Environmental Factors Affecting Weaning Weight of Libyan Barbary Lambs Under Range Conditions

A. M. IHTASH and A. F. MAGID[1]

ABSTRACT

Weaning weight records on 39728 Libyan Barbary lambs were collected from the cereal project at Azizia in the Jafara plain. The project included nine locations. The objectives of this study were to evaluate the importance of factors affecting weaning weight of lambs and to establish correction factors for weaning weight of Libyan Barbary lambs under range conditions.

Least square procedures were used to evaluate the important factor affecting weaning weight of lambs. Sex, birth type, birth year, location, age at weaning and age of dam were the factors that contributed significantly to variation in weaning weight of lambs.

The results indicated that ram lambs were 2.4 kg heavier than ewe lambs. Single born lambs were 4.45 kg heavier at weaning than multiple born lambs. Yearly variation in weaning weight were attributed to environmental conditions. Differences in weaning weight among locations might be due to differences in rainfall as well as management differences between these locations.

Average daily gain was found to be 0.17 kg/day as obtained by partial linear regression. Age of dam significantly affected weaning weight of lambs. Lambs from 5 year old ewes weighed 4.23 kg more than lambs from 2 year old ewes. Additive correction factors were recommended to eliminate variability in weaning weight due to these environmental factors. Interactions between the environmental factors attributed significantly to the variation in weaning weight of lambs.

INTRODUCTION

The Libyan Barbary breed represents almost 95% of the sheep raised in Libya and is used primarily for mutton production. The general characteristic of the breed were reported by Ghanem (6).

Lambs represent one of the major sources of income from range sheep production. Weaning weight of lambs is one of the most important traits to consider in selection prgrams (3). The evaluation of weaning weight is greatly influenced by non-genetic factors, such as the effect of birth type, birth year, age of dam and age at weaning. These factors operate to conceal the genetic merit, thereby confusing the breeder and obstructing this efforts to select those animals with the greatest breeding value. In

(1) Dept. of Animal Production, Faculty of Agriculture, University Al-Fateh, Tripoli, G.S.P.A.J.

many instances variation in these factors can be eliminated or controlled but in others the use of adjustment or correction factors may help place animals on a comparable basis.

The objectives of this study were to evaluate the factors affecting weaning weight of the Libyan Barbary sheep and to establish correction factors for weaning weight of this breed under local range conditions.

MATERIALS AND METHODS

Source of data and Management:

Weaning weight records on 39728 Libyan lambs were obtained from the cereal project at Azizia in the Jafara plain. The main objective of the cereal project was to improve the production of both cereal and mutton. The project included nine locations which are presented in Table 1 together with the number of lambs per year.

Table (1) – The distribution of weaned lambs by years and locations

LOCATIONS	1978	1979	1980	1981	1982
Jendoubah	955	1508	1527	1161	-
Bir Alghanem	453	457	392	1894	1805[b]
Wadi Alathel	2168	984	972	1287	-
Abu Shaibah	1244	2066	512	1596	-
Al Hira	1077	a	1329	828	-
Tarhounah	916	823	1039	982	-
Diga	1428	1008	313	571	-
Ajailat	1125	1178	1583	1388	-
Abu Aishah	389	1417	687	666	-

a. In 1979 all lambs and ewes of Al-Hira were transferred to Diga locations.

b. The records of the nucleus flock were collected only in 1982.

A total of 20000 breeding ewes were distributed into small flocks among the nine locations of the project. These flocks were collected from different regions of the country, the plan included a selection program to improve pre-weaning growth rates in order to create a nucleus flock. The nucleus flock would be a source of distributing improved breeding rams. The breeding season usually starts from the beginning of June to the end of July and lasts 56 days. A group of selected rams (4% ratio) were joined with all project ewe flocks as near as possible on the same date, so that lambing will occur four weeks after the start of rainy season.

Lambing started around the beginning of November and continued to the end of December. All lambs were identified and ear-tagged on the day of birth. Single born lambs received one tag, while twin born lambs received two tags. Lambs born after day 28 of the lambing season were neither ear-tagged nor considered for selection.

