MEASUREMENTS OF FETAL GROWTH VIA TRANSABDOMINAL ULTRASONOGRAPHY DURING MID - PREGNANCY

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Abstract

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The aim of present study was to determine values of some measurements of foetal growth via transabdominal ultrasonography (5 MHz sector probe) during mid-pregnancy (50-84 days) at ewes from Synthetic Population Bulgarian Milk. The study was a continuation of our previous work, in which we evaluated the fetal growth between 25-63 days. The following measurements (in mm) were taken on days 50, 60, 70 and 84 of pregnancy: head diameters - biparieatal (BPD) and occipito-nasal (ONL) (except day 84), placentome size: width and length. The effect of gestational phase on foetal growth is analysed by one way ANOVA and coefficients of correlation (r) were established between gestational phase and measurements. The gestational phase influence significantly ($P<0.001$) all taken measurements. The mean values for BPD were 14.26, 20.92, 25.94 and 31.43 respectively for day 50.60, 70 and 84. On day 50 the mean value for ONL was 22.82 and reached 44.4 on day 70. The size of placentomes varied in wide range, as we observed in our previous work. On days 50 the mean values were: length- 18.54 and width – 13.28 and reached on 84 day mean length – 37.24 and mean width – 25.11. It was established high, positive and significant correlation between head diameters, placentome size and gestational age (r = 0.97*** - BPD, r = 0.94*** - ONL, r = 0.78*** - length and r = 0.72*** - width). In our previous study we concluded, that independently using of both diameters was suitable for prognosis of gestational age. But now, as we take in mind the present and pervious study, we recommend the BPD as primary measurement for prediction of fetal age. The placentomes size were poorer reliable for prognosis gestational age in comparison to head diameters, but could be used as auxiliary parameter for prognosis.

Key words: ultrasound, ewe, measurements, gestational age

Introduction

The real-time B-mode ultrasonography is the earliest, most accurate, safest, fastest and most economical method of pregnancy diagnosis in sheep at farm level (Ganie et al., 2009). When the date of mating is unknown, monitoring fetal development allows estimation of gestational age (Gonzáles de Bulnes et al., 1998). According to Karen et al (2001) the most practical measurements of foetal structures are embryonic vesicle, crown-rump length, fetal head diameters, thoracic diameters, foetal heart rate, placentome size. Ideally, intrauterine fetal growth rate should be defined in the same population as that evaluated (Ali and Hayder, 2007).

Synthetic population Bulgarian milk is newly created breed (officially acknowledged during 2005) and it's the most spread

breed in Bulgaria (Livestock breeds in the Republic of Bulgaria, 2011). The information about foetal measurements and growth standards for Synthetic Population Bulgarian Milk (SPBM) sheep breed is scarce. There is only one study that was done from our scientific group, in which we evaluated the fetal growth between 25-63 days (Metodiev et. al., 2012).

The aim of present study was to determine values of some measurements of foetal growth via transabdominal ultrasonography during mid-pregnancy at ewes from Synthetic population Bulgarian Milk.

Material and Methods

The experiment was carried out with 19 ewes, artificially inseminated in one day. The ewes were with induced syn-

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chronized estrus after two injections, given in 9 days apart, of synthetic analog of prostaglandin $F_{2\alpha}$ - alfaprostolum (0.5 ml Alfabedyl CEVA ANIMAL HEALTH). All ewes were conceived as that was established previously by non-return method. It was used Eickemeyer Medic 2000 device and sector probe with frequency 5 MHz. It was used transabodminal approach in right abdominal wall, in the area between pecten ossis pubis and last rib. An ultrasonic jelly was put on the probe, before attaching it to the skin.

Four consecutive ultrasound observations on days 50, 60, 70 and 84 of pregnancy were done. All measurements were taken after freezing the images with built-in electronic callipers. Where two fetuses were predicted and measured, but after the lambing the prognosis was untrue, we took mean value.

The following measurements were taken (Images 1-6):
- Head diameters: biparieatal (BPD) and occipito-nasal (ONL).
- Placentome size: width and length.
- BPD - head width, determined from a symmetrical image of the skull (by Sergeev et al., 1990).
- ONL – head length, determined from the top of os nasale to the end of os occipitale. This parameter was not measured on day 86 because of the small screen of the camera.
- Size of placentomes. After the 40-th day of gestation, the placentomes of ewes are cup-shape (Doizé et al., 1997). It was measured its width and length.
- Normally (but not in all cases), one placentome from each ewe was measured and that was the first placentome that was imaged on the screen.

Statistical analysis

All measurements were in millimeters (mm). The results were presented in means and standard errors. The effect of gestational phase on foetal growth is analysed by one way ANOVA. T-statistics was used to compare differences between different observations of each measurement.

