

Teaching Transrectal Palpation of the Internal Genital Organs in Cattle

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ABSTRACT

In this article, a simulation model for rectal palpation teaching in cows, Breed'n Betsy®, is evaluated. Furthermore, the learning process of rectal palpation is depicted during a training period in live cows. In experiment 1, eight students were trained in live cows (group A) and nine students were trained using Breed'n Betsy (group B). After 25 palpations, their ability to localize and evaluate structures was evaluated in practical tests in live cows. Group A had higher results than group B ($p < 0.001$) and were more skilled at localizing the uterus and localizing and evaluating the ovaries ($p < 0.05$). Group B was better at pregnancy diagnosis (nonsignificant). Results suggest that Breed'n Betsy cannot fully replace training in live cows, but may be a valuable addition to the classical teaching method. Suggestions for future improvement are made. In experiment 2, 10 students were intensely trained in live cows throughout the year and evaluated in practical tests at three time points (September, January, and March). Results were analyzed as a function of time point and the category of experience (1: 0–50 cows; 2: 50–100 cows; 3: 100–150 cows; 4: 150–200 cows; 5: >200 cows). Results increased in time ($p < 0.05$) and were higher in categories 3, 4, and 5 than in category 1 ($p < 0.05$). Although all of the students in the higher categories successfully localized the cervix, uterus, and ovaries, they had difficulties in interpreting these structures, suggesting that palpation of 200 cows is insufficient to reach a consistent level of expertise.

Key words: animal welfare, clinical competence, reproduction, student programs

INTRODUCTION

Combining high production with acceptable fertility is one of the greatest challenges in contemporary dairy and beef farming. Many cow-specific (e.g., the dairy cow's typical transition period metabolism) and management-specific (e.g., increasing herd sizes) factors may perturb fertility, increasing the need for veterinary herd health guidance.^{1,2} Since delayed resumption of ovarian activity and failure to conceive are the two major causes of sub-optimal fertility, the early diagnosis of reproductive disorders and early detection of pregnant and open cows are crucial tools for improving a herd's fertility status. Therefore, rectal examination of the genital apparatus is an indispensable skill for veterinarians. Despite widespread access to ultrasonography, teaching of rectal palpation is still considered vital in veterinary medicine education.³ However, the technique requires considerable training before adequate dexterity is obtained.

Teaching rectal palpation to veterinary students presents a number of difficulties. Farmers are often reluctant to allow students to palpate their cows. Several authors have reported that rectal palpation may increase the risk for embryonic or fetal death, depending on gestation stage and the method used. For instance, it has been reported that slight pressure on the amniotic vesicle increases the risk for embryonic death, particularly between 39 and 45 days of gestation.⁴ Others have suggested that palpation of the membrane slip or the amniotic vesicle increases the rate of embryonic death.⁵ However, this could not be confirmed by a number of other studies,^{6,7} and a clear-

cut answer about the effect of rectal palpation on embryonic death has yet to be found. Additionally, the availability of cows is often inadequate due to large numbers of students and animal welfare concerns. Teaching in live cows is difficult, since the teacher is not able to see or feel what students are palpating and hence cannot comment on their actions. This is unfortunate, especially during the early stages of education, since novice students often have problems locating structures through feces and the rectal wall or in an air-filled rectum.³

To set concrete goals for education, it is important to know how many live cows need to be palpated to obtain acceptable dexterity. To our knowledge, concrete scientific data about this are unavailable. In addition, the search for alternative educational methods needs to be encouraged, since this might yield the opportunity to train students in an animal-friendly, student-friendly, safe, and efficient way. For instance, Baillie et al. have described the benefits of a virtual-reality teaching model.³ All participants agreed that this teaching method increased their palpation skills. More specifically, the opportunity to palpate the virtual cow without any risks or animal welfare implications and the ability to provide feedback during palpation was greatly appreciated by all students and teachers. In another study, a group of students receiving training in live cows combined with the simulation model performed significantly better at *in vivo* palpation than students trained only in live cows.⁸ Recently, a new simulation model called Breed'n Betsy has been developed. Validation of this model is necessary



Figure 1: The Breed'n Betsy model consists of a replica of a cow's pelvis in a metal frame containing an artificial rectal sphincter and vulva. A latex replica of a reproductive tract (above) or a slaughterhouse genital apparatus (following page) can be suspended with two clamps attached to the pelvis, offering a wide range of possibilities for rectal palpation training

before it is used on a large scale in veterinary education, and might yield important suggestions for future improvements.