All lambs were weaned at an avarage age of 120 days. At weaning, the weight, sex and birth type were recorded for each lamb at all locations. The heaviest lambs at weaning were selected for entry to the nucleus according to the plan of the project.

Feeding of the animals in all project sites was largely dependent on pastures which were composed of medics *(Medicago littoralis)* or residuals of harvesting of either wheat or barley according to the crop rotation at the location. Supplementary feeding of 300-400g/head/day of barley was given when natural pastures were inadequate, particularly prior to mating and lambing.

Statistical procedures:

The least squares procedures of data with unequal subclass numbers (8) were used to determine the importance of factors affecting weaning weight and obtain the correction factors. Two statistical models were used in the analysis of all data.

Model 1 included the effect of sex, type of birth, birth year, location, age at weaning and the two way interactions between the main effects. The lambs born as triplet were combined with those born as twins because of their relative small number.

Model 2 was essentially the same as model 1 except that it included the age of dam effect and did not include the effect of birth year and location because age of dam was recorded at Bir-alganam in the year 1982 only.

This model was used primarily to evaluate the effect of age of dam on weaning weight and to establish correction factors for its classes.

Tests of significance for differences between individual means for both models were estimated using Duncan's multiple range test (4).

RESULTS AND DISCUSSION

An analysis of variance was made to determine if the factors included in the models had significant effects on weaning weights of lambs. The overall mean for weaning weight was found to be 24.06 $\pm$ 3.97kg. and the coefficient of variation was 16.54%. The average weaning age was about 100 $\pm$ 11 day.

Effect of birth year, birth type, sex, location, age of dam and age at weaning are presented in Table 2.

The effect of birth year of lambs was highly significant ($P < 0.001$). Yearly variations in weaning weight of lambs were expected, because of variations in environmental conditions. These findings were in agreement with previous studies under range and farm conditions which indicated that years were an important source of variation in weaning weight (2,5,11,16,). Studies with fat-tailed sheep were in close agreement with results of the present study (7,12).

Table (2) – Least squares means for weaning weight by birth year, birth type, sex, location, age of dam and age at weaning

Factors	Weaning weight (Kg)	S.E.
Birth year	* * *	
1978	25.01	.06
1979	25.49	.06
1980	24.17	.06
1981	18.82	.06
Birth type	* * *	
Single	25.59	.03
multiple	21.14	.05
Sex	* * *	
Male	24.57	.04
female	22.17	.04
Locations	* * *	
Jendoubah	21.48	.09
Bir Alghanem	24.52	.09
Wadi Alathel	22.80	.06
Abu Shybah	23.23	.07
Al Hira	23.83	.08
Tarhounah	21.35	.10
Diga	23.64	.13
Ajailat	24.86	.06
Abu Aishah	24.62	.10
Age of dam[a]	* * *	
2 - year	28.22	.23
3 - year	28.80	.24
4 - year	29.58	.27
5 - year	32.45	.27
6 - year	30.72	.23
bl (age at weaning)	.170	

a: Obtained by model 2.

* * *: $P < .0001$.

Type of birth significantly influenced ($P < 0.001$) weaning weight of lambs Table 2. Single born lambs exceeded multiple-born lambs by 4.45kg. These results were in close agreement with previously reported findings under range conditions (10, 13, 15).

Studies under farm conditions were nearly in agreement with the results of the present study (5,17). Work with Chios sheep (a fat-tailed breed) showed that lambs born as singles grew faster than twins before weaning (12).

Sex of lambs had a highly significant ($P < 0.001$) effect on weaning weight. Ram lambs exceeded ewe lambs at weaning by 2.4kg. which is in agreement with the finding of Hazel and Terrill (10). In a study with range Rombouillet lambs it was reported that ram lambs grew 7.2% faster than ewe lambs (15). However, in another study, ram lambs were found to be 0.8kg heavier than ewe lambs at weaning (3); a result that was far below the figures presented in this study. Studies under farm conditions were in close agreement with the results of the present study for the effect of sex (5,9,14 and 17).

