Praca oryginalna *Original paper*

Progress in acquiring skills in cattle rectal examination by veterinary students consulting their acquired experience and professional motivation

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Received 30.03.2022 *Accepted 06.06.2022*

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Summary

Transrectal examination of the female reproductive organ is one of the essential skills that every veterinarian should possess. Rectal palpation is currently the fastest, cheapest and easiest technique to accurately assess the condition of the uterus and ovaries. However, it is hard to evaluate the actual level of rectal examination skills among veterinary medicine students. The purpose of the research was to measure students' skills in rectal examination consulting their acquired experience and professional motivation. Twenty-one students of veterinary medicine were divided into three groups according to their experience and motivation. The time and correctness of palpation were noted in every training and testing session. The most motivated and experienced students showed the best cattle palpation skills. Although an increase in the accuracy of the results of transrectal examination was noted in every student group, an increase in the accuracy of right ovary size rating was observed only in the group of the least motivated students.

Keywords: cattle, rectal examinations, skills, veterinary medicine students

Rectal examination is a key skill for veterinarians working with cattle herds. The examination makes it possible to assess the development of the reproductive organ, determine the phase of the oestrus cycle, detect oestrus, confirm or exclude pregnancy and identify pathological structures within the reproductive system and the ovaries (9). Many authors believe that palpation of live cattle is necessary to acquire this skill (4). However, there is a limited number of studies describing the appropriate training method for transrectal palpation of live animals (4).

The teaching of rectal examination with the use of live animals is frequently forgone due to difficult access to livestock, large groups of students practising and the need to maintain adequate welfare. From an economic point of view, the rectal examination of cows by students can cause some stress, which can lead, among others, to reduced milk production (14).

Currently, substitute methods for teaching rectal examination without contact with an animal are often recommended. These include simple phantoms, training models, and simulators combining a phantom with a virtual image (1, 8, 10). This kind of simulation allows students to perform a palpation examination without the risk of contact with an animal and to fully control the teaching process (4).

The acquisition of appropriate rectal examination skills by students of veterinary medicine is a required effect of education (12). However, it takes proper training to gain the necessary experience and dexterity

in transrectal palpation of cattle. It depends on a number of factors, including the number of cows tested, students' motivation, the chosen training method and the use of phantoms that improve animal welfare by reducing the number of animals needed for training (3, 4).

Less attention is paid to students' previous experience and additional practice with phantoms to improve their skills. We assume that these factors increase the efficiency of examination.

The purpose of the research was to evaluate cattle rectal examination skills among veterinary students consulting their acquired experience and professional motivation.

Material and methods

Animals and the organization of research. The research was conducted among fourth-year students of veterinary medicine. Five sessions were run, including four training sessions and a fifth one to control the results of rectal examination training. The sessions were run alongside classes on farms at regular weekly intervals from October to November 2021. The research was carried out on three farms with ca. 100 cows. Cow temperament (CTS) was assessed on a three-point scale (9). Cows with a mild temperament (CTS = 1) were used for examinations. Each examination was conducted very delicately, following the general principles of welfare.

Division into groups. The participants in the sessions were twenty-one 7th-semester students of veterinary medicine: 16 females and 5 males, who were divided into three groups according to their experience and motivation. The first group (I) comprised highly motivated students who planned to work with farm animals in the future, were raised on cattle farms and had some previous technical experience and certain skills in conducting a rectal examination of cows (N = 2). The second group (II) consisted of students who were highly motivated (willing to work in the future with farm animals), but inexperienced in rectal examination (N = 4). Before starting rectal examinations, the students from groups I and II practiced ovarian size assessment on ovarian rubber phantoms. During four training sessions, they were required to determine the size of 10 ovaries. The last group (III) was composed of the least motivated students, who did not want to treat large animals in the future and had no experience in rectal examination (N = 15).

Examination of structures. In the experiment, the students were given the following tasks:

1. Find the cervix. The finding of the cervix was confirmed by the assessment of its width. It was performed on a two-point scale, where 1A: width < two fingers, 1B: width > 2 fingers.

2. Find the uterus. The finding of the uterus was confirmed by the assessment of the size of the uterus and the width of its horns. The size of the uterus was assessed using a two-point scale, where 2A: the uterus fit in the hand, and 2B: the uterus was enlarged and did not fit in the hand. The width of the uterine horns was assessed on a two-point scale, where A: width < 2 fingers, and B: width > 2 fingers.