The coefficients of correlation (r) between gestational phase and embryofetal measurements were established by standard regression with computer program EXCEL, 2003 and package Data Analysis. The correlation relationships were classified as: r ≤0.3 – low correlation; r from 0.3 to 0.5 – moderate correlation; r from 0.5 to 0.7 – considerable; r ≥0.7 – high correlation. The significance of the coefficients of correlation was analyzed by t-criteria of Student.

Results

The gestational phase influence significantly (P<0,001) all taken measurements (Table 1). The differences of sizes of BPD and ONL between Day 50 and Day 60, Day 60 to Day 70 and Day 70 to Day 84 were highly significant (P<0.001) (Table 2). The mean values for BPD (Table 2) were 14.26, 20.92, 25.94 and 31.43 respectively for day 50, 60, 70 and 84. On day 50 the mean value for ONL was 22.82 and reached 44.4 on day 70 (Table 2).

The size of placentomes varied in a wide range. On days 50 the mean values were: length- 18.54 and width – 13.28 and reached on 84 day mean length – 37.24 and mean width – 25.11 (Table 2). It is observed that with the increase of age the
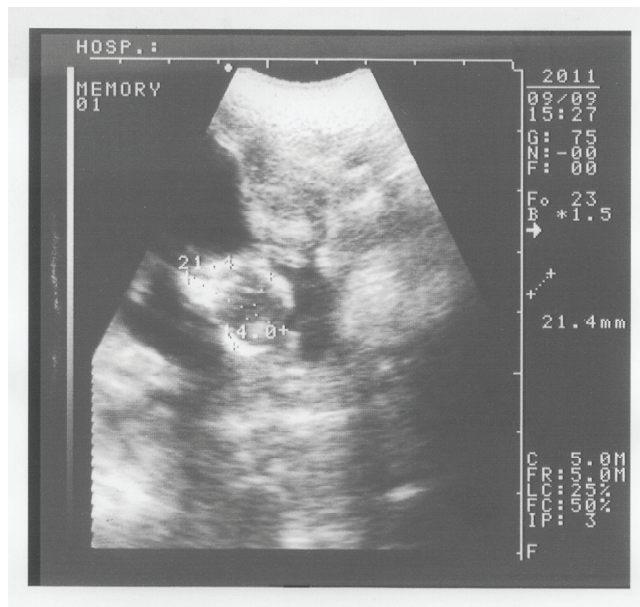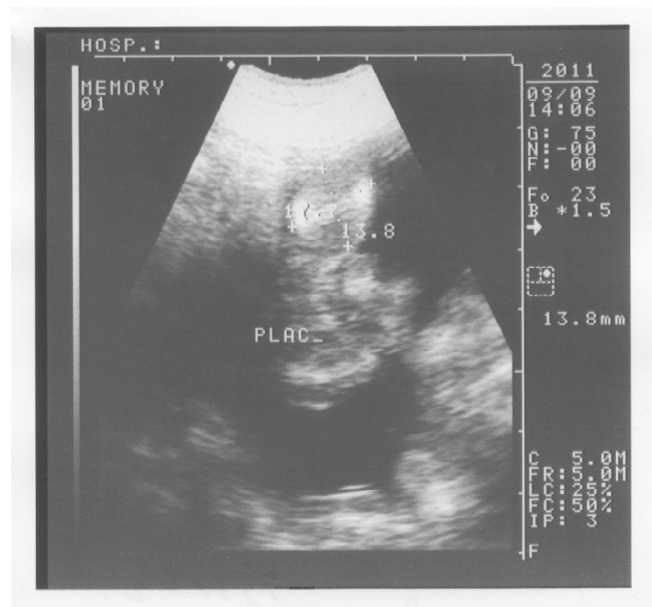
Placentome (Image 1) and head diameters (Image 2) on day 50

Table 1
Values of F-criteria for the effect of gestational age on fetal measurements

	BPD			ONL			Placentome, length			Placentome, width		
Source of variation	DF	MS	F	DF	MS	F	DF	MS	F	DF	MS	F
Between groups	3	1168.1	704.32***	2	2659.3	294.99***	3	1364.5	65.39***	3	524.2	40.27***
Within groups	85	1.66		67	9.06		72	20.87		72	13.02	
Total	88			69			75			75		

