake recordings, errors were divided into two categories. Type A errors are unidentified visits, which can easily be traced in the data (e.g., Visit 8, table 1). An error of type A1 can occur when a transponder is out of order or when a pig loses its transponder (De Haer et al., 1992; Knap and Van der Steen, 1994; Nielsen, 1995), error A2 can occur when two visits happen in rapid succession (Nielsen, 1995), error A3 can occur when the quality of a transponder signal is decreasing, or error A4 can occur when identification system tuning is sub-optimal. If the quality of a transponder signal is decreasing, a transponder needs to be closer to the antennas before the feeding station recognizes the identification. Errors A1 and A3 only affect pigs with a transponder problem; whereas, errors A2 and A4 may affect any pig. To diagnose possible causes of failed identification, the number of unidentified visits per station per test day was studied, as well as feed intake and duration of unidentified visits and total daily feed intake during unidentified visits.

Type B errors are caused by incorrect recordings of feeder weight or time, and include both identified and unidentified visits. Error B1 includes an incorrect recording of start or final feeder weight, resulting in an incorrect value of feed intake of a visit. A possible cause of an incorrect feeder weight is accumulation of material under the feeder (De Haer et al., 1992; Knap and Van der Steen, 1994). Error B2 includes an incorrect recording caused by software that controls functioning of a feeding station. A B2 error may occur, for example, when a feeding station cannot record the feeder weight correctly because two visits occur in rapid succession. Final weight of the first visit and start weight of the second visit have to be generated according to software procedures. Error B3 originates from a pig that is identified by the feeding station while in proximity, but not eating (Von Felde, 1996). B3 errors may be caused by a sub-optimal tuning of the identification system.

Algorithms and criteria were developed to identify type B errors in the data (table 2), as these errors were not indicated by the software of a feeding station. Algorithms focused on feed intake per visit, feeding rate per visit, or on similarity of feeder weight recordings of subsequent visits. Some criteria were derived as a result of the analysis. Therefore, justification of algorithms and criteria is presented in the results section.

Feed Intake Data

Individual data on *ad-libitum* feed intake of 250 growing pigs were used for this study. Data were recorded by IVOG-feeding stations at three breeding herds of Stamboek and Dumeco Breeding. Pigs were tested in groups of 6 to 12 per pen, for a variable period with a maximum of 110 days (on average 91 days). Data contained 385,329 records on visits of which 3,659 were unidentified (0.95%). There were 105,511 records on filling up the feeder. At herd 1, six feeding stations were used during one test period (groups 1.1 to 6.1 which signify number of feeding station.test period). At herds 2 and 3, six feeding stations were used during two successive test periods (groups 7.1/7.2 to 12.1/12.2 for herd 2 and groups 13.1/13.2 to 18.1/18.2 for herd 3). Results are presented per group in figures 3 and 6. In total, 30 groups were tested with 18 feeding stations during 2,714 test days.

Table 1. Fictive example of data on feed intake per visit*

Visits	Animal Identity/ Fill-up	Start Weight (kg)	Final Weight (kg)	Feed Intake (kg)	Start Time (h:min:sec)	Final Time (h:min:sec)	Duration (min.sec)	Feeding Rate (g/min)
1	Fill-up	8.92	9.48	–0.56	17:26:01	17:26:03	0.02	-
2	17330577	9.48	9.48	0.00	17:26:20	17:26:32	0.12	0.0
3	17324881	9.48	9.24	0.24	17:26:34	17:32:21	5.47	41.5
4	17324881	9.25	9.74	**–0.49**	17:32:41	17:32:51	0.10	–2,940.0
5	17341906	9.74	9.02	0.72	17:33:12	17:37:19	4.07	**174.9**
6	17334418	9.02	8.54	0.48	17:40:22	17:54:09	13.47	34.8
7	17334374	8.54	8.56	–0.02	17:54:19	17:54:42	0.23	–52.2
8	Unidentified	8.56	**8.34**	0.22	17:54:43	17:57:50	3.07	70.6
9	17341906	**8.30**	7.84	0.46	17:57:53	18:08:33	10.40	43.1
10	Fill-up	7.84	7.84	0.00	18:08:43	18:08:43	0.00	-
11	17341906	8.40	8.40	0.00	18:08:45	18:08:59	0.14	0.0

* Date and pen number are the same for all visits and are, therefore, omitted. Values classified as being incorrect by the algorithms have been printed in bold type.