3. Examine the consistency of the uterus. Its consistency was assessed on a three-point scale, where A: a flaccid, atonic uterus, B: a uterus with moderately taut walls, and C: a uterus with a significant tone of the walls (perineal period).

4. Locate 4A: the right ovary, and 4B: the left ovary.

5. Assess the size of the right and left ovaries according to a four-point scale, where "I": ovaries with a length of up to 3 cm, width of 1.5-2 cm, height of up to 1.5 cm, "II": ovaries with a length of 3-4 cm, width of 2-3 cm, and height of 1.5-2 cm, "III": ovaries with a length of 4-5 cm, width of 3-3.5 cm, and height of 1.5-2.5 cm, "IV": ovaries with a length of more than 5 cm, width of 3-4 cm and height of 1.5-3.5 cm.

The evaluation of the functional structures of the ovary was not obligatory. Volunteers could also confirm or exclude the presence of the corpus luteum.

During the examination, each student was required to report finding the structure required by the protocol and provide a simple description. The following were noted: 1) rectal examination time, i.e. the time from inserting a hand into the cow's rectum to the end of the examination and 2) the total number of examinations during the training period and after the end of the examination cycle.

The first test performed by a student during one session was used for the calculations. All cows examined by the students were previously inspected by an experienced veterinarian. The structures and sizes of the ovaries were determined using an iScan ultrasound scanner with a linear 7.5 MHz probe.

Statistical analysis. The numerical data were compiled by commonly used methods. The Microsoft Office Excel 2016 software was used. The percentage of correct diagnoses and assessments for the student groups was calculated. The significance of differences between the groups was assessed with the Chi-square test (statistical tools package Statistica version 7.1 PL). Differences were considered significant at $P < 0.05$.

Results and discussion

During the training sessions, the percentage of the required structures of the reproductive system found correctly by the students was 75% for group I, 43.7% for group II ($P < 0.05\%$), and 28.3% for group III ($P < 0.05\%$). After the training sessions, in the session verifying the acquired skills, the percentage of correct assessments increased to 100% in group I, 87.5% ($P < 0.05\%$) in group II and 75% ($P < 0.05\%$) in group III.

A comparison of the results of the training sessions and the testing session shows that the accuracy of uterus size rating increased from 50% to 100% in group I, from 46.7% to 100% ($P < 0.05\%$) in group III and from 61.7% to 100% ($P < 0.05\%$) in group III. The accuracy of left ovary size rating increased from 25% to 75% in group I, from 13.3% to 62.5% ($P < 0.05\%$) in group II and from 3.3% to 28.1% ($P < 0.05\%$) in group III. The accuracy of right ovary size rating increased from 8.3% to 31.2% in group III ($P < 0.05\%$), but there was no improvement in groups I and II.

Tab. 1. The evaluation of students' skills in recognizing the structures of the reproductive system of cows (positive evaluation only when all structures were identified/found, i.e. cervix, uterine body and horns and both ovaries)

Specification	Group 1 (2 males)	Group 2 (3 females, 1 male)	Group 3 (13 females, 2 males)
[1] Recognizing the structures of the reproductive system during the training period	75.0%^{A} (number of examinations during training sessions – 8, including correct ones – 6)	43.7%^{ABa} (number of examinations during training sessions – 16, including correct ones – 7)	28.3%^{Ba} (number of examinations during training sessions – 60, including correct ones – 17)
[2] Recognizing the structures of the reproductive system after the training period	100% (number of examinations during testing sessions – 4, including correct ones – 4)	87.5%^{b} (number of examinations during training sessions – 8, including correct ones – 7)	75.0%^{b} (number of examinations during training sessions – 32, including correct ones – 24)

Explanations: [1]examinations during four training sessions; [2]examinations after four training sessions (testing session); a, b, c – $P < 0.05$ (comparison of results in columns); A, B, C – $P < 0.05$ (comparison of results in rows)

Tab. 2. The evaluation of students' skills in recognizing the cervix, body of the uterus and horns, and the accuracy of the assessment of the size and consistency of the cow's uterus (positive evaluation only when the cervix, body and horns of the uterus were diagnosed/found and when the size and consistency were assessed in accordance with the results of an examination performed by an experienced veterinarian)

