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The evolution of body condition score of Manchega breed ewes according to lambing season and birth type, and its effect on lamb growth

A. MOLINA*
L. GALLEGO*
M. PLAZA**
C. GÓMEZ***
*DEPARTAMENTO DE CIENCIA Y TECNOLOGIA AGROFORESTAL
**DEPARTAMENTO DE SISTEMAS LOGICOS
CTRA. DE LAS PEÑAS, KM 3.2 ALBACETE (SPAIN)
***INSTITUTO TÉCNICO AGRONOMICO PROVINCIAL (ITAP)
ALBACETE (SPAIN)

SUMMARY - The effect of Body Condition Score (BCS) at Lambing (BCL) on parameters related to lamb growth (BW= Birth Weight; WW= Weight at Weaning; ADG= Average Daily Gain) was studied using a flock of 530 Manchega breed ewes with three different lambing seasons (January, May and September). The evolution of BCS between birth and weaning was also studied. Statistical analysis was undertaken to explain the influence on the parameters observed (BW, WW and ADG) of the BCL, Lambing Season (LS) and Birth Type (BT). Statistical differences were observed at different levels, except in the case of MDG and BCL. Linear regression analysis was carried out between BW, WW, ADG and BCL and the following correlation coefficients were obtained for single-birth lambs: 0.931, 0.634 and 0.955 respectively. For twin-birth lambs the coefficients were 0.744, 0.467 and 0.668. The BCL gave statistically significant differences according to LS (P< 0.01) and BT (P< 0.001). The Body Condition Score at Weaning (BCW) also varied significantly according to LS and BT (P< 0.001).

RESUME - Dans un troupeau de 530 brebis de race Manchega, et en se basant sur trois époques de mise bas (Janvier, Mai et Septembre), on a étudié l'effet que la note d'état corporel (NEC) au moment de la mise bas (NECM) a eu sur quelques paramètres liés à la croissance des agneaux (PN=poids à la naissance; PS=poids au sevrage; GMQ= gain de poids quotidien moyen), ainsi que l'évolution de la NEC entre la mise bas et le sevrage. L'analyse statistique effectuée pour expliquer l'influence sur les paramètres étudiés de la NECM, de l'époque de la mise bas (MB) et du nombre d'agneaux nés (NA), a permis d'établir des différences statistiques à différents niveaux, excepté dans le cas du GMQ et de la NECM. On a effectué une régression linéaire entre PN, PS, GMQ et NECM dans laquelle on a obtenu respectivement 0,931; 0,634 et 0,955 comme coefficient de corrélation chez les agneaux de mise bas simple. Chez les agneaux issus de mise-bas double, les coefficients on été de 0,744; 0,467 et 0,668. La NECM a présenté des différences statistiques significatives selon la MB (P<0,01) et NA (P< 0,001). La condition corporelle au moment du sevrage (NECS) a également varié significativement selon la MB et le NA (P<0,001).

Introduction

The body condition score (BCS) method (Russel *et al.*, 1969) has been widely used in recent years in English sheep breeds as a means of evaluating body fat reserves, whose effect on the relation between alimentation and production is well known.

The use of this method in Mediterranean sheep breeds has been limited until recently, principally because of the doubts expressed by some authors as to its validity in rustic breeds, based on the different distribution and movement of fatty deposits in these breeds compared to genetically improved breeds (Kempster, 1980).

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The earliest work using body condition score in Mediterranean breeds aimed to adapt the original method to the characteristics of fat deposits in the Rasa Aragonesa breed and its crosses (Paramio and Folch,1985; Delfa *et al.*, 1987; Purroy *et. al.*, 1987).

Under farming conditions which rely heavily on pasture in order to minimize feeding costs, the capacity of ewes to store and release body fat reserves when pasture is poor means that alimentary management has an important effect on productive results.