Work with fat-tailed breeds like Awassi (7) and Chios (12) showed the same results obtained herein for the Barbary sheep.

Location effects on weaning weight of lambs were highly significant ($P < 0.001$). The flucturation in weaning weight of lambs born and raised among different locations could be expected since environmental factors such as temperature, precipitation, humidity, wind and light varies from one location to another. These factors, however, might influence the quality and the quantity of pastures resulting in the net performance of lambs. The management of the flocks at each location could contribute to the differences in weaning weight of lambs among locations.

The effect of age of dam was determined by using model 2 and presented in Table 2. Age of ewe contributed significantly ($P < 0.001$) to the variation in weaning weight. The results showed that lambs from mature dams were superior to lambs from 2 years old dams in weaning weights. Lambs from 5 years old ewes weighed 4.23kg more than lambs from 2 years old ewes. Studies under range conditions showed that lambs from mature ewes weighed 2.8kg more than lambs from 2 years old ewes (10). In another study it was noted that two years old ewes weaned the smallest lambs while 4-7 year old ewes weaned the heaviest lambs (16). Studies under farm conditions showed that lambs from mature dams were 3.9kg heavier than lambs from 2 years old dams (9). Lambs born to two years old ewes were lighter at birth and grew more slowly than lambs born to older ewes (1). Studies on fat tailed breed showed a significant effect of age of dam on weaning weight of lambs and that lambs from 4 and 5 year old dams had the heaviest weaning weights than lambs from younger and older dams (7). These results were in general agreement with the results of the present study.

The effect of weaning age on weaning weight of lambs was highly significant ($P < 0.001$). The partial linear regression of weaning weight on age of lambs at weaning was 0.17kg/day. The coefficient indicates that older lambs had heavier weights at weaning. These results are in close agreement with other studies under range conditions (10,16) and under farm conditions (5,9). The possible two way interactions between fators included in model 1 were found to be a significant source of variation in weaning weight and are presented in figures 1 throught 6.

Location X sex, location X birth type, location X year, sex X year, birth type X year and sex X birth type interactions were found to be the most important interactions that contributed significantly to the variation in weaning weight of lambs. The magnitude of differences between males and females among locations might be due to different performance of the two sexes under unfavorable and favorable environment (Fig.1). Differences between single born lambs and multiple born lambs were also variable from one location to another due to different performances of the two types of birth under favorable and unfavorable environments, indicating that multiple born lambs were more sensitive to environmental variation than single born lambs (Fig.2).

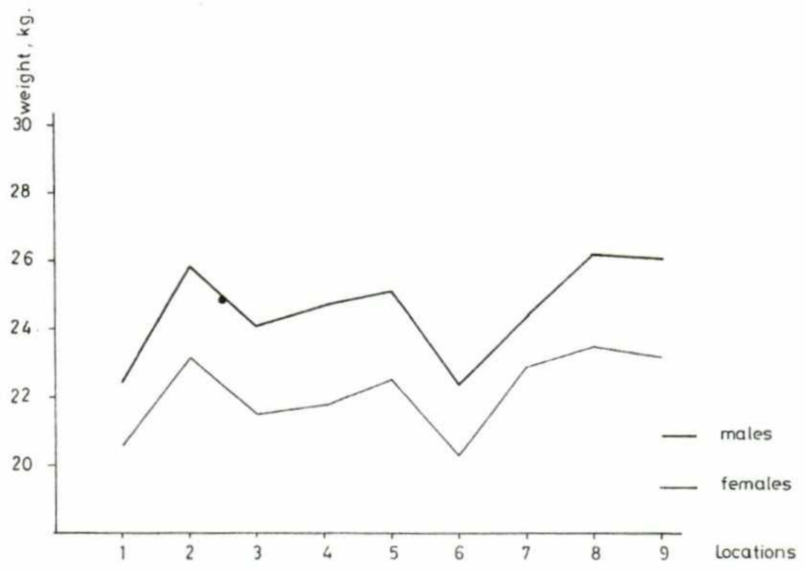

Figure 1: Least squares means of weaning weight by location x sex of lambs interaction (model 1).