Specification		Group 1 (2 males)	Group 2 (3 females, 1 male)	Group 3 (13 females, 2 males)
Recognizing the body of the uterus and the length of the cervix	[1] recognizing the structures of the reproductive system during the training period	75% (number of examinations during training sessions – 8, including correct ones – 6)	60%^{a} (number of examinations during training sessions – 15, including correct ones – 9)	61.7%^{a} (number of examinations during training sessions – 60, including correct ones – 37)
	[2] recognizing the structures of the reproductive system after the training period	100% (number of examinations during testing sessions – 4, including correct ones – 4)	100%^{b} (number of examinations during testing sessions – 8, including correct ones – 8)	100%^{b} (number of examinations during testing sessions – 32, including correct ones – 32)
Recognizing the uterus: rating the size of the uterus and the width of the horns	[1] recognizing the structures of the reproductive system during the training period	50% (number of examinations during training sessions – 8, including correct ones – 4)	46.7%^{a} (number of examinations during training sessions – 15, including correct ones – 7)	61.7%^{a} (number of examinations during training sessions – 60, including correct ones – 37)
	[2] recognizing the structures of the reproductive system after the training period	100% (number of examinations during testing sessions – 4, including correct ones – 4)	100%^{b} (number of examinations during testing sessions – 8, including correct ones – 8)	100%^{b} (number of examinations during testing sessions – 32, including correct ones – 32)
Rating the uterus consistency	[1] recognizing the structures of the reproductive system during the training period	12.5% (number of examinations during training sessions – 8, including correct ones – 1)	20.0%^{a} (number of examinations during training sessions – 15, including correct ones – 3)	28.3%^{a} (number of examinations during training sessions – 60, including correct ones – 17)
	[2] recognizing the structures of the reproductive system after the training period	50% (number of examinations during testing sessions – 4, including correct ones – 2)	87.5%^{b} (number of examinations during testing sessions – 8, including correct ones – 7)	53.1%^{b} (number of examinations during testing sessions – 32, including correct ones – 17)

Explanations: as in Tab. 1.

The average time needed to complete a rectal examination in groups I, II and III, totalled, respectively, 1.8 min, 4.73 min and 4.16 min (108 s, 284 s, 250 s) in the training sessions, and 0.87 min, 2.48 min and 263 min (52 s, 149 s, 158 s) in the testing sessions.

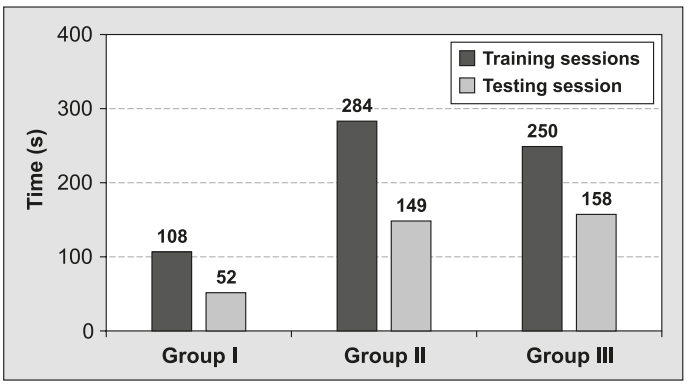

Fig. 1. Average time needed to complete a rectal examination for each group in training and testing sessions

The average number of examinations during the entire training session totalled 7.0, 7.5 and 4.2 in groups I, II and III, respectively.

It is assumed that during cattle reproduction classes, students of veterinary medicine acquire skills in the clinical examination of reproductive organs *per rectum*. The possibility of learning these skills differs depending on the size of the group of students, their commitment, training intensity, as well as the number of animals available and tested during training sessions. (3-5). The availability of animals may be limited, so numerous types of phantoms and trainers are increasingly used for training purposes (2). However, the level of skills acquired by students during veterinary studies is not widely known.

