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Ultrasonography Use in the Reproduction of the Kazakh White-headed Breed Cows

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Abstract

The study was performed in the western region of Kazakhstan with cows and heifers Kazakh white-headed breed of cattle. This article presents the results of trans-rectal ultrasonography in determining pregnancy of cows at an early stage. Using ultrasonography, we managed not only to visualize the gynecological organs but also to obtain valuable diagnostic information about the size of internal structures, including localization and morphotype. It has been found that fetal gender can be determined with ultrasonography, starting from the 45th day of pregnancy. The aim was to obtain preliminary information for future studies that would provide a scientific basis for ways of increasing production of beef cattle due to a more complete use of the breed's genetic potential.

Keywords

Kazakh white-headed breed of cattle; Pregnancy diagnosis; Trans-rectal ultrasonography

Introduction

Cost-effective management of highly productive beef cattle breeding is only possible with the maximum use of the reproductive potential of animals breeding stock [1] reports that economic efficiency of beef cattle breeding mainly depends on calves yield per 100 heads of the reproductive part of the herd.

As noted in Studentsov *et al.* [2], diagnosis of pregnancy is paramount and mandatory in every household involved in breeding.

The current cattle livestock production systems require a reliable and effective method of diagnosing early pregnancy and abnormalities of the reproductive tract that would make it possible to substantially improve farms' economic results due to early detection of dry animals and causes of infertility. Trans-rectal ultrasonography is such a method.

References [3-13] draw attention to the fact that trans-rectal ultrasonography ensures detection of early pregnancy, diagnosing reproduction diseases and continuous monitoring of fetal development. Revolutionary significance of ultrasonography for breakthrough in research on cattle breeding is also noted in Williams [14]. The possibility of determining pregnancy on the 30th day after fertilization is in line with the data of Hansar *et al.* [15]. The article of magazine describes the possibility of determining pregnancy as early as on the 26th day after insemination.

As reported in Zinullin; Bozymov *et al.* [16,17], out of the specialized beef breeds in the Republic of Kazakhstan the most widely used one is the Kazakh white-headed breed created in the period 1930-1950 by reproductive crossing of Kazakh and Kalmyk breeds of cows and their hybrids with Hereford bulls.

Wide spread of the breed shows its genetic diversity and strength of constitution. The animals feature heavy body weight, sufficient milking capacity, high slaughter yield, good quality of meat, and at the same time good adaptability to breeding in harsh conditions of the extreme continental climate.

The aim of our study was to use a portable digital diagnostic apparatus in trans-rectal ultrasound study of early pregnancy in cows and heifers of the Kazakh white-headed breed of cattle, on the basis of the data obtained, to characterize the advantages of using the method of cows' genitals ultrasonography in beef cattle breeding in the West Kazakhstan region.

Methods

This research experiment was performed between April and November, 2014 at the "Bakhyt" farm in the Terektinsky district of the West Kazakhstan region, which is the mainly specialized in breeding the Kazakh white-headed breed of cattle.

In course of diagnostics, we used disposable PET gloves for rectal examination and a portable digital diagnostic (veterinary) apparatus KH 5200 with rectal linear sensor.

For studying uterus, according to [18,19], the oscillation frequency was set between 5.0 and 7.5 MHz, the depth of ultrasound penetration for each animal was individually selected between 10 and 15 cm, for studying ovary the frequency was 7.5 to 9.0 MHz, and the depth of ultrasound penetration – 15 to 20 cm.

The working surface of the sensor was smeared with sound-conducting gel, and the sensor was introduced into the rectum, and cervix, body, uterine horns, and ovaries were scanned step by step. In order to comply with the rules of aseptics and antiseptics, chlorhexidine (0.05%) was used. On the screen, continuous image of the structure located beneath the work surface of the sensor was obtained.

Positive pregnancy diagnosis was based on visual assessment of the cavity and uterine horn structure, namely, appearance of echo-positive structure surrounded by echo-negative amniotic fluid.

When calculating cost-effectiveness of early detection of pregnancy, the amount of losses was calculated, which includes the cost of the lost calf and cost of keeping a dry cow.

The cost of the lost calf is calculated as the product of gain in beef cattle and a hundredweight of live weight of higher fatness cattle.

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Cost of keeping a dry cow mainly consists of the cost of forage per day. The cost of forage per day, in turn, consists of the cost of the daily ration, and the cost of feed distribution, care and keeping.