The first goal of this study was to compare the efficiency of palpation training using Breed'n Betsy to the classical training method in live slaughterhouse cows. The second goal was to depict the evolution of rectal palpation skills as a function of the amount of practical experience in live cows.

MATERIAL AND METHODS

Description of Breed'n Betsy

The Breed'n Betsy simulation consists of a replica of a cow's pelvis surrounded by a metal frame, in which an artificial vulva and anal sphincter are installed (Figure 1). Using two clamps attached to the pelvis, a latex genital apparatus—consisting of a vagina, cervix, uterus, and uterine arteries—can be suspended in the pelvis. Possibilities range from an empty uterus with thin uterine arteries to a series of uteruses representing different gesta-

tion stages from six weeks to eight months, accompanied by arteries of increasing diameters. Replicas of gravid uteruses are filled with lukewarm water to mimic an enlarged uterus and the presence of fluid; in later gestation stages, a floating fetus is present in the lumen and cotyledons are palpable in the uterine wall. Other positive pregnancy signs, such as the membrane slip, amniotic vessel, and fremitus of the uterine arteries are not simulated. Ovaries are not included in the model, but will be developed in the near future. These disadvantages can be overcome by placing slaughterhouse uteruses and ovaries in the model. By means of this model, the manufacturer aims to reduce the number of live-cow palpations needed to attain a certain degree of agility by 40%. Breed'n Betsy can also be used for other purposes, such as teaching artificial insemination and embryo transfer.

Experiment 1

For the first experiment, we selected 17 veterinary students with no hands-on experience of rectal palpation in cows from the first and second Master year of Ghent Uni-



Figure 1: continued

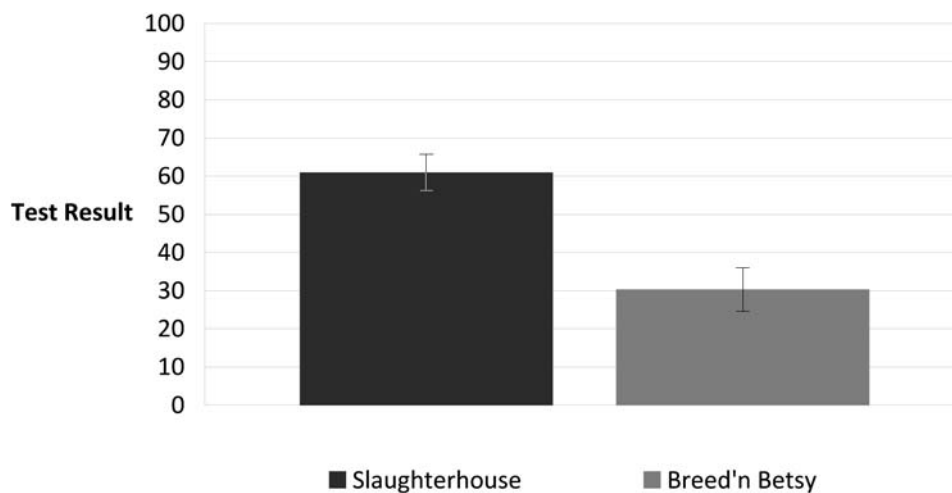


Figure 2: A comparison between the results of a practical palpation test in live cows after a training period using live cows in the slaughterhouse or Breed'n Betsy. Error bars represent the standard error of the mean