Table 2. Overview of algorithms and criteria used to identify incorrect recordings of feeder weight or time (type B errors)

Algorithm	Feed Intake Information	Visits Involved	Criteria for Classifying Recordings as Incorrect
1	Feed intake per visit (FIV)	All	FIV < –0.02 kg
2		All	FIV > 2.00 kg
3		Duration = 0 s	Abs (FIV) > 0.01 kg
4	Feeding rate per visit (FRV)*	0.00 < FIV < 0.05 kg (category I)	FRV > 600.00 g/min.
5		FIV ≥ 0.05 kg, preceding or following a visit with FIV < –0.02 kg (category IIa)	FRV > 110.00 g/min.
6		FIV ≥ 0.05 kg, not preceding or following a visit with FIV < –0.02 kg (category IIb)	FRV > 150.00 g/min.
7		FRV = 0 g/min	Duration > 250 s
8		All, except for FRV = 0 g/min	Abs (FRV) ≤ 2.00g/min.
9	'Difference'† (DIF)	All, except visits with 0.40 ≤ DIF ≤ 0.70 kg preceded by a fill-up	Abs (DIF) > 0.02 kg‡

* FRV was not computed for visits lasting zero seconds.
† Difference = start weight of present visit – final weight of preceding visit.
‡ Present visit and its preceding visit are classified as being incorrect.

Results

Unidentified Visits

Feed intake per unidentified visit ranged from –1.27 to 9.11 kg, and duration of unidentified visits ranged from zero seconds to more than 22 min. More than 82% of unidentified visits had a feed intake ≤ 0.05 kg; whereas, only 45% of all visits had a feed intake ≤ 0.05 kg (fig. 1). Furthermore, 85% of unidentified visits lasted ≤ 50 s; whereas, only 29% of all visits lasted ≤ 50 s (fig. 2).

Of the 2,714 test days, 52.8% had zero unidentified visits, 34.0% had 0 < unidentified visits ≤ 2, and 9.1% had 2 < unidentified visits ≤ 5. A proportion of 0.4% of test days had more than 25 unidentified visits, up to a maximum of 44. Figure 1 shows the distribution of total daily feed intake during unidentified visits of all test days with ≥ 1 unidentified visits. A proportion of 62% of these test days had a total daily feed intake ≤ 0.05 kg.

Groups 2.1 and 11.2 had more unidentified visits than other groups (fig. 3). Both groups had a period of 20 test days with > 19 unidentified visits per day (on average) and a total daily feed intake during unidentified visits > 0.6 kg. As each transponder was recognized daily during these periods, loss of a transponder (error A1) was not the cause of these results.

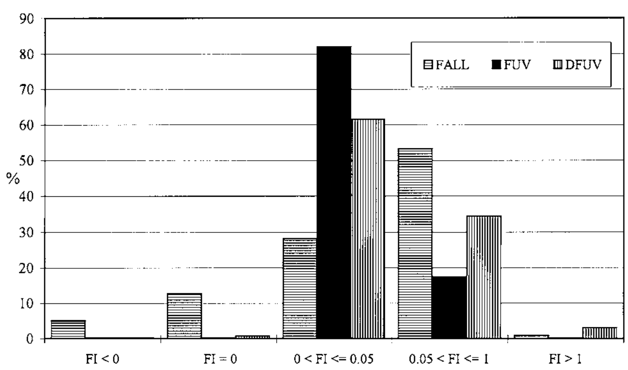

Figure 1–Distribution of feed intake per visit of all visits (FALL; N = 385,329) and of unidentified visits (FUV; N = 3,659), and total daily feed intake during unidentified visits (DFUV) per station of test days with at least one unidentified visit (N = 1,280).

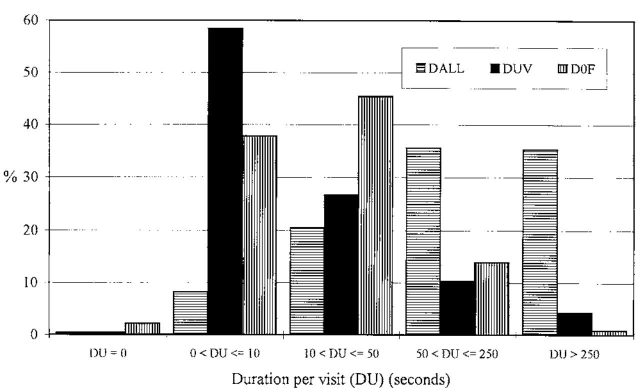

Figure 2–Distribution of duration per visit of all visits (DALL; N = 385,329), of unidentified visits (DUV; N = 3,659), and of visits with feed intake equal to zero kg (D0F; N = 48,732).