Results and Discussion

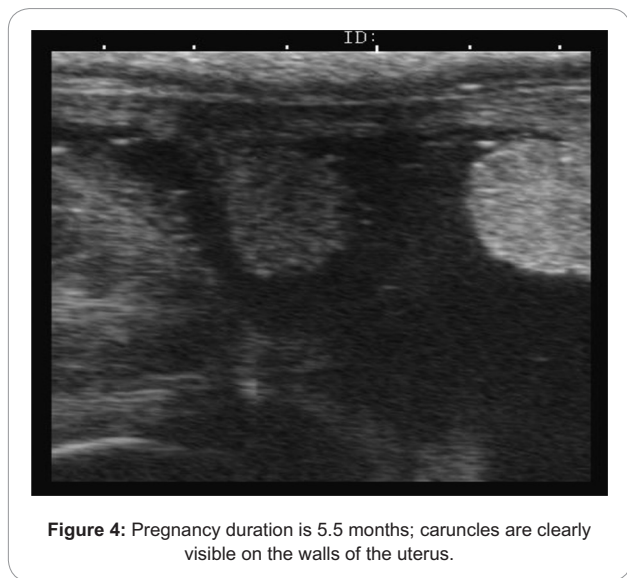
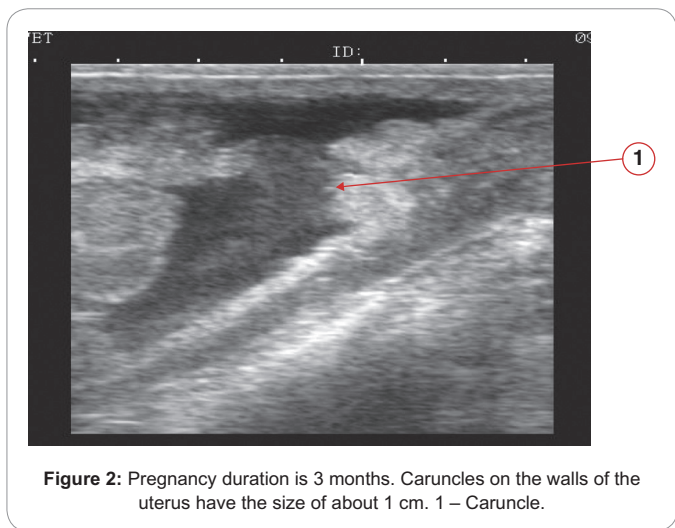
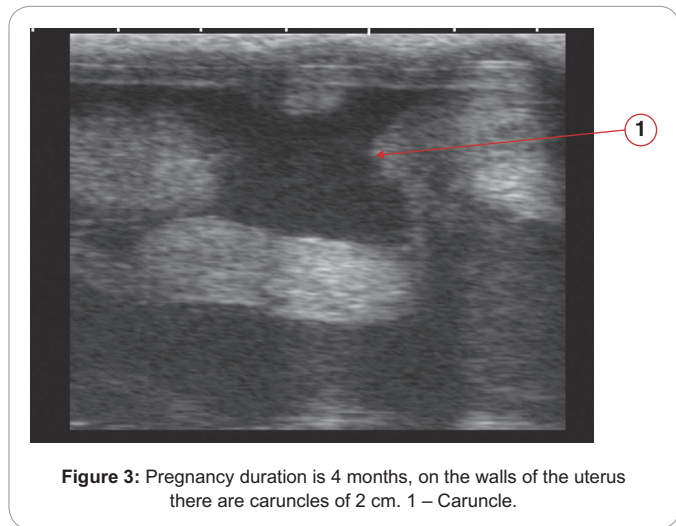
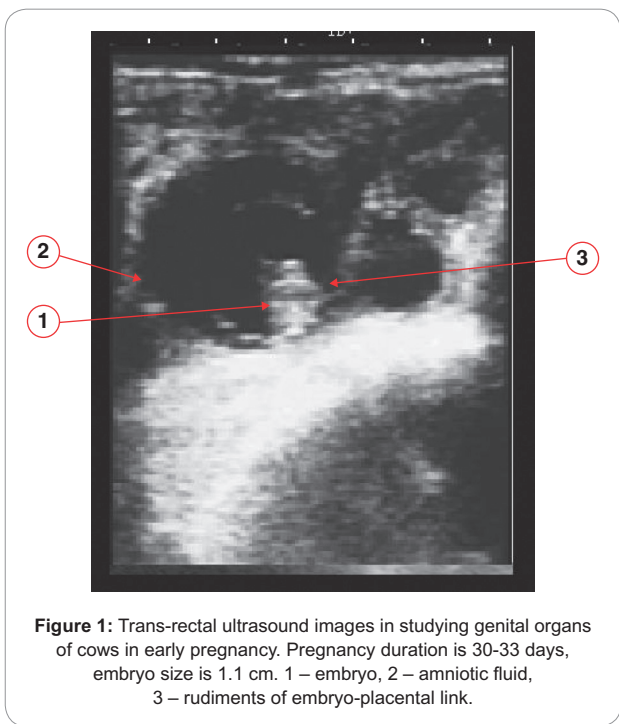
Throughout the whole cavity of the pregnant uterus horn, echo-negative structure (liquid) was visualized; in some cases, an embryo in the form of echo-positive formation (Figure 1).