For these reasons BCS was used in the Manchega breed to study the effects of body fat reserves on birth weight and growth in lambs reared during different lambing seasons. The evolution of BCS in the ewes was studied over the period from lambing to weaning.

Material and methods

Five hundred and thirty Manchega breed ewes in Albacete province belonging to the Diputación Provincial were used in the experiment.

The flock was divided into two groups and the traditional reproductive frequency of three lambings in two years was followed. The three lambing seasons were bored on January, May and September. The rams were allowed free access to the ewes for 35 days with a ratio of one ram to 20 ewes. Male effect was used for all three mating periods.

Alimentation was based on range grazing and the stubble of both irrigated and non-irrigated cereal crops. However as part of the irrigated land was turned to horticulture, the remains of these crops were used in winter and spring (peas, cauliflower, green beans etc.). In the last month of pregnancy and until weaning the ewes were given a complement of alfalfa hay (0.5kg ewe/day) and varying amounts of concentrates (maize, barley and soya).

During the day, when the ewes went to pasture, the lambs were separated, but spent the night with the ewes. Weaning was abrupt and the lambs were separated from the ewes at 45 ± 3 days.

The body condition score method described by Russel *et al.* (1969) modified by the Meat and Livestock Commission (1975) was used to give a final score in 11 categories at intervals of 0.5 points.

Scoring was undertaken simultaneously by two observers with three months experience in ewes on the same farm. When scores differed the measurements were repeated until a consensus was achieved.

Results and discussion

Lamb growth

The results obtained for the parameters observed in order to evaluate the growth of the lambs, birth weight (BW), weight at weaning (WW), and average daily gain (ADG), divided into groups according to body condition score at lambing (BCL) and sub-divided according to birth type and lambing season, appear in Tables 1, 2 and 3.

The BW of the lambs in each BCL group (4.7, 4.9, 5.5 kg) was higher as the BCL of the ewes increased, giving statistically different values ($P<0.05$). The same effect is observed on studying single births (4.9, 5.4, 5.7 kg) and twin births (4.6, 4.7, 5.1 kg).

A study of the results of BW obtained according to lambing season shows a general tendency to an increase in BW as BCL in the ewes increases in the three lambing seasons (January, May and September). BW, for both single and twin birth lambs was always higher (5.6 kg *vs* 5.4 kg and 5.0 kg *vs* 4.7 kg) for September lambing. This is probably due to the higher percentage of ewes with a BCL>3 appearing in this season, due, no doubt, to the better alimentary conditions as a result of the use of summer stubble.

The evolution of BW in single and twin birth lambs, represented by a curve on which each point corresponds to the lean value of BW for each BCL of the ewes, together with the regression lines in each case, are shown in Figure 1. For both curves a general tendency to an increase in BW as BCL in the ewes increases is observed. There was a better adjustment for the single birth lambs ($R=0.931$) than for twins ($R=0.744$).

The WW of the single birth lambs (17.0, 17.8, 19.4 kg) increased as the BCL of the ewes increased, although only the two groups with highest BCL were differentiated statistically ($P<0.05$). However, in the case of twin birth lambs the WW (15.7, 15.8, 16.0 kg) did not vary significantly in relation to the BCL of the ewes.

On analyzing the lambing season effect on WW for the BCL groups, we observed, as occurred with BW, higher WWs for September births compared to the annual mean, for both single and twin birth lambs (19.0 v 18.2 kg and 15.9 v 15.6 kg).

The evolution of WW in relation to the BCL of the ewes together with the regression lines of these curves appear in Figure 1. It can be seen from this Figure that in single birth lambs, from BCL=2, the WW increases with the BCL, while in twin birth lambs there are hardly any differences for WW in relation to the different BCL groups. The correlation coefficients were R=0.634 and R=0.467 for single and double birth lambs respectively.

The ADG also gave increases in line with the increase of the BCL of the ewes, both for single birth lambs (271, 289, 303 g) and for twins (247, 257, 254 g), although only the singles and the WW values of the two groups with highest BCL were significant statistically (P<0.05).