Tab. 3. The evaluation of students' skills in finding the left ovary and the right ovary during the rectal palpitation of cows and the accuracy of ovary size rating (positive evaluation only when the ovary was diagnosed/found and the structure (size) was assessed in accordance with the results of examination performed by an experienced veterinarian)

Specification		Group 1 (2 males)	Group 2 (3 females, 1 male)	Group 3 (13 females, 2 males)
Finding the left ovary	[1] finding the left ovary during the training period	75%^{A} (number of examinations during training sessions – 8, including correct ones – 6)	40%^{aAB} (number of examinations during training sessions – 15, including correct ones – 6)	25%^{aB} (number of examinations during training sessions – 60, including correct ones – 15)
	[2] finding the left ovary after the training period	100% (number of examinations during testing sessions – 4, including correct ones – 4)	87.5%^{b} (number of examinations during testing sessions – 8, including correct ones – 7)	78.1%^{b} (number of examinations during testing sessions – 32, including correct ones – 25)
Rating the size of the left ovary	[1] rating the size of the left ovary during the training period	20%^{A} (number of examinations during training sessions – 8, including correct ones – 2)	75%^{aAB} (number of examinations during training sessions – 15, including correct ones – 2)	3.3%^{aB} (number of examinations during training sessions – 60, including correct ones – 2)
	[2] rating the size of the left ovary after the training period	75.0% (number of examinations during testing sessions – 4, including correct ones – 3)	62.5%^{b} (number of examinations during testing sessions – 8, including correct ones – 5)	28.1%^{b} (number of examinations during testing sessions – 32, including correct ones – 9)
Finding the right ovary	[1] finding the right ovary during the training period	75%^{A} (number of examinations during training sessions – 8, including correct ones – 6)	60%^{aAB} (number of examinations during training sessions – 15, including correct ones – 9)	43.3%^{aB} (number of examinations during training sessions – 60, including correct ones – 26)
	[2] finding the right ovary after the end of the training period	100% (number of examinations during testing sessions – 4, including correct ones – 4)	100%^{b} (number of examinations during testing sessions – 8, including correct ones – 8)	84.4%^{b} (number of examinations during testing sessions – 32, including correct ones – 27)
Rating the size of the right ovary	[1] rating the size of the right ovary during the training period	62.5%^{A} (number of examinations during training sessions – 8, including correct ones – 5)	26.7%^{A} (number of examinations during training sessions – 15, including correct ones – 4)	8.3%^{aB} (number of examinations during training sessions – 60, including correct ones – 5)
	[2] rating the size of the right ovary after the training period	50.0% (number of examinations during testing sessions – 4, including correct ones – 2)	25.0% (number of examinations during testing sessions – 8, including correct ones – 4)	31.2%^{b} (number of examinations during testing sessions – 32, including correct ones – 10)

Explanations: as in Tab. 1.

As it results from the experiment, the students' skills in recognizing the structures of the reproductive system of cows in a gynecological examination were lowest in the group of the least motivated students. During the training sessions, 28.3% of the students correctly recognized the cervix, the body of the uterus and horns and both ovaries. Significantly better results were obtained by the group of moderately motivated students and highly motivated students. In the latter group, the percentage of correct diagnoses during the training sessions was 75%, which was almost three times as high as in the group of the least motivated students. An improvement in the recognition of the structures of the reproductive system after the end of the training cycle was noted in all groups of students.

The percentage of correct diagnoses increased statistically significantly, that is, up to 75% and 87.5% among the least motivated and moderately motivated students, respectively. In the group of the most motivated students, this increase was not significant, but only in this group did it reach 100%. The ability to rate the size of the uterus was already high at the beginning of the training. During the training sessions, the size was assessed accurately by 46.7% to 61.7% of students, and after the end of the training sessions by 100% of students in all groups. The ability to correctly assess the consistency of the uterus was slightly lower. After the end of the training cycle, 50% to 85.7% of students accurately assessed its consistency. An increase in uterine tonus is accompanied by heat and strong estrogenization of the female. The proportion of such animals among the cows examined was understandably limited. Therefore, some problems with the accurate determination of uterine tone were to be expected.

In a previous study, the skills of students practicing on live animals were highly rated. They were higher than those of students who practiced with phantoms. The research included, among others, finding the uterus and ovaries, as well as diagnosing pregnancy (3). In the available literature, no data were found regarding the accuracy of students' recognition of various structures of the reproductive system. One exception is a study in which factors influencing the results of pregnancy diagnosis in cattle were determined. It considered the influence of the students' training method, sex, origin (rural, urban, mixed), experience and career plans after graduation (small animals, large animals, mixed practice). During training sessions, students of one group