On the basis of the obtained pictures, one can not only diagnose early pregnancy in cows but also monitor fetal development (Figures 2-4), as well as identify some indicators that point to fetus viability, which are of great practical importance for perinatal diagnostics.

So, on the 28th day of pregnancy heartbeat of the embryo is recorded, and on the 30th-32nd day it is well identified, since it is surrounded by echo-negative amniotic fluid. Starting with the 33rd-35th day, echo-positive arc-form lines are visualized embryo shells. On the 33rd-36th day of pregnancy, the locomotor activity of the fetus is detected, on the 37th day the placenta becomes visible. After the 40th day, contours of the embryo are well detected. Starting from the 41st-42nd day, first ossification centers in the vertebrae, ribs, jaw, femur, and humerus are observed as hyperechoic lines. From the 43rd day, echo-negative formation of round shape becomes visible in the area of the head, i.e., eyeballs (Table 1).

Embryo gender may also be defined starting from the 45th to the 70th day of pregnancy, paying attention to the type of genital tubercle rudiment localization – caudal or cranial (Figure 5).

Farms can use this information in many ways. Information about embryo gender will help to make a sales contract, which will allow them to sell a pregnant cow at a higher price. The practice confirms



Duration of pregnancy (days)	Set of indicators								
	Embryo length (cm)	Heart	Fluid	Motion	Shells	Placenta	Umbilical cord	Organs, bones	Eyeball
26-29	up to 1.0	+	-	-	-	-	-	-	-
30-32	1.0-1.2	+	+	-	-	-	-	-	-
33-35	1.2-1.4	+	+	+	+	+	-	-	-
36-37	1.4-1.6	+	+	+	+	+	-	-	-
38-40	1.6-2.0	+	+	+	+	+	+	-	-
41-42	2.0-2.3	+	+	+	+	+	+	+	-
43-45	2.3-2.7	+	+	+	+	+	+	+	+

Table 1: Pregnancy duration by a set of indicators



that farmers want to have this information, which makes it possible to make decisions about rejecting low-income or ill cows and about herd planning, as well as to determine which cows are to be put into individual boxes.

Calculation of cost-effectiveness of early pregnancy detection for the “Bakhyt” farm in the West Kazakhstan region has shown that the cost of a calf is \$190.94; farm’s loss from a dry cow is \$0.93 per day. Farm’s total loss from one dry animal for the entire reproductive cycle will be \$486.45 per animal.

Use of ultrasonography for pregnancy diagnostics makes it possible to early obtain the result of insemination and either to re-inseminate or reject the animal. The service period is at least 30 days shorter, i.e., the information about pregnancy is obtained 30 days earlier. Thus, we can ascertain economic efficiency of using ultrasonography for diagnosing pregnancy in farming production.

Conclusion

Using ultrasonography, we managed not only to visualize the gynecological organs but also to obtain valuable diagnostic information

about the size of internal structures, including localization and morphotype in cows and heifers of the Kazakh white-headed breed. During the experiment it was found that fetal gender can be determined with ultrasonography, starting from the 45th day of pregnancy.

This article has been developed in the framework of the rendering services for implementation and dissemination of knowledge within the framework of the innovative project in the field of agribusiness in the West Kazakhstan region performed in accordance with the Law of the Republic of Kazakhstan dated July 8, 2005 “About State Regulation of development of agriculture complex and rural areas” according to the budget program 255019000 “Management of agricultural area – Spreading and implementation of innovative practices” according to the specifics 159 “Payment for other services and activities.” on the topic: “Introduction of biotechnological methods for improving reproduction of beef cattle in the “Bakhyt” farm in the Terektinsky district of the West Kazakhstan region”.

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