The evolution of ADG in relation to BCL of the ewes and the corresponding regression lines (Figure 1), show an increasing evolution and a correlation coefficient of R=0.955 in the case of singles. In the case of twin birth lambs the ADG increase was not as clear and the regression line was worse (R=0.688).

Multiple variance analysis was used to show the influence of BCL, lambing season (LS) and birth type (BT) on each of the growth parameters of the lambs studied, BW, WW and MDG; the results are given in Table 4.

It was observed that BW varied significantly at a maximum level (P<0.001) according to the three BCLs groups, the three LSs and the two BTs studied. The same occurred with the WW which was highly influenced by BCL, LS and BT, although for BCL there was a lower level of significance (P<0.01). ADG only showed significant differences as a consequence of Ls (P<0.05) and BT (P<0.001), while on the other hand the BCL of the ewes had no influence on the ADG of the lambs.

Evolution of BCS

The BCL values obtained (Table 5) showed a clear difference between single and twin birth ewes, both for the three lambing seasons studied and for the annual mean (2.99 v 2.69). The last value gave a 10% advantage to the single birth ewes.

The LS also determined differences in the BCL, September was again the month which gave best results for BCL. For single birth ewes the BCL for September (3.12) was higher and significantly different (P<0.05) from those observed for January and May (2.97 and 2.84). In the case of twin birth ewes we can only note that May was unfavourable for BCL (2.47) and this value was statistically different (P<0.05) from those obtained in January (2.81) and September (2.76).

Body condition score at weaning (BCW) according to birth type is shown in Table 6. As happened with BCL, there was a better BCW in the single birth ewes (2.69) compared to twin birth ewes (2.38), giving a 11.5% BCL advantage to the single birth ewes.

With respect to lambing season, for both single and twin birth ewes the highest BCW were for May lambing (2.95 and 2.69); they were significantly different from the results obtained for January and September (P<0.05). These results confirm those obtained for BCL and the influence of greater availability of alimentation in the months of June and July. Cereal stubble was widely available over the weaning period from 15 June to 15 July (45 days postpartum).

The variations in BCS between birth and weaning found in Table 7 show a positive, but not very important, increase (0.11 and 0.22) in single and twin birth ewes respectively for May lambing, the reason for which is explained in the previous paragraph.

For the January and September lambings, the rearing of lambs caused a decrease in the BCS of the ewes of up to 20.2% in the worst case. In general, over the lambing to weaning interval the decrease in BCS was very similar for single (0.30) and twin birth (0.31) ewes.

Finally, in Figure 2 the distribution of BCL and BCW in graphic form can be found, with the percentages of ewes belonging to each of the three BCS groups studied represented by LS and BT. For all of the ewes, both for BCL and BCW, the percentage of ewes included in the intermediate (2-3) BCS group remains within constant limits (50-60%) in both cases. On the other hand important differences appear for the BCS<2.5 group (BCL=17.1%, BCW=34.4%) and for the BCS>3 group (BCL=23.5%, BCW=16.5%). We can conclude that between lambing and weaning there is a displacement of the ewes from the groups with better BCSs to groups with worse BCSs.

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Table 1: Birth weight (kg) of Manchega breed lambs for different seasons and according to the body condition scoring of the ewes at lambing (BCL= body condition scoring at lambing)