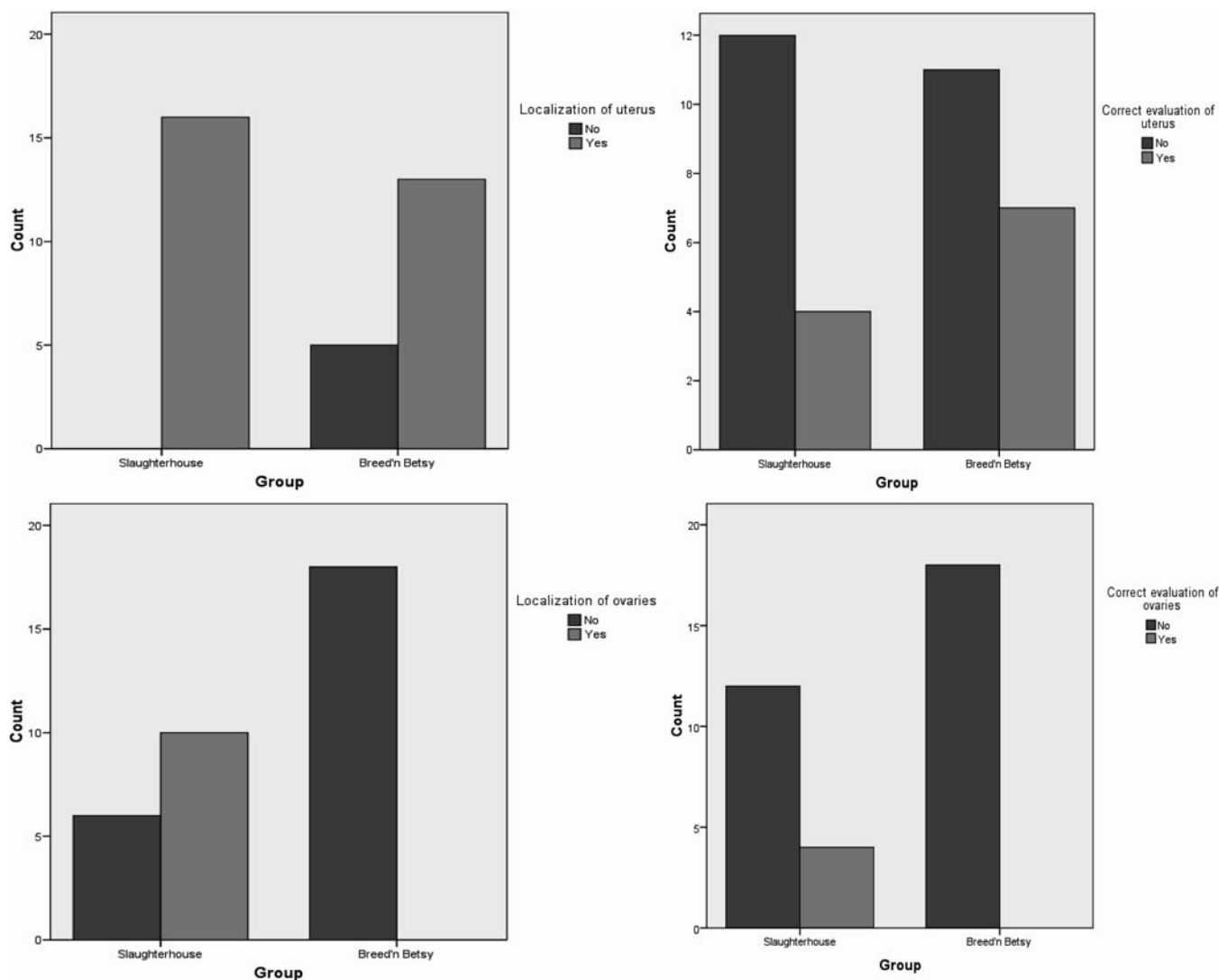