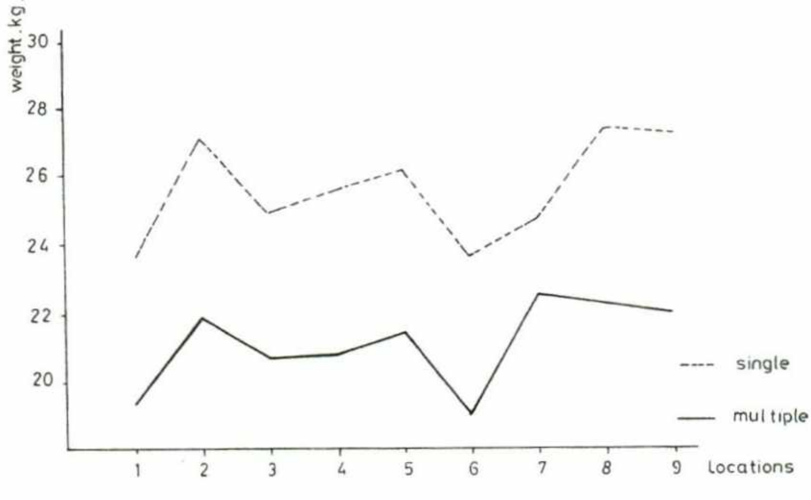

Figure 2: Least squares means of weaning weight by location x birth type of lambs Interaction (model 1).

The differences in weaning weight among years between locations might be due to differences in management of the flocks at different locations and the differences in weather conditions from year to year and from location to location (Fig.3).

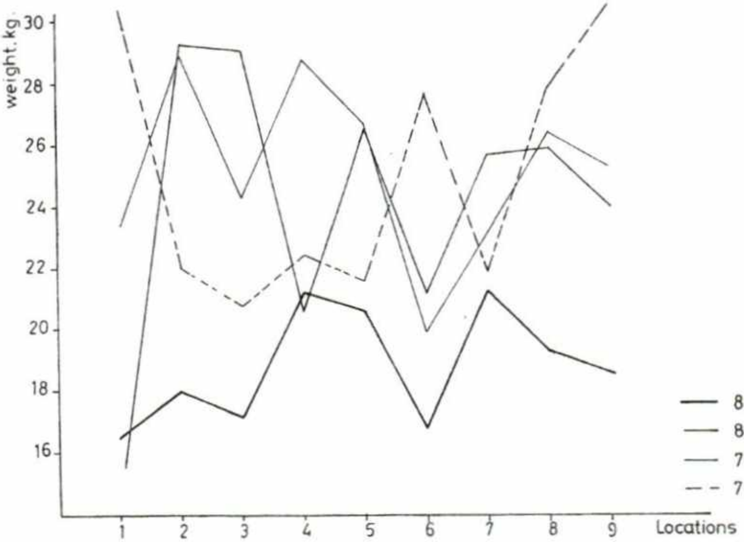

Figure 3: Least squares means of weaning weight by location x years Interaction (model 1).

Weaning weight of males is greater than the average in good years than in bad years. While females are below the average in bad years (Fig.4). Differences in weaning weight between single and multiple born lambs among years were smaller in good

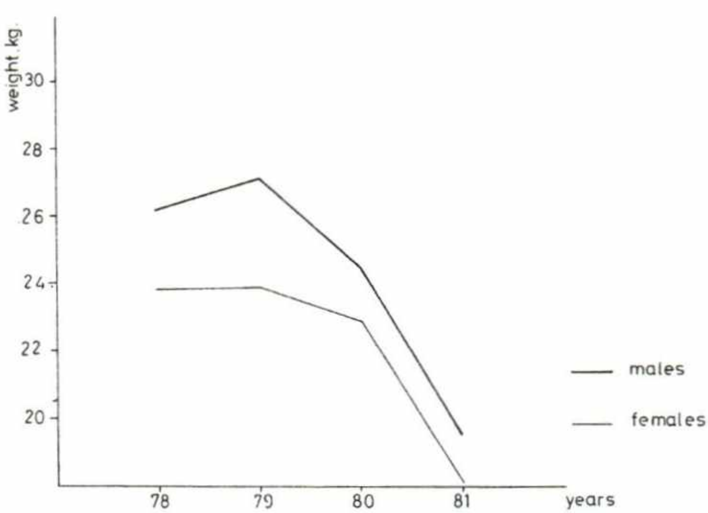

Figure 4: Least squares means of weaning weight by years x sex of lambs interaction (model 1).