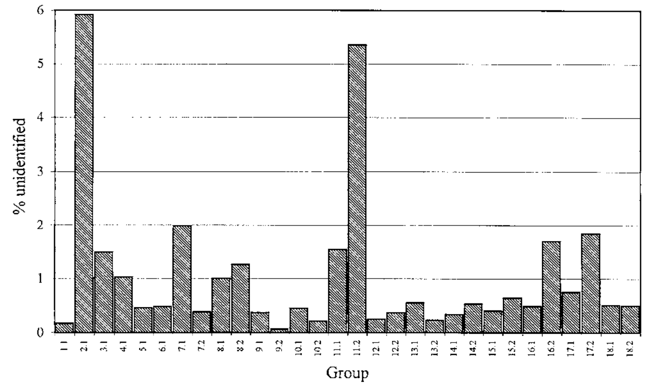

Figure 3–Proportion of unidentified visits per group.

Justification of Algorithms and Criteria for Identifying Incorrect Measurements of Feeder Weight or Time

In total, nine algorithms were developed as summarized in table 2. The number of visits classified as being incorrect are presented per algorithm in table 4. The first three algorithms focused on feed intake per visit, which ranged from –9.23 kg up to 19.98 kg. An incorrect value for feed intake per visit is caused by an incorrect recording of start or final feeder weight. Algorithm 1 focused on visits with a negative value for feed intake. A negative value means that final feeder weight was larger than start feeder weight. A small increase in feeder weight during a visit may be the result of, for example, an amount of saliva falling from a pig's mouth into the feeder's trough. If no feed is eaten during such a visit, the result will be a negative value for feed intake. Furthermore, a small change in feeder weight may cause a change in recorded feeder weight of 10 grams due to rounding. Negative values of feed intake per visit of –0.02 and –0.01 kg, therefore, were tolerated (e.g., Visit 7, table 1); whereas, values < –0.02 kg were arbitrarily classified as being incorrect (e.g., Visit 4, table 1).

Algorithm 2 focused on large values for feed intake per visit. Based on the analysis, it was decided to classify visits with a feed intake > 2 kg as being incorrect. Algorithm 3 focused on visits lasting zero seconds. In the data, values found for feed intake ranged from –0.52 to 0.93 kg. Feed intake of such a visit is expected to be zero kg. Intake data, however, may deviate slightly from zero due to a small change in feeder weight, combined with rounding. Therefore, visits lasting zero seconds were only classified as being incorrect if the absolute value for feed intake was > 0.01 kg.

Algorithms 4-8 focused on feeding rate per visit (FRV) of visits lasting ≥ 1 s. Algorithms 4-6 checked for large values for FRV caused by an incorrect recording of start or final feeder weight. Calculating the FRV as feed intake divided by duration of a visit introduces a high level of variation. Short visits often result in a large FRV value when a mouthful of feed is taken from the feeder (Nielsen, 1995). Therefore, two categories of visits were distinguished: (I) 0 kg < feed intake < 0.05 kg (algorithm 4); and (II) feed intake ≥ 0.05 kg. Within category II, visits were divided over two sub categories: IIa, visits directly preceding or following a visit with a feed intake < –0.02 kg (algorithm 5), and IIb all other visits (algorithm 6). Visits with a negative value for feed intake were often directly preceded or followed by a visit with an elevated positive feed intake value (e.g., Visits 4 and 5, table 1). Category IIa visits were, therefore, subjected to more stringent criteria for FRV than category IIb visits. Figure 4 shows the distribution of FRV of category I, IIa and IIb visits. Criteria were arbitrarily set to FRV > 600 (algorithm 4), FRV > 110 (algorithm 5), and FRV > 150 g/min (algorithm 6).