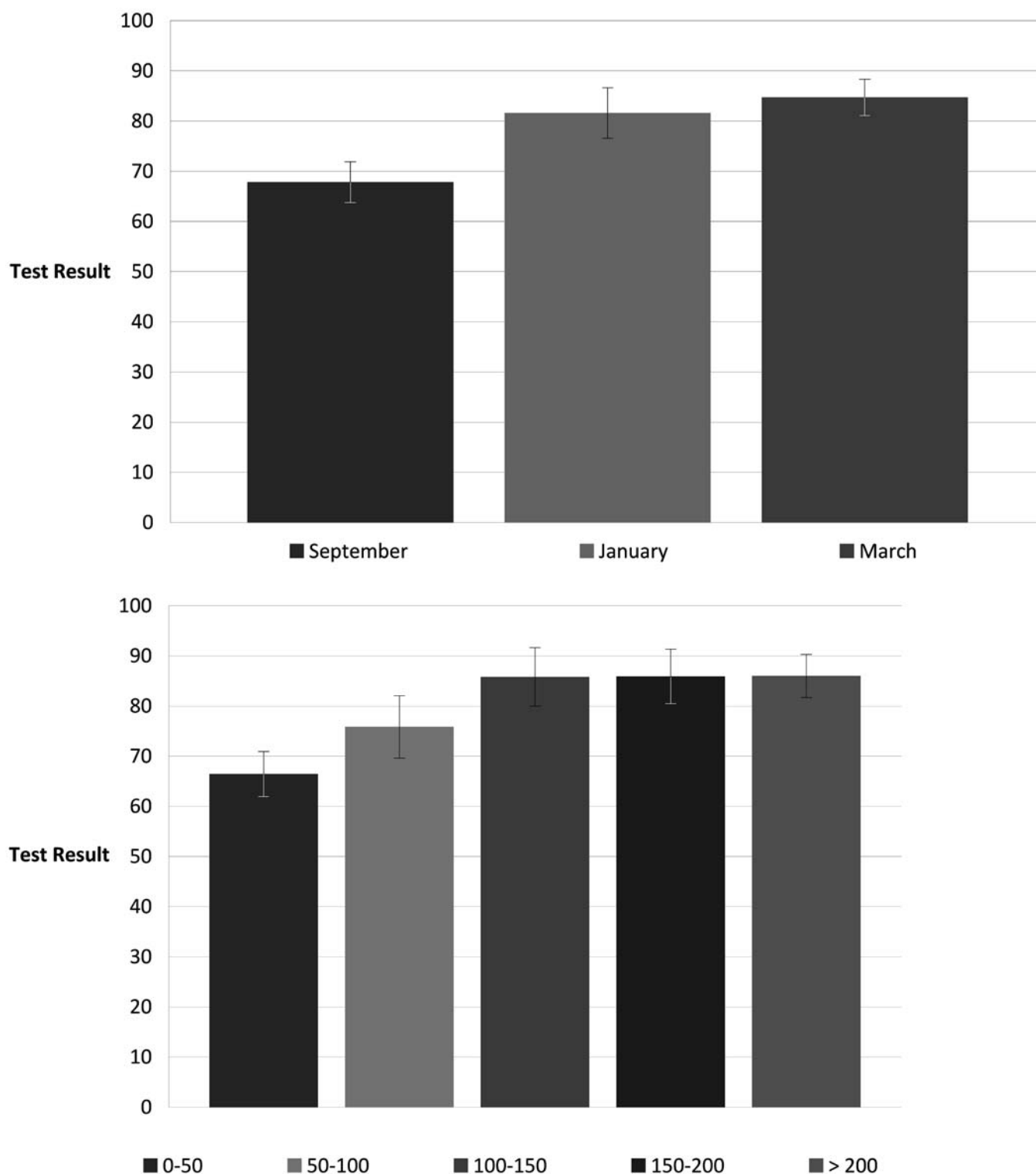