years. Since both types of birth were expected to do better in a good environment, however, in a bad environment multiple born lambs were more sensitive (Fig.5).

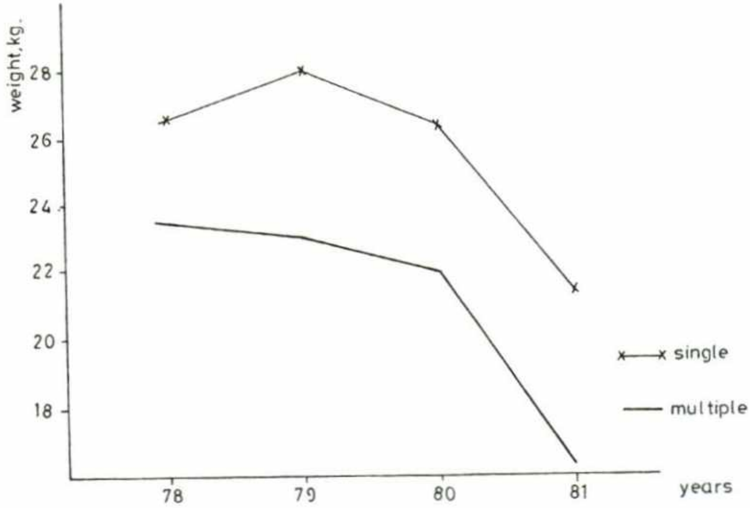

Figure 5: Least squares means of weaning weight by years x birth type of lambs interaction (model 1).

Differences between multiple born males and females were smaller than differences between single born males and females. Male and female lambs performed better under a favorable environment than that under an unfavorable environment (Fig.6). Little information is available in the literature concerning the interaction among factors affecting weaning weight in sheep.

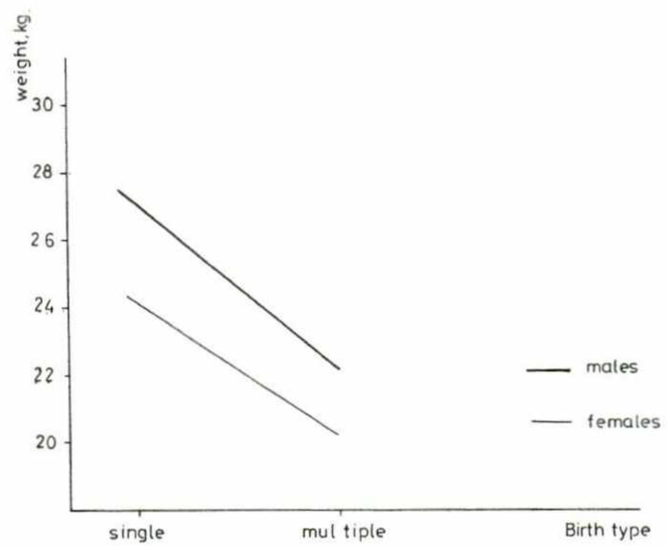

Figure 6: Least squares means of weaning weight by birth type x sex of lambs interaction (model 1).