Algorithms 7 and 8 checked for small absolute values for FRV of visits, caused by an incorrect recording of start or final feeder weight or time (error B3). Visits with FRV equal to zero g/min, that lasted more than 250 s (D0F, fig. 2) were arbitrarily classified as being incorrect (algorithm 7). Visits with an absolute value 0 < FRV ≤ 2 g/min were also classified as being incorrect (algorithm 8).

Algorithm 9 examined the connection between subsequent visits by calculating 'difference', which is defined as start weight of one visit minus final weight of the preceding visit (table 3). Values found for difference varied from –30.27 to 19.98 kg. Assuming there were no environmental effects on feeder weight, difference should equal 0. Because conditions may change slightly between visits, small absolute values for difference up to 0.02 kg were tolerated (e.g., Visits 3 and 4, table 1). If a feeding station fails to record final feeder weight of a fill-up before a pig is identified, then final weight is set equal to the start weight of the fill-up. Start weight of the visit, subsequently, is computed as start weight of the fill-up plus average size (kg) of the last ten undisturbed fill-ups (e.g., Visit 11, table 1; Knap and Van der Steen, 1994). In the data, close to 99% of all fill-up sizes differing from zero kg varied from 0.40 to 0.70 kg. Visits with 0.40 ≤ difference ≤ 0.70 kg, preceded by a fill-up with equal start and final feeder weights, therefore, were also considered to be correct. In all other cases, however, both the present and its preceding visit were classified as being incorrect because it was generally not clear whether start weight of the present visit or final weight of the preceding visit was incorrect (e.g., Visits 8 and 9, table 1).

Applying the criteria of all nine algorithms resulted in 23,217 visits classified as being incorrect, or 6.0% of all visits. Some visits were incorrect due to more than one algorithm. The overlap, as indicated in table 4, was caused largely by algorithms 1 and 9. Algorithm 2 also indicates pronounced overlap with algorithms 5 and 6. The table indicates that 90% of visits (62.2 + 27.8) with feed intake greater that 2 kg also had high feeding rates.

Large differences were found between groups concerning proportion of incorrect visits (fig. 5). Table 5 presents the distribution of incorrect visits per algorithm for each group with at least 10% visits classified as being incorrect. Each of these groups had a period of at least two weeks with a relatively large proportion of incorrect visits, indicating that the feeding station was functioning sub-optimally during this period. In each case either algorithm 1 or 9 was the main cause of the large proportion of incorrect visits.

Table 4. Number (N) of unidentified visits (UV) and visits classified as being incorrect per algorithm*, and their degree of overlap as % of N

Algo-rithm	UV	1	2	3	4	5	6	7	8	9
UV		0.0	4.4	9.5	76.1	8.7	9.1	-	-	6.7
1	0.1		-	15.2	-	-	-	-	1.1	18.6
2	0.1	-		-	-	3.0	1.3	-	-	0.3
3	0.3	0.2	-		-	-	-	-	-	0.1
4	16.2	-	-	-		-	-	-	-	2.7
5	4.4	-	62.2	-	-		-	-	-	2.3
6	5.4	-	27.8	-	-	-		-	-	1.6
7	-	-	-	-	-	-	-		-	0.3
8	-	0.0	-	-	-	-	-	-		0.4
9	22.6	26.6	41.1	16.2	42.2	15.0	9.3	8.6	15.6	
N	3,659	8,587	90	105	777	1,858	2,155	384	276	12,259

* See table 2 for algorithm definitions.
0.0 One or more records.

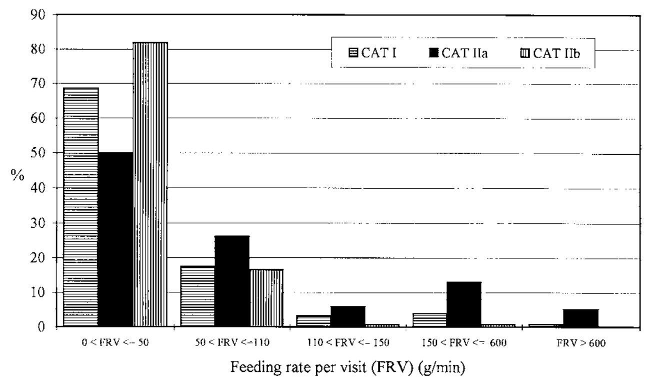

Figure 4–Distribution of feeding rate per visit of visits lasting at least one second with 0 < feed intake (FIV) < 0.05 kg (CAT I; N = 95,757), with FIV ≥ 0.05 kg and preceding or following a visit with FIV < –0.02 (CAT IIa; N = 7,728), and all other visits with FIV ≥ 0.05 kg (CAT IIb; N = 213,496).