Figure 3: The number of cases in which students were (light bars) or were not (dark bars) able to localize and correctly evaluate the uterus and ovaries in a practical palpation test in live cows after a training period using live cows in the slaughterhouse or Breed'n Betsy



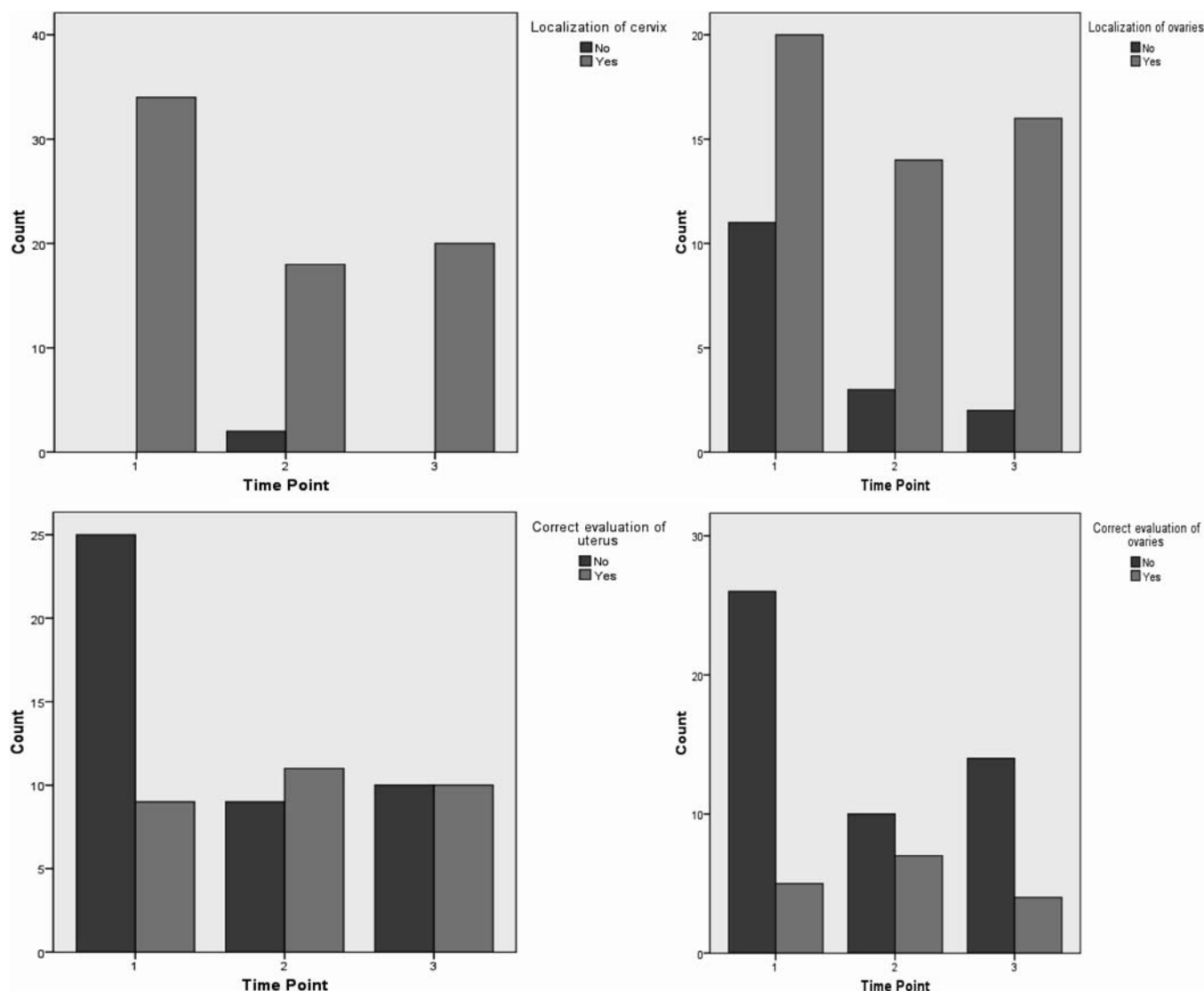


Figure 5: The number of cases in which students were (light bars) or were not (dark bars) able to localize the cervix and ovaries and correctly evaluate the uterus and ovaries in a practical palpation test in live cows. Tests were carried out at three different time points throughout the year (1, September; 2, January; and 3, March) during an intensive training period with slaughterhouse cows

with a 5 MHz linear ultrasound probe (Tringa Linear, Esaote Pie Medical, Maastricht, The Netherlands). Students in group B were offered a variety of non-gravid and gravid replicas (14 out of 25 cases) and slaughterhouse uteruses (11 out of 25 cases). The importance of working in a systematic manner was repeatedly emphasized to both groups. Students were instructed to first remove feces and localize the cervix as an orientation point; from there, the uterus bifurcation and both uterine horns were localized. The size, symmetry, and contents of the uterus and the tension, consistency, and possible adhesions of the uterine wall were assessed, as described elsewhere.^{9,10} When students were able to localize the ovaries, they were instructed to assess their size, the presence of adhesions, and the consistency of any protrusions to differentiate between a follicle, corpus luteum, or cystic structure, as suggested elsewhere.^{9,10} Furthermore, all students were asked to read an article with practical

guidelines for rectal palpation⁹ to exclude major differences in theoretical knowledge.

After the training period, both groups were evaluated in two tests with live cows: one in 60- to 70-day pregnant HF cows and one in nonpregnant HF cows at varying phases of the ovarian cycle. The test procedure is described below.