		BCL of ewes			Mean
		<2.5	2.5-3.0	>3.0	(n.º of lambs)
SINGLES	Jan.	4.9^{a}	5.4^{b}	5.3^{ab}	5.3 ± 0.9 (97)
	May	4.9^{a}	5.4^{b}	5.4^{ab}	5.3 ± 10.0 (92)
	Sep.	5.1^{a}	5.4^{a}	6.0^{c}	5.6 ± 1.0 (117)
	Mean	4.9 ± 0.8^{a} (43)	5.4 ± 0.8^{b} (163)	5.7 ± 1.1^{c} (100)	5.4 ± 1.0 (306)
TWINS	Jan.	4.4^{a}	4.6^{ab}	5.0^{b}	4.6 ± 0.8 (149)
	May	4.4^{a}	4.5^{a}	5.1^{b}	4.5 ± 0.8 (142)
	Sep.	5.0^{a}	4.9^{a}	5.1^{a}	5.0 ± 0.9 (162)
	Mean	4.6 ± 0.8^{a} (97)	4.7 ± 0.8^{a} (3.5)	5.1 ± 0.8^{b} (51)	4.7 ± 0.8 (453)
TOTAL	Jan.	4.6^{a}	4.8^{a}	5.2^{b}	4.9 ± 0.9 (246)
	May	4.6^{a}	4.9^{a}	5.3^{c}	4.8 ± 0.9 (234)
	Sep.	5.0^{a}	5.1^{a}	5.7^{b}	5.2 ± 1.0 (279)
	Mean	4.7 ± 0.8^{a} (140)	4.9 ± 0.9^{b} (468)	5.5 ± 1.1^{c} (151)	5.0 ± 1.0 (759)

Different Letters: significant differences (P<0.05)

Table 2: Weight at weaning (kg) of Manchega breed lambs for different seasons and according to the body condition scoring of the ewes at lambing (BCL= body condition scoring at lambing)

		BCL of ewes			Mean
		<2.5	2.5-3.0	>3.0	(n.º of lambs)
SINGLES	Jan.	17.9^{a}	18.9^{a}	19.9^{a}	18.9 ± 3.5 (97)
	May	16.1^{a}	16.5^{a}	16.4^{a}	16.0 ± 2.3 (90)
	Sep.	17.1^{a}	17.9^{a}	20.8^{a}	19.0 ± 5.1 (117)
	Mean	17.0 ± 3.0^{a} (42)	17.8 ± 4.0^{a} (162)	19.4 ± 4.3^{b} (100)	18.2 ± 4.0 (304)
TWINS	Jan.	15.3^{a}	15.8^{a}	16.2^{a}	15.8 ± 2.6 (147)
	May	15.5^{a}	15.5^{a}	17.8^{b}	15.6 ± 1.7 (142)
	Sep.	16.3^{a}	15.9^{a}	15.5^{a}	15.9 ± 3.6 (162)
	Mean	15.7 ± 2.7^{a} (97)	15.8 ± 2.7^{a} (303)	16.0 ± 3.4^{a} (51)	15.6 ± 2.8 (451)
TOTAL	Jan.	16.5^{a}	16.8^{a}	17.8^{b}	17.0 ± 3.3 (244)
	May	15.6^{a}	15.9^{ac}	16.8^{bc}	15.6 ± 2.8 (232)
	Sep.	16.5^{a}	16.6^{a}	19.9^{b}	17.2 ± 4.6 (279)
	Mean	16.1 ± 2.8^{a} (139)	16.5 ± 3.4^{a} (465)	18.3 ± 4.3^{b} (151)	16.7 ± 3.6 (755)

Different Letters: significant differences (P<0.05)

Table 3: Average daily gain (g) of Manchega breed lambs ford different seasons and according to the body condition scoring of the ewes at lambing (BCL= body condition scoring at lambing).