Note*** - Significant at P<0.001
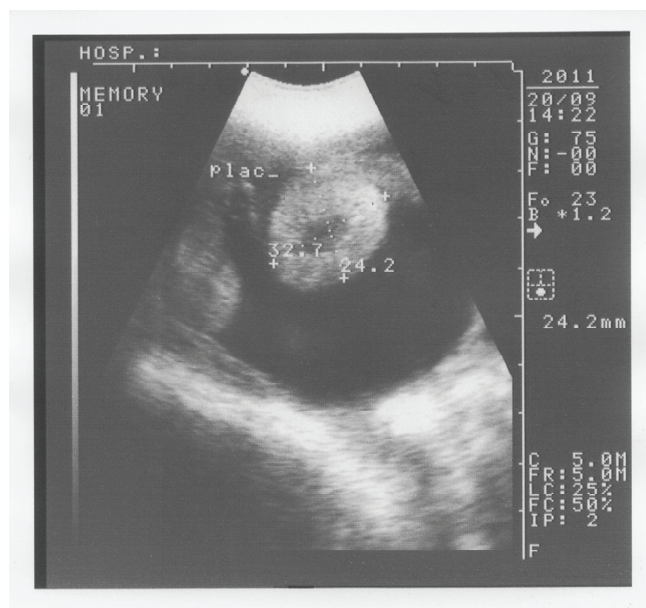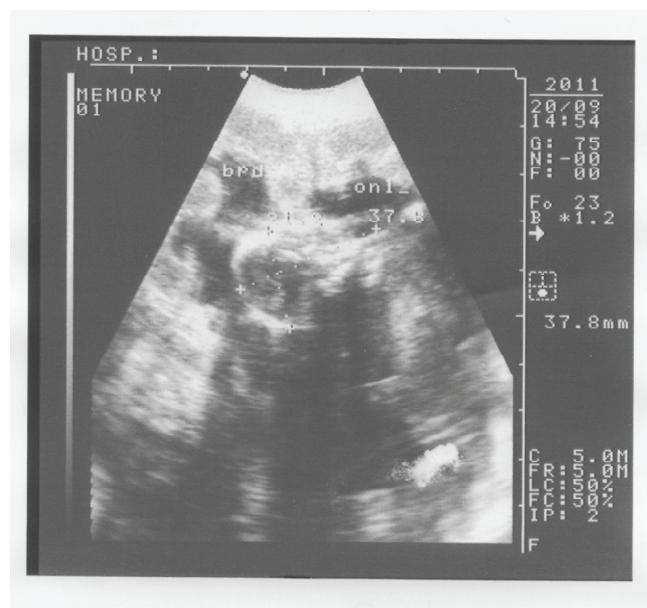
Head diameters (Image 3) and placentome (Image 4) on day 60
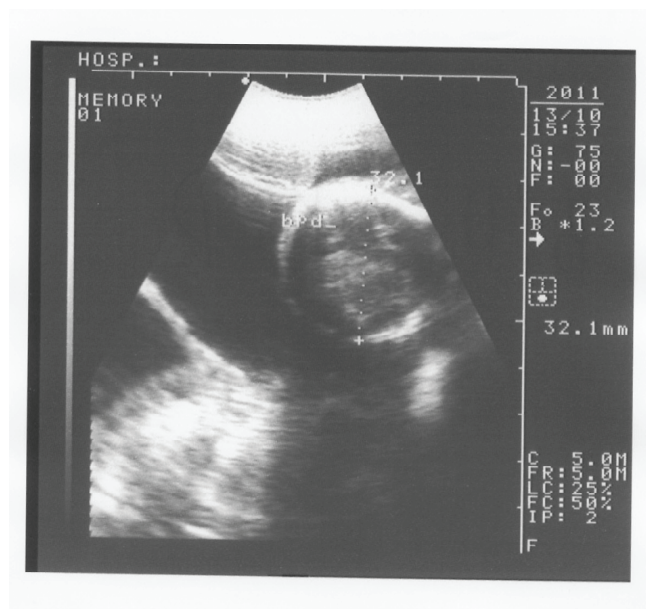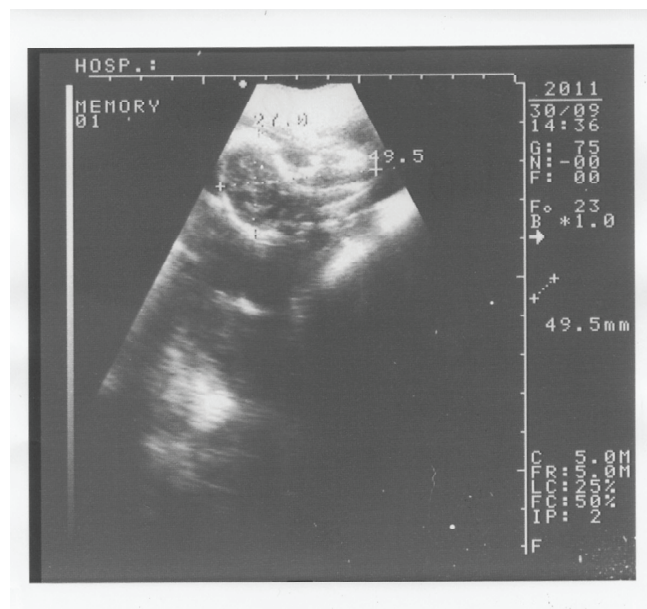
Head diameters (Image 5) on day 70 and BPD (Image 6) on day 84

differences between size placentomes became lower about significances (Table 2).