Experiment 2

In the second experiment, 10 veterinary students with no or minimal practical experience with rectal palpation from the third Master year of Ghent University were selected at the beginning of the academic year. Students were encouraged to join the slaughterhouse training sessions as often as possible from August 2008 to March 2009, as well as other palpation opportunities offered in the education program. As described above, students in

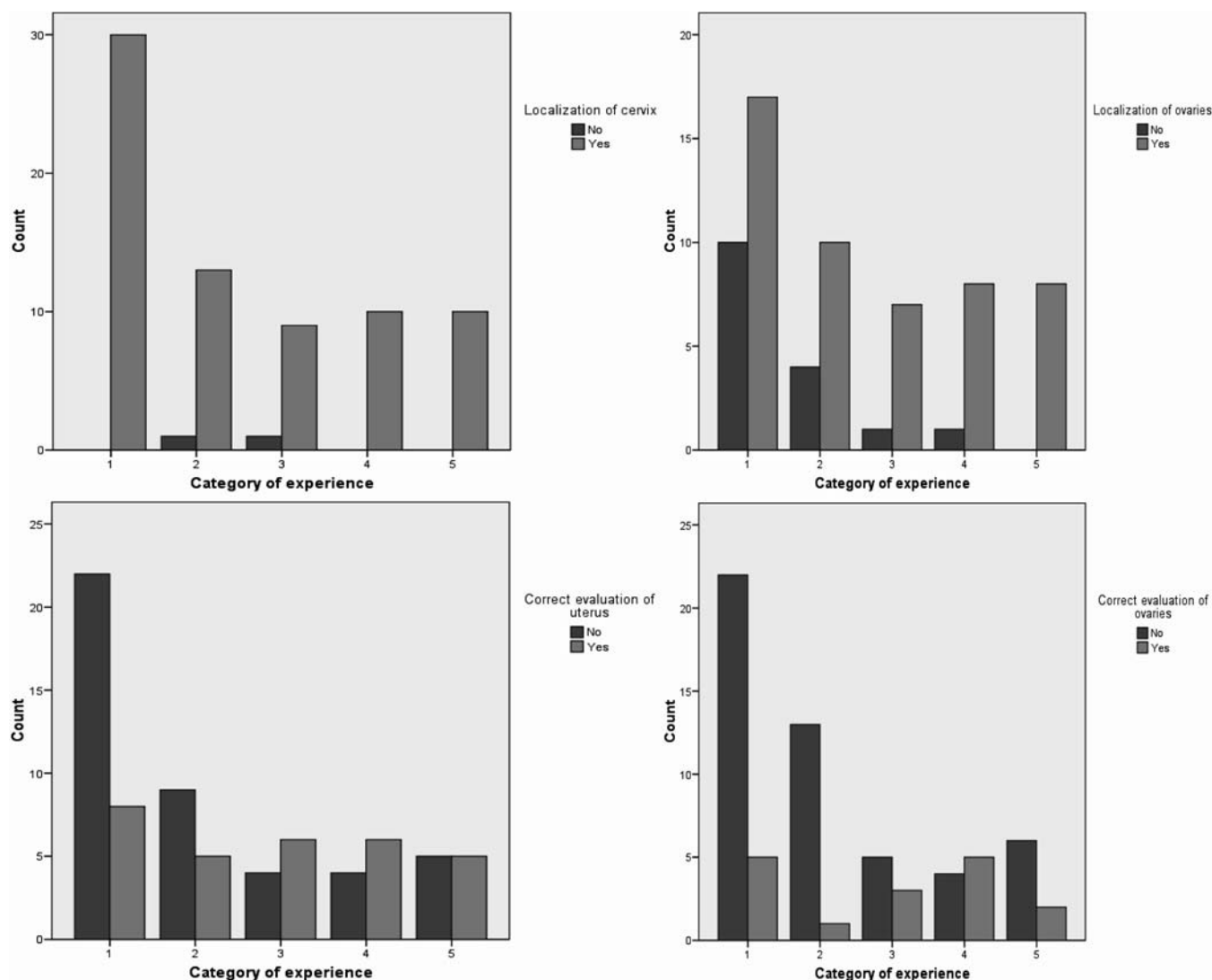


Figure 6: The number of cases in which students were (light bars) or were not (dark bars) able to localize the cervix and the ovaries and correctly evaluate the uterus and ovaries in a practical palpation test in live cows. Results are ranked by the student's level of experience during an intensive training period in slaughterhouse cows (1, 0–50; 2, 50–100; 3, 100–150; 4, 150–200; and 5, >200 cows)