practiced with the Breed'n Betsy Bovine Training Simulator (Brad Pickford, Australia), and the others with live animals. Each student completed a questionnaire on his or her sex, place of origin and professional preferences, and then proceeded to examine six cows. There was no evidence of the influence of the student's sex or experience on the correct confirmation or exclusion of the cow's pregnancy. The factors that influenced the overall accuracy of pregnancy diagnosis were the training method (traditional), rural origin, professional preferences (mixed practice) and the stage of pregnancy of the animal examined. Training with the Breed'n Betsy model was associated with a lower sensitivity of detecting pregnancies younger than six months, but no differences were found between the groups in detecting pregnancies of over six months. None of the factors assessed was found to be significantly related to the specificity of pregnancy detection. Nevertheless, it was found that the best strategy to increase students' ability to detect pregnancy was intensive training with both the training model and live animals (1).

Already during the training sessions, a significant percentage of students in all groups were able to find the right ovary. After completing the classes, all students of the motivated and moderately motivated groups and 87.5% of the students of the poorly motivated group found the right ovary. More problems were noted in finding the left ovary. After completing the classes, only all of the most motivated students found the left ovary.

The students' ability to accurately rate the size of ovaries varied during the training. It was high in all groups of students after the end of training. Finding the left ovary proved much more difficult. During the training session, it was properly recognized by 3.3% to 25% of students. After the end of the training cycle, the left ovary was correctly recognized by 75% and 62.5% of the motivated and moderately motivated students, respectively, and 28.1% of the poorly motivated students. It is worth mentioning that students who additionally practiced with ovarian phantoms obtained better results in ovarian size assessment. The importance of phantom training has already been emphasized elsewhere (2, 3). Similarly, the experience acquired during the training and related to the number of examinations conducted by students is not without significance (1, 3). This was also evident in our research. As experience increased, the time needed to make a diagnosis was significantly shortened. It was the shortest among the most motivated students. However, it was also the group of the most committed students who performed the largest number of examinations.

In both the training sessions and the testing session, the students were required to rate the size of the right and left ovaries.

Assessment of ovarian structures was not obligatory. It was carried out by several students, and the only structure diagnosed was the corpus luteum. The accuracy of diagnosis was 19.67%. Each examination in which a student could detect the presence of the corpus luteum, previously confirmed by an ultrasound examination carried out by an experienced veterinarian, was accepted as one hundred percent. The literature shows that a high diagnostic accuracy is achieved in the recognition of the corpus luteum and large ovarian cysts, less often of large follicles (5). According to various data, the accuracy of the diagnosis of the corpus luteum ranges from 78% to 83.3% (5, 11, 13). Large cysts were correctly diagnosed in 66% of cases. Ovarian follicles were not detected if they were smaller than 10 mm (5, 12). The results of ovarian palpitation by practicing veterinarians were inadequate: the percentage of correct diagnoses was low (7). Watson and Munro (15) reported an 85% accuracy in a study of the corpus luteum in a distant past. However, in the case of the corpus luteum, some diagnostic problems may also arise in the presence of the corpus luteum inside the ovarian parenchyma (6).

Other research (4) showed that assigning specific cows to students did not improve the efficiency of rectal examination. Better teaching outcomes and greater student involvement were obtained by asking students for more a detailed examination of the ovarian structures and the sizes of various portions of the reproductive system, as well as changes that make it possible to track the oestrus cycle. Over time, the diameter of the cervix, uterine tone, the diameter of the left and right uterine horns and ovarian structures were recorded.

The description of the reproductive system structures provided by the students was compared with that of an experienced clinician. The test index was estimated statistically.

The experiment showed that assigning specific cows to students did not improve the results of their rectal palpation training. The results of the present study also suggest that when the time for palpation instruction is limited, selecting cows with easy handling behaviour is more important in the educational process (4).

In summary, our research is one of few that evaluated the skills of students during training and after the completion of training in cattle rectal examination. The drawbacks of our research were the relatively small number of students evaluated, groups differing in the number of students and the relatively simple test that verified the skills acquired. At the basic level, significant differences were noticeable between students with different levels of experience and motivation. Despite the simplicity and drawbacks of the research, it provides information about the skills of students and provides a basis for their improvement in the future.

The most motivated and experienced students showed the best cattle palpation skills. Although an

increase in the accuracy of the results of transrectal examination was noted in every group of students, an increase in the accuracy of right ovary size rating was observed in group III only. The research needs to be continued.

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