It was established high, positive and significant correlation between head diameters, placentome size and gestational age (r = 0.97*** - BPD, r = 0.94*** - ONL, r = 0.78*** - length and r = 0.72*** - width) (Table 3).

Discussion

The obtained high values of coefficients of correlation and determination for head diameters (BPD – r = 0.97, P<0.001; ONL r = 0.94, P<0.001) (Table 3) were in conformity with those that we established in our previous work (BPD – r = 0.93, P<0.001, ONL r = 0.92, P<0,001) and with those observed from other researchers in that field. Gonzáles de Bulnes et al. (1998), in study with Manchega ewes obtained high coefficient of correlation for BPD (r = 0.96), measured between days 32-90 and high coefficient of correlation for ONL, measured between days 38-91. Haibel and Perkins (1989), Sergeev et al. (1990), Greenwood et al. (2002) and Gunduz et al. (2010) also established high coefficient of correlation over 0.9 for those parameters.

The authors gave advantages to one or another diameter as more accurate for prediction of gestational age. Kelly and Nehman (1989), recommended ONL as more accurate, but Haibel and Perkins (1989), Sergeev et al. (1990) and Gonzáles de Bulnes et al. (1998) said that the BPD was the most representative parameter for prediction during second third of pregnancy. In addition, Sergeev et al. (1990) said that the head length proved more difficult to measure.

In our previous study we concluded, that independently using of both diameters was suitable for prognosis of gestational age. But now, as we take in mind the present and pervious study, we recommend the BPD as primary measurement for prediction of fetal age. This measurement has the highest

coefficient of correlation (r = 0.97) and from practical point of view it is more easier to measure compared to ONL. Also we weren't able to measure ONL on day 84, because of the small screen of camera and its increasing size.

The size of placentomes varied in wide range as we observed in our previous work. Gonzáles de Bulnes et al. (1998) also reported that it was existed a great variation of size of placentomes in the same foetus.

Our results were similar to those, obtained from Ali and Hayder (2007) at Ossimi ewes. The authors established moderate value for the coefficient of determination of the size of placentomes (R² = 0.38), which when calculated become r = 0.62.

The obtained results in this study confirm the conclusion that we did in our previous study – the placentomes size were poorer reliable for prognosis gestational age in comparison to head diameters, but could be used as auxiliary parameter for prognosis.

Conclusion

The gestational phase influence significantly (P<0,001) all taken measurements – BPD, ONL and placentomes size.

It was established high, positive and significant correlation between head diameters, placentome size and gestational

Table 3
Coefficients of correlation between measurements and fetal age

Measurement	Coefficient of correlation (r)
BPD	0.97***
ONL	0.94***
Placentome, length	0.78***
Placentome, width	0.72***

Note*** - Significant at P<0.001

Table 2
Values of all taken measurements and significance of the differences between them

Day	50		60		70		84	
Measurement, mm	n	Mean ± SE	n	Mean ± SE	n	Mean ± SE	n	Mean ± SE
BPD	26	14.26±0.13	24	20.92±0.29 A***	21	25.94±0.2 B***	18	31.43±0.47 C***
ONL	25	22.82±0.42	24	32.49±0.71 A***	21	44.4±0.73 B***		
Placentome, length	19	18.54±0.79	20	29.76±1.12 A***	18	35.8±1.2 B***	19	37.24±1.06 NS
Placentome, width	19	13.28±0.84	20	21.05±0.8421 A***	18	23.6±0.61 B*	19	25.11±0.97 NS

Notes:
• On day 50 one measurement of ONL wasn't taken, because of position of fetus
• Number of measurements varied, because of two causes: 1) false diagnosis of fetal number in each day 2) sometimes wasn't able to do measurements because of the fetus position
• Significant differences at *** - P<0.001 A - Day 50 and Day 60; B - Day 60 and Day 70; C - Day 70 and 84; * P<0,05 - B - Day 60 and Day 70; NS –not significant

age (r = 0.97*** - BPD, r = 0.94*** - ONL, r = 0.78*** - length and r = 0.72*** - width)

We recommend the BPD as primary measurement for prediction of fetal age.

Acknowledgments

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