the slaughterhouse were guided by one of five experienced veterinarians. Linear ultrasonography was available whenever necessary to confirm their findings. Students were asked to read an article with practical guidelines⁹ to avoid major differences in theoretical knowledge, and were instructed to follow the systematic approach described above. Students kept track of all of the palpation opportunities they had throughout the year. On three different time points during the academic year (September, January, and March, referred to below as time points 1, 2, and 3, respectively), students were evaluated in two consecutive tests in the slaughterhouse, performed in one HF and one BB cow. Depending on availability, students were offered a variety of physiological and pathological situations. Because the number of palpations differed greatly between students at the three time points, the number of palpated cows was divided in categories five categories: 1, 0–50 cows; 2, 50–100 cows; 3, 100–150

cows; 4, 150–200 cows; and 5, >200 cows. To increase the number of test cases, group A students from the first experiment were also included in the study.

Description of the Test

For the evaluation, students were allowed to rectally palpate a cow for exactly 10 minutes, after which a questionnaire was completed. Questions were asked about the localization and evaluation of the cervix, uterus, and ovaries, following the systematic approach described above.^{9,10} Students were asked to draw a final conclusion about the presence or absence of pregnancy, the phase of the estrous cycle, and the presence or absence of pathologies. Points were allocated to each answer, resulting in the final “test result,” ranging from 0 to 100. Whenever a question was irrelevant, no points were allocated (for instance, localization and evaluation of the ovaries was not always possible in pregnant cows). The diagnosis made

by an experienced veterinarian using a linear ultrasound probe was used as the gold standard.

Statistics

All statistical analyses were performed with the SPSS version 15.0^a and S-PLUS version 8.0^b. A *p*-value between 0.05 was considered statistically significant; a *p*-value between 0.05 and 0.10 was considered as a tendency.

In experiment 1, the following binominal variables were acquired from the test forms: localization of the cervix, uterus, and ovaries, and correct evaluation of uterus and ovaries (0 = no; 1 = yes). The 0:1 ratio was compared between groups A and B by calculation of the Pearson's chi-square test. A Fisher's exact test was performed when the number of observations in any cell was less than five. After checking for normality using the Kolmogorov-Smirnov test, test results were compared between both groups using a *t*-test for independent variables. No pregnant cows were available during the training sessions of group A, while a variety of pregnant uteruses were offered to students from group B; therefore, the data set was split and analyses were repeated with the results from tests performed in pregnant cows.

In experiment 2, the test result was checked for normality in a Kolmogorov-Smirnov test. The Pearson's correlation coefficient between the number of palpated cows and the test score was computed. The effect of time on performance was investigated in a mixed-effect linear model with test result as the outcome variable, time point as a fixed factor, and "student" as a random factor. In addition, the effect of experience on performance was analyzed in a mixed-effect linear model with test result as the outcome variable, category as a fixed factor and student as a random factor. Test results in BB and HF cows were compared in a paired sample *t*-test. The 0:1 ratio for localization and correct evaluation of the cervix, uterus, and ovaries was compared between time points, categories, and breeds by calculation of the Pearson's chi-square. A Fisher's exact test was performed when the number of observations in any cell was less than five.

RESULTS

Experiment 1

The test results are displayed as the mean \pm the standard error of the mean in Figures 2 and 3. Test results were normally distributed. Overall, the results were significantly higher ($p < 0.001$) in group A (60.9 ± 5.73) compared to group B (30.3 ± 4.80). Students in group A successfully localized the cervix in all cases, compared to 14 out of 18 cases in group B ($p = 0.10$). Students from group A were able to find the uterus in all cases, compared to 13 out of 18 cases in group B ($p = 0.045$). No significant difference was found for the evaluation of the uterus ($p = 0.48$): four out of 16 evaluations were correct in group A, compared to seven out of 18 in group B. In group A, ovaries were localized in 10 out of 16 cases, while no students were able to find the ovaries in group B ($p < 0.001$). Consequently, students in group A were significantly better (four out of 16) at evaluating the ovaries compared to group B ($p = 0.039$).