		BCL of ewes			Mean (n.° of Lambs)
		<2.5	2.5-3.0	>3.0	
SINGLES	Jan.	293 ^{a}	299 ^{a}	294 ^{a}	297 ± 45 (97)
	May	263 ^{a}	287 ^{a}	292 ^{a}	283 ± 59 (90)
	Sep.	253 ^{a}	283 ^{a}	314 ^{a}	293 ± 58 (115)
	Mean	271 ± 51 ^{a} (42)	289 ± 54 ^{a} (161)	303 ± 49 ^{b} (99)	291 ± 53 (302)
TWINS	Jan.	234 ^{a}	252 ^{a}	281 ^{b}	254 ± 53 (147)
	May	257 ^{a}	287 ^{a}	270 ^{a}	275 ± 164 (142)
	Sep.	237 ^{a}	240 ^{a}	227 ^{a}	237 ± 59 (162)
	Mean	247 ± 51 ^{a} (97)	257 ± 120 ^{a} (303)	254 ± 75 ^{b} (51)	255 ± 110 (451)
TOTAL	Jan.	262 ^{a}	267 ^{a}	289 ^{b}	271 ± 54 (244)
	May	258 ^{a}	287 ^{a}	287 ^{a}	279 ± 132 (232)
	Sep.	241 ^{a}	254 ^{a}	285 ^{b}	260 ± 64 (277)
	Mean	254 ± 52 ^{a} (139)	268 ± 103 ^{b} (464)	287 ± 64 ^{c} (150)	269 ± 89 (753)

Different letters: significant differences (P<0.05)

Table 6: Body condition scoring at weaning (BCW) in Manchega breed ewes according to lambing season and birth type.

LS	BCW		Mean
	Singles	Twins	
Jan.	2.68 ± 0.63 ^{b} (97)	2.27 ± 0.71 ^{b} (75)	2.50 ± 0.69 (172)
May	2.95 ± 0.84 ^{a} (87)	2.69 ± 0.69 ^{a} (66)	2.84 ± 0.79 (153)
Sep.	2.49 ± 0.65 ^{b} (110)	2.21 ± 0.63 ^{b} (77)	2.37 ± 0.66 (187)
Mean	2.69 ± 0.73 (294)	2.38 ± 0.71 (218)	2.55 ± 0.74 (512)

Different letters: significant differences (P<0.05)
( ): number of ewes.

Table 4: Growth until weaning of Manchega breed lambs according to the body condition scoring of the ewes, season and type of birth.
(BCL: body condition scoring at lambing; LS: lambing season; BT: birth type; BW: birth weight; WW: weaning weight; ADG: average daily gain).

		N	BW (kg)	WW (kg)	ADG (g)
BCL	<2.5	146	4.7 ± 0.8 ^{a}	16.1 ± 3.3 ^{a}	254 ± 52 ^{a}
	2.5 - 3.0	468	4.9 ± 0.9 ^{a}	16.5 ± 3.4 ^{a}	268 ± 103 ^{b}
	>3.0	151	5.5 ± 1.1 ^{c}	18.3 ± 4.3 ^{b}	287 ± 64 ^{c}
			***	**	NS
LS	Jan.	246	4.9 ± 0.9 ^{a}	17.0 ± 3.3 ^{a}	271 ± 54 ^{a}
	May	234	4.8 ± 0.9 ^{a}	15.6 ± 2.8 ^{b}	279 ± 132 ^{b}
	Sep.	285	5.2 ± 1.0 ^{b}	17.2 ± 4.6 ^{a}	260 ± 64 ^{c}
			***	***	*
BT	Single	308	5.4 ± 1.0	18.2 ± 4.0	291 ± 53
	Twin	457	4.7 ± 0.8	15.6 ± 2.8	255 ± 110
Mean		765	5.0 ± 1.0***	16.7 ± 3.6***	269 ± 89***

***: p<0.001; **: p<0.01; *: p<0.05
NS: no significant difference
Different letters: significant differences (p<0.05)

Table 5: Body condition scoring at lambing (BCL) in Manchega breed ewes according to lambing season and birth type.

