RELATIONSHIP BETWEEN HERD SIZE, MILKING TECHNOLOGY AND MILK PRODUCTION PARAMETERS ON LARGE-SCALE HUNGARIAN DAIRY FARMS

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The aim of the study was to survey the milking technology on the large-scale (≥50 cows) Hungarian dairy farms and to compare the different types of milking parlour with herd size, average daily milk yield, average daily milk production per each cow and average somatic cell count (SCC).

The milking technology was surveyed by using a questionnaire on 380 large-scale commercial Hungarian dairy farms in 2017, and it was compared with the official farm milk production data of March 2017. Three herd size categories (Group 1: 50–300 cows, Group 2: 301–600 cows and Group 3: >600 cows) were set up and the relationship between milking technology, herd-size and milk production parameters were analysed by using two-way ANOVA and Tukey-test.

In Group 1, 2 and 3 (1) the number of farms was 142, 142 and 96; (2) the average herd size was 165, 437 and 958 cows; (3) the average daily milk yield was 24.73, 29.42 and 32.25 kg; (4) the average daily milk production per each cow was 21.07, 25.83 and 28.49 kg; and (5) the weighted average SCC was 432.5, 412.7 and 341.9×10\textsuperscript{3}/ml. As the herd size increases, so does the average daily milk yield and the average daily milk production per each cow, however, the average SCC decreases significantly (P<0.001). The type of milking parlour had a significant effect (P=0.027) on the average SCC, and dairy units having herringbone milking system produced the lowest quality of milk with an average of 430.0×10\textsuperscript{3}/ml.

The type of milking parlour has an impact on milk quality, however further research is required in this regard.

Keywords: DAIRY FARM, MILKING TECHNOLOGY, HERD SIZE, MILK YIELD, SCC

Milking technology greatly influences the organization of animal movements, the selection of milking routines, the influence of the quality of human labour, the hygiene of technology and the technical efficiency of milking equipment during the time of milking. Technological diversity has an impact on milk production, particularly on milk quality. The most common milking system on large dairy farms is herringbone. In addition parallel, tandem and carousel milking technology is used, but in recent years the spread of robot milking systems has also started [3]. [5] compared three types of milking technology (pipeline, parallel milking parlour and robot). In the case of pipeline milking, the germ count (18,000 CFU/cm\textsuperscript{3}) was one and a half times higher than that of the parallel milking parlour (11,500 CFU/cm\textsuperscript{3}) and robot (6,200 CFU/cm\textsuperscript{3}). Somatic cell count (SCC) was 279,000/cm\textsuperscript{3} in pipeline milking, 281,600/cm\textsuperscript{3} in parallel and 195,600/cm\textsuperscript{3} in robot milking system. The lowest milk fat% (3.75 %) was also measured in pipeline milking system, while the milk fat% was 3.83 % in parallel and 3.88 % in robot milking system. Further research has also confirmed that in case of robot milking, the daily milk production is higher and the SCC is lower compared to the traditional milking parlour (herringbone) [1; 2].

The aim of the study was to survey the milking technology on the large-scale (≥50 cows) Hungarian dairy farms and to compare the different types of milking parlour [herringbone (H), parallel (P), carousel (C) and other (O)] with herd size, average daily milk yield, average daily milk production per each cow and average somatic cell count (SCC).

Materials and methods

The milking technology was surveyed by using a questionnaire on 380 large-scale commercial Hungarian dairy farms in 2017, and it was
compared with the official farm milk production data of March 2017. On the surveyed farms milk performance test is conducted monthly that is based on individual milk samples from all milking cows. The herd size of the Hungarian dairy farms varies largely, therefore three herd size categories (Group 1: 50–300 cows, Group 2: 301–600 cows and Group 3: >601 cows) were set up. Data were processed in MS Excel 2013 software (Microsoft Corporation, Redmond, WA, USA). The relationship between milking technology, herd-size and milk production parameters were analysed. Statistical analysis was performed by using two-way ANOVA and Tukey-test in R version 3.5.1. [4].