Table 3. Distribution of 'difference' between start weight of present visit and final weight of preceding visit (N = 385,329)

'Difference'* (DIF) (kg)	Percentage
< –0.02	1.1
–0.02 ≤ DIF < 0	10.5
0	78.2
0 < DIF ≤ 0.02	7.9
0.02 < DIF < 0.40	0.4
0.40 ≤ DIF ≤ 0.70	1.9
> 0.70	0.0
No value†	0.0

* Difference = start weight of present visit – final weight of preceding visit.
† Values for difference could not be computed for each first visit on test day 1 per group, and for each visit directly following technical operations of stations.
0.0 One or more records.

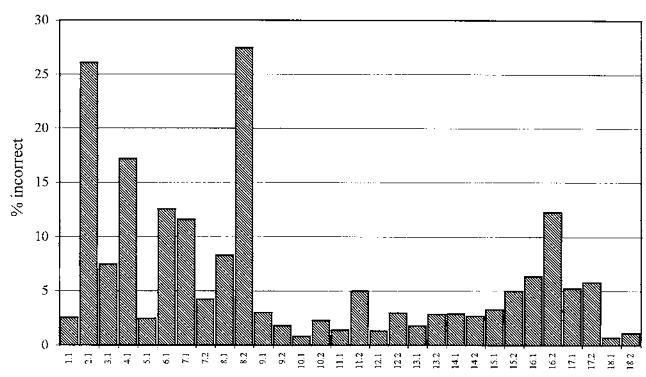

Figure 5–Proportion of visits classified as being incorrect per group.

Table 5. Proportion of visits classified as being incorrect per group (total), and per algorithm* for groups† with more than ten percent visits classified as being incorrect

Group	Total	Algorithm 1	2	3	4	5	6	7	8	9
2.1	26.0	11.2	0.0	0.0	1.6	2.1	1.4	0.0	0.1	19.0
4.1	17.2	9.0	-	-	0.3	1.4	2.0	0.3	0.3	4.8
6.1	12.5	4.0	-	0.0	0.1	0.6	2.0	0.0	0.1	7.2
7.1	11.6	4.8	0.2	0.0	0.2	0.7	0.4	0.2	0.1	10.1
8.2	27.4	14.3	0.3	0.0	0.3	6.0	3.0	0.3	0.2	5.7
16.2	12.2	3.8	-	0.2	0.3	0.6	1.8	0.2	0.1	6.0

* See table 2 for algorithm definitions.
† See text.
0.0 One or more records.

Twelve feeding stations were used during two subsequent test periods (groups 7.1/7.2 to 18.1/18.2 which signify number of feeding station.test period). Nine of these stations showed a higher percentage of incorrect visits during the second test period than during the first test period (fig. 5). Using a feeding station for a longer period without maintenance seems to increase the number of errors. These errors most likely involve incorrect recording of start or final feeder weights (B1 errors). Additionally, these errors may have been the main cause of the somewhat larger proportion of incorrect visits per test day during the second part of the test period than during the first part of the test period (fig. 6).

Relationship Between Unidentified Visits and Visits Classified as Being Incorrect

In total, 5.9% of visits classified as being incorrect were unidentified. Algorithm 4 and 9 were the main factors, respectively classifying 16.2 and 22.6% of unidentified visits as being incorrect (table 4). Visits classified as being incorrect because of algorithm 4 were for 76.1% unidentified (table 4).

Herd

Proportions of unidentified and incorrect visits are presented per group in figures 3 and 6, respectively. At herd 1 (groups 1.1 to 6.1), 1.47% of the visits were unidentified and 11.8% were classified as being incorrect; at herd 2 (groups 7.1 to 12.2), 0.97% of the visits were unidentified and 5.8% were classified as being incorrect; at herd 3 (groups 13.1 to 18.2), 0.69% of the visits were unidentified and 3.9% were classified as being incorrect. Possible causes for differences may be the differing states of station maintenance, number of pigs per pen, sex and genotype of pigs tested, or extent of a farmer's experience in working with feeding station.