No pregnant cows were available during training sessions in group A, while several pregnancy stages were included in the training of group B. Hence, a difference in expertise in pregnant live cows may be expected. When only the pregnant cows were considered (data not shown), no significant differences were found between groups A and B for the localization of the cervix ($p = 0.27$) and uterus ($p = 0.124$). Interestingly, group B was slightly more successful at recognizing pregnancy (three out of nine students) compared to group A (one out of eight students), but this difference was not significant ($p = 0.33$). Group A remained more successful at finding the ovaries compared to group B ($p = 0.009$).

Experiment 2

Results from experiment 2 are displayed as their mean \pm the standard error of the mean and presented in Figures 4–6. Test results were normally distributed. The Pearson's correlation coefficient between the number of palpation experiences and the result was 0.36 ($p = 0.001$). Results were higher at time points 2 and 3 compared to time point 1 ($p = 0.035$ and $p = 0.010$, respectively). No difference was found between scores at time points 2 and 3 ($p = 0.64$). We found no significant effect of time point on the likelihood to successfully localize the cervix and uterus, although students on time points 2 and 3 tended to be more successful at evaluating the uterus ($p = 0.071$). The uterus was localized in all cases (data not shown). On time points 2 and 3, there seemed to be a higher proportion of students able to localize ($p = 0.14$) and correctly evaluate ($p = 0.17$) the ovaries, but these differences were not significant.

An effect of category on the test result was observed ($p = 0.038$). Test results were significantly higher in categories 3 ($p = 0.028$), 4 ($p = 0.017$), and 5 ($p = 0.032$) than in category 1, while test results in category 2 did not differ from those in category 1 ($p = 0.20$). As students attained more experience in living cows, a larger proportion of students appeared able to localize the ovaries ($p = 0.191$) and to evaluate the uterus ($p = 0.190$) and ovaries ($p = 0.075$), but these differences were not significant. No significant difference in test results was found between HF and BB breeds (data not shown; $p > 0.25$).

DISCUSSION

Experiment 1

Even though this study was carried out with a limited number of students, our results suggest that students trained exclusively with Breed'n Betsy had markedly more difficulties with orientation in a live cow, particularly for the uterus and ovaries. This suggests that the Breed'n Betsy model does not fully resemble the feeling of a live cow. The model has only recently been developed and is currently being adjusted; our results suggest that inclusion of ovaries is necessary since none of the students in group B was able to locate the ovaries in live cows. The successful localization of structures does not imply correct evaluation: students from both groups had major difficulties interpreting their findings in a final conclusion about the cyclic stage, illustrating that palpation of only 25 cows is not nearly sufficient to attain satisfac-

tory dexterity. The poor results from group A in pregnant cows illustrate the limited availability of pregnant cows in slaughterhouses as an important obstacle; the slightly better pregnancy diagnosis in group B indicates that the wide range of possibilities in Breed'n Betsy may counter this problem. In addition, all of the students in group B appreciated the opportunity to receive feedback during and after palpation and the possibility to practice safely and without any animal welfare concerns. A comparison between students trained in live cows alone and students who received training in live cows combined with Breed'n Betsy may shed more light on its usefulness in veterinary education.

Experiment 2

The results from this experiment indicate that hands-on palpation experience has an important effect on performance. However, the correlation coefficient of 0.36 indicates that only 13% of the variation in test results can be attributed to the student's experience. As seen in Figure 6, the proportion of students localizing the cervix, uterus, and ovaries increased as students acquired more experience. In category 5, all students succeeded in finding the cervix, uterus, and both ovaries. However, as discussed in experiment 1, this does not necessarily imply a more accurate interpretation: a rather low proportion of students was able to correctly evaluate the ovaries and uterus (Figure 6). Overall, we suggest that the palpation of 200 cows may result in correct orientation of structures inside the pelvis, but a larger basis of experience is needed to correctly interpret these structures and deduce a correct diagnosis. These data are in line with the generally established statement that rectal palpation in cows requires a considerable amount of experience to attain acceptable skill.^{3,8}

NOTES

- a SPSS Inc., Chicago, IL <<http://www.ssps.com>>.
- b Insightful Corp., Seattle, WA
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