Results and discussion

The most common type of parlour is the herringbone, but with the increase number of cows, the number of parallel and carousel milking parlour also increases (fig.).

The differences by the type of parlour of herd size, average daily milk yield, average daily milk production per cow and SCC are shown in table 1.

![Fig. The distribution of farms using different type of milking parlour per herd size groups (n=380)](image)

| Group 1 | Parlour       | Average number of cows | Average daily milk yield, kg/day | Average daily milk production per cow, kg/day | Average SCC, ×10³ cell/ml |
|---------|---------------|------------------------|---------------------------------|---------------------------------------------|--------------------------|
|         | herringbone   | 164                    | 24.69                           | 21.03                                       | 441.50                   |
|         | parallel      | 167                    | 24.59                           | 21.12                                       | 364.14                   |
|         | carousel      | 152                    | 19.95                           | 17.19                                       | 368.00                   |
|         | other         | 180                    | 26.72                           | 22.71                                       | 258.75                   |
| Group 2 | herringbone   | 420                    | 29.03                           | 25.48                                       | 432.42                   |
|         | parallel      | 486                    | 31.32                           | 27.78                                       | 347.74                   |
|         | carousel      | 477                    | 29.32                           | 25.06                                       | 356.00                   |
|         | other         | 437                    | 27.89                           | 24.31                                       | 453.75                   |
| Group 3 | herringbone   | 787                    | 30.28                           | 26.51                                       | 376.93                   |
|         | parallel      | 937                    | 33.44                           | 29.41                                       | 342.21                   |
|         | carousel      | 1055                   | 32.35                           | 28.80                                       | 317.45                   |
|         | other         | 1227                   | 34.29                           | 30.76                                       | 316.67                   |

Table 1

Milk production parameters by herd size groups (n=380)

| Group 1 | Number of farms | Average number of cows | Average daily milk yield, kg/day | Average daily milk production per cow, kg/day | Average SCC, ×10³ cell/ml |
|---------|----------------|------------------------|---------------------------------|---------------------------------------------|--------------------------|
|          | 142            | 165                    | 24.73                           | 21.07                                       | 432.5                    |
| Group 2 |                | 142                    | 437                             | 29.42                                       | 412.7                    |
| Group 3 |                | 96                     | 958                             | 32.25                                       | 341.9                    |

Note: a, b, c groups with different superscripts differ significantly (P<0.05).
Table 3

Milk production parameters by the type of milking parlour (n=380)

| Parlour       | Number of farms | Average daily milk yield, kg/day | Average daily milk production per cow, kg/day | Average SCC, $\times 10^3$ cell/ml |
|---------------|----------------|---------------------------------|---------------------------------------------|----------------------------------|
| herringbone   | 259            | 27.03\textsuperscript{a}       | 23.40\textsuperscript{a}                   | 430.00\textsuperscript{a}       |
| parallel      | 61             | 31.71\textsuperscript{b}       | 27.94\textsuperscript{b}                   | 346.75\textsuperscript{a}       |
| carousel      | 41             | 31.38\textsuperscript{ab}      | 27.70\textsuperscript{ab}                  | 327.15\textsuperscript{a}       |
| other         | 19             | 30.06\textsuperscript{ab}      | 26.41\textsuperscript{ab}                  | 363.79\textsuperscript{a}       |

Note: \textsuperscript{a, b} Milking parlour types with different superscripts differ significantly (P<0.05).

milking systems. Higher cow number and milk production enable the use of newer technologies, which could have an impact on production.

The average SCC in Hungary is high in all groups, which is not only the most commonly used indicator of milk quality but could influence the quantity of milk production, as well. It makes necessary to explore the weak points in the dairy production. Regarding to this study milking technology and herd size have impact on the milk production parameters, as well. Further researches are needed to explain the influences of each segment of the used technologies in Hungary.

Conclusions

The lower milk production in smaller dairy farms can be explained with lower standards of housing, feeding, milking technology and genetics. The type of milking parlour and the number of cows has an impact on milk production, however further research is required in this regard.

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