Summary and Discussion

Data on *ad-libitum* feed intake were studied for errors to develop algorithms for monitoring feeding station function. Errors were divided into two categories: Unidentified visits (type A errors) and incorrect recordings of feeder weight or time (type B errors). Potential causes for type A errors are loss of transponder (A1), rapid succession of two visits (A2), decrease in transponder signal quality (A3), or sub-optimal tuning of the identification system (A4). Potential causes for type B errors are recording of an incorrect start or final feeder weight of a visit (B1), incorrect recording caused by controlling software (B2), or identification of non-visiting pigs (B3).

Unidentified Visits

Type A1 errors were the only errors that could be distinguished from other type A errors. During a period of several days one of the transponders in a pen was not identified while the number of unidentified visits was elevated to 5 to 20 per day. The total daily feed intake

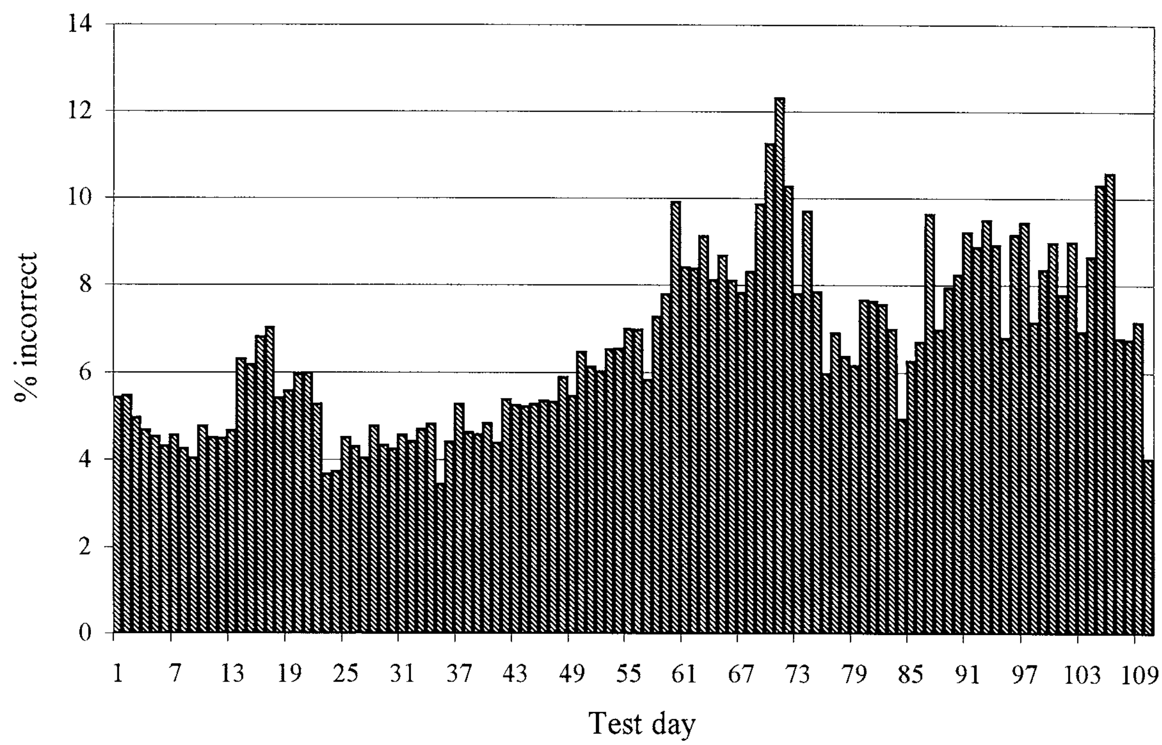

Figure 6–Proportion of visits classified as being incorrect per test day.

during unidentified visits ranged from 0.5 to 3 kg. A proportion of these unidentified visits, however, may have been caused by type A2-A4 errors.

Errors A2-A4 were probably the most important causes of failed identification. This is supported by relatively large proportions of unidentified visits with a short duration or small feed intake and by the large proportion of test days with a small value for total daily feed intake during unidentified visits. Moreover, the large number of unidentified visits in groups 2.1 and 11.2 were not caused by A1 errors.