LS	BCL		Mean
	Singles	Twins	
Jan.	2.97 ± 0.66 ^{a} (97)	2.81 ± 0.50 ^{b} (75)	2.90 ± 0.60 (172)
May	2.84 ± 0.64 ^{a} (92)	2.47 ± 0.59 ^{a} (71)	2.68 ± 0.64 (163)
Sep.	3.12 ± 0.60 ^{b} (117)	2.76 ± 0.58 ^{b} (81)	2.97 ± 0.62 (198)
Mean	2.99 ± 0.64 (306)	2.69 ± 0.58 (277)	2.86 ± 0.63 (533)

Table 7: Differences between body condition scores at lambing (BCL) and at weaning (BCW) in Manchega breed ewes.

LS	Singles		Twins	
	BCL-BCW	(%)	BCL-BCW	(%)
Jan.	-0.29	(-9.8)	-0.54	(-19.2)
May	0.11	(3.7)	0.22	(8.2)
Sep.	-0.63	(-20.2)	-0.55	(-19.9)
Mean	-0.30	(-11.1)	-0.31	(-13.0)

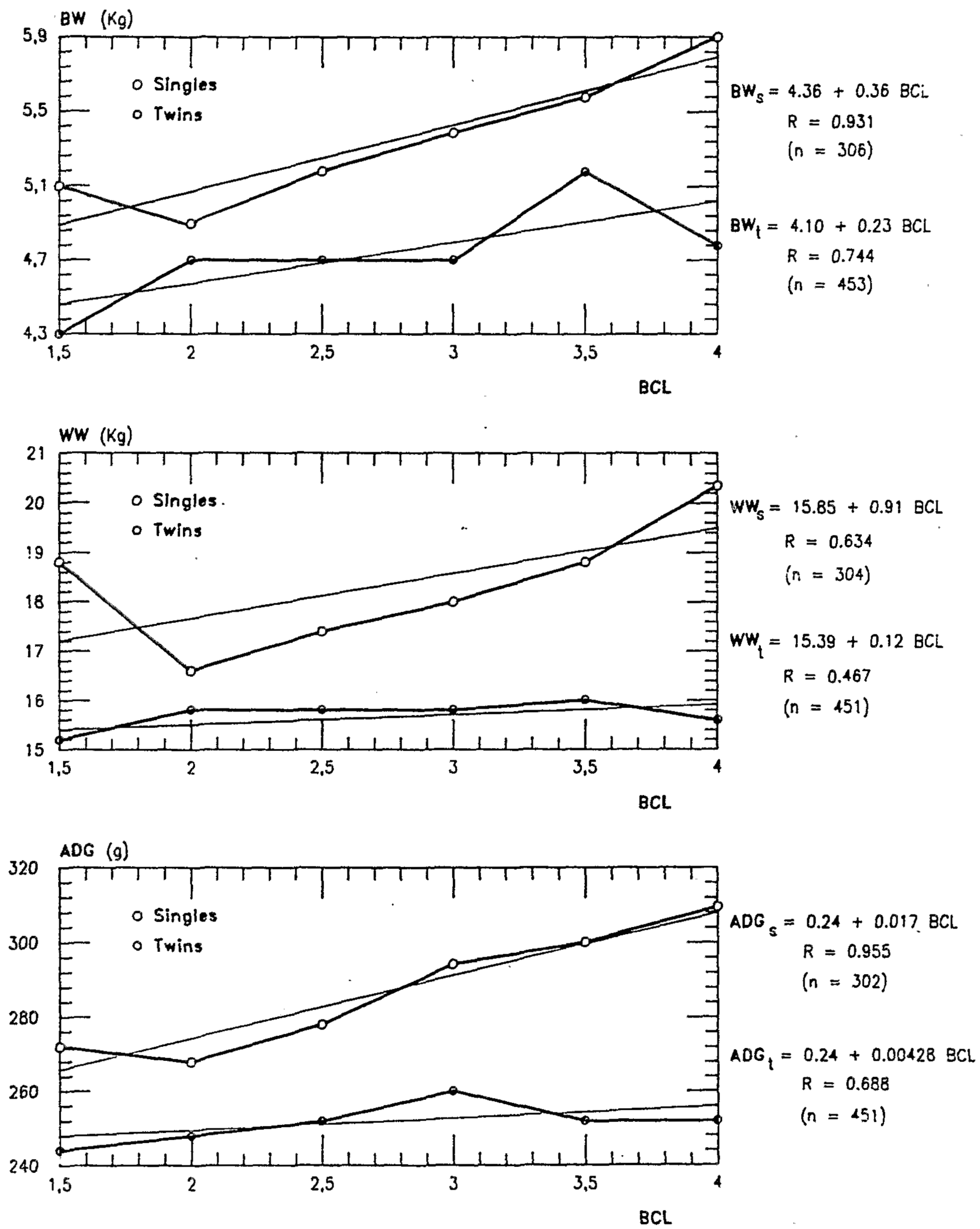
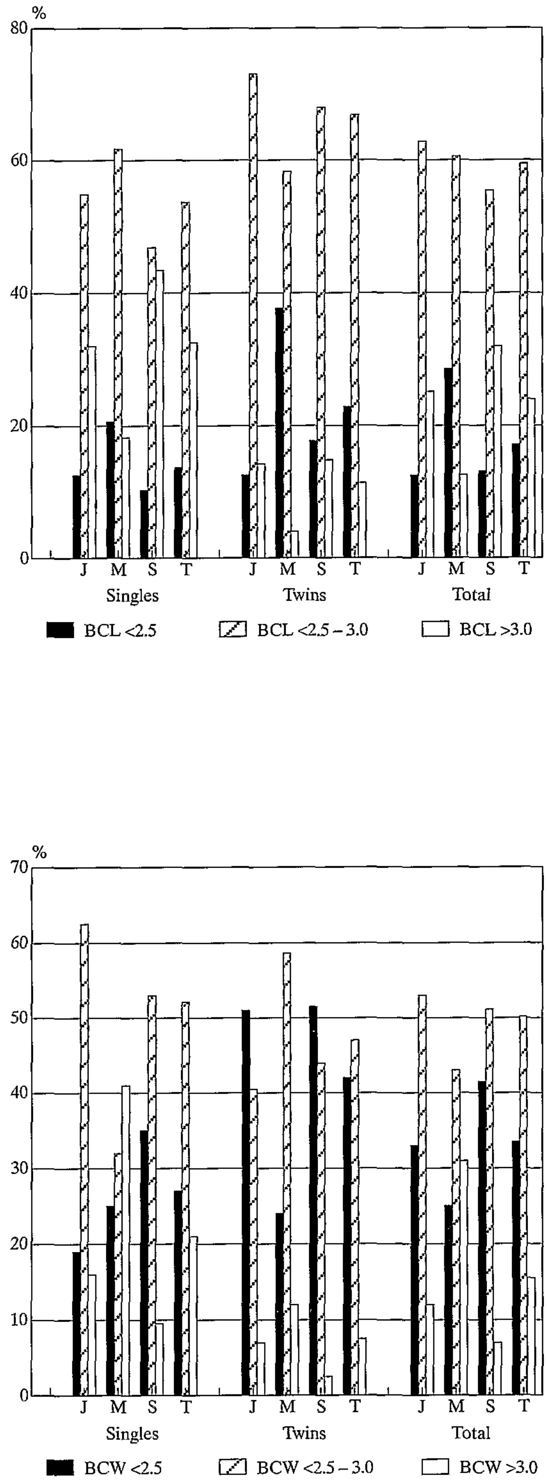


Fig. 1. Evolution of birth weight (BW), weight at weaning (WW) and awerage daily gain (ADG) according to body condition scoring at lambing (BCL) in Manchega breed ewes.



(J= January, M= May, S= September, T= Total)

Fig. 2. Body condition scoring at lambing (BCL) and at weaning (BCW) distribution in Manchega breed ewes according to season and type of birth.