Algorithms and Criteria for Identifying Incorrect Measurements of Feeder Weight or Time

Each criterion used to judge the correctness of a feed intake recording was subjective. Therefore, some visits may have been falsely assumed to be correct or incorrect. Figure 7 shows the minimum and maximum values found for feed intake per day (FID) per pig per test day before and after eliminating visits classified as being incorrect. To calculate FID records only identified visits were used. Before elimination, the analysis included 27,741 records on FID. After elimination, only 18,142 records were left, because FID was computed only when none of a pig's visits on a test day was classified as being incorrect. Figure 7 shows that all outlying values for FID disappeared after elimination, indicating that all large errors were identified. It may, therefore, be concluded that the presented combination of algorithms can be used to check the function of a feeding station.

Relationship Between Unidentified Visits and Visits Classified as Being Incorrect

The way unidentified visits are generated indicates that these visits will more often last a shorter period than identified visits. Unidentified visits, therefore, will more often have a large value for FRV or a duration of zero seconds, and less often a small value for FRV. Consequently, algorithms checking visits of zero seconds and visits with large FRV values (algorithms 3 to 6) showed a relatively strong overlap with unidentified visits; whereas, visits being incorrect because of small FRV values (algorithms 7 and 8) were all identified (table 4). Since feeding stations only start recording unidentified

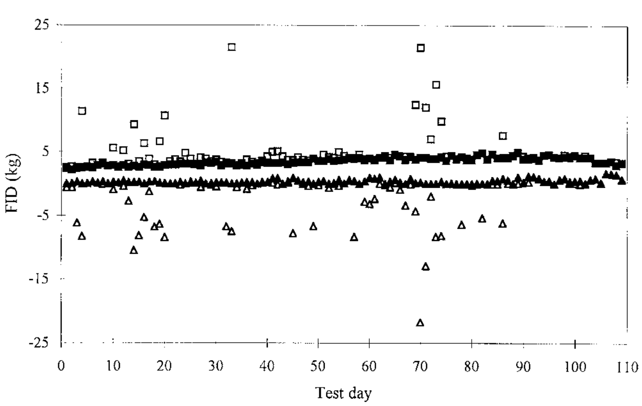

Figure 7–Minimum and maximum values for feed intake per day (FID) per pig per test day before (s , n) and after (s, n) eliminating visits classified as being incorrect.

visits when feeder weight drops, algorithm 1 hardly classified unidentified visits as being incorrect.

Optimal tuning of the identification system is important to assure proper functioning of the feeding station. A sub-optimal tuning in one direction may increase the number of unidentified visits; whereas, the number of B3 errors may increase when tuning is sub-optimal in another direction.

Type of Feeding Station

Station type may affect proportion of visits without identification, criteria of algorithms, and the number and relative importance of different types of errors. Various types of feeding stations differ in the design of entrance, in level of protection to the visiting pig (Nielsen et al., 1995), and in controlling software procedures. In this study only IVOG-feeding stations were used.

Concluding Remarks

Visits without identification, and incorrect measurements of feeder weight or time at the beginning or end of a visit were the two types of errors on which this study focused. Feed intake data of unidentified visits cannot easily be allocated to pigs because it was generally not clear which pigs caused unidentified visits. It would be difficult to adjust visits classified as being incorrect because it was not apparent what the true data should be. Moreover, causes of incorrect visits can vary, making it impossible to use standard solutions for adjusting data. Therefore, the number of unidentified visits and visits classified as being incorrect need to be kept small (Knap and Van der Steen, 1994).

Results indicated several instances where a feeding station did not function optimally during a period of days or weeks. Frequently checking recorded data and correcting the feeding station's function will, therefore, reduce numbers of errors. This study showed that by checking for the occurrence of unidentified visits and for incorrect feed intake recordings by using nine algorithms, function of a feeding station can be successfully monitored. Expanding a feeding station's software with the editing system described herein would allow a daily check of recorded data for errors. Furthermore, frequent maintenance of feeding stations (e.g., between test periods) may reduce the number of visits classified as being incorrect.

Control routines could be further extended to frequently check the accuracy of a feeding station's recording of weight. A possible routine could add a pre-weighed amount of feed to the feeder and check the recorded value. At present, identification and adjustment of errors is a subjective process (e.g., De Haer et al., 1992; Von Felde, 1996). The presented editing system provides a more systematic method of identifying errors in feed intake data for growing pigs in group housing.

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