Correction Factors:

Additive and multiplicative correction factors are currently used in livestock production to adjust the differences in weaning weight due to the environmental factors. Both methods can equalize the means between adjusted groups. Additive correction factors are the most appropriate when standard deviation are equal. Multiplicative correction factors are appropriate when scaler effect causes the coefficient of variation to be equal. The means, standard deviations and coefficients of variability of weaning weight for the factors contributing to the variation in weaning weight are presented in Table 3. Standard deviations with subclasses of each of the factors are approximately equal. Therefore, additive rather than multiplicative correction factors were used in this study to adjust the weaning weight. The recommended additive correction factors for each subclass have been presented in Table 4. Correction for these environmental effects eliminates the biases against females and twins, so that future selection on the basis of weaning weight will be more accurate, since variability in weaning weight due to identifiable environmental factors in minimized.

Table (3) – Means, standard deviation (S.D) and coefficient of variation (CV), for weaning weight by sex, birth type and age of dam.

Factors	Means (Kg)	S.D	C.V
Sex			
Males	24.57	5.37	21.90
Females	22.17	5.24	23.64
Birth - Type			
Single	25.59	4.4	17.20
Multiple	21.14	4.8	22.71
Age of Dam*			
2 - Year	28.22	4.6	16.30
3 - Year	28.80	4.9	17.01
4 - Year	29.58	4.9	16.57
5 - Year	32.45	4.9	15.10
6 - Year	30.72	4.13	13.44

* obtained by model 2.

Table (4) – Weaning weight adjustment factors

Main Effects	Adjustment Factor
Sex	
Male	None
Female	+ 2.4
Birth Type	
Single	None
Multiple	+ 4.44
Age of Dam	
2 - Year Old	+ 4.22
3 - Year Old	+ 3.64
4 - Year Old	+ 2.86
5 - Year Old	None
6 - Year Old	+ 3.25
Age at Weaning	*b (120 - age in days)

* b: .170 kg in Libyan Barbary Lambs.

LITERATURE CITED

1. Atkins, K.D., 1980. The comparative productivity of five ewe breeds. I-lamb growth and survival. Aust. J. Expt. Agric. Anim. Husb. 20:257.
2. Blackwell, R.C. and C.R Henderson, 1955. Variation in fleece weight, weaning weight and birth weight of sheep under farm condition. J.Anim. Sci. 14:831-843.
3. Bush, F. leon and J.K. Lewis. 1977. Growth patterns of range grazed Rambouillet lambs. J.Anim. Sci. 45:953-960.
4. Duncan, D.B. 1955. «Multiple range and multiple F test», Biometrics 11:1-42.
5. El-Tawil. E.A., L.N. Hazel, G.M. Sidwell and C.F. Terrill. 1970. Evaluation of environmental factors affecting birth, weaning and yearling traits in Navajo sheep. J.Anim. Sci. 31:823-827.
6. Ghanem, Y.S. 1980. Encyclopedia of animal production. Part I. The Arabian sheep breeds. ECSAD, 297 pages (in Arabic).
7. Ghoneim, K.E., N.T. Kazzal and J.B. Mc laren, 1975. Selection for increased weight of Awassi sheep in Iraq. Trop. Agric. 52:229-232.
8. Harvey, Walter, R. 1976. Least squares analysis of data with unequal subclass numbers. USDA - ARS 20-8.
9. Hazel, L.N. and Claire E. Terrill. 1946. Effect of some environmental factors on weaning traits of range Columbia, Corriedale and Targhee lambs. J. Anim. Sci. 5: 318-325.

10. Hazel, L.N. and Claire E. Terril, 1945. Effect of some environmental factors on weanling traits of range Rambouillet lambs. J. Anim. Sci. 4:331-341.

11. Magid, A.F., V.B. Swanson and J.S. Brinks, 1976. Most probable producing ability of Hampshire and Columbia ewes. Proc. Western Sec. Am. Soc. Anim. Sci. 27:16-19.

12. Mavrogenis, A.P. and S. Economides, 1981. Relationships between ewe milk production and lamb growth. Anim. Breed, Abstr. 49:6388.

13. Napier, K.M. and L.P. Jones, 1982. Effect of age, maternal handicap, birth and survival type on five fleece and body characters of Corriedale rams. Aust. J. Expt. Agric. Anim. Husb. 22:281.

14. Notter, R. David, L.A. Swiger and Walter R. Harvey, 1975. Adjustment factors for 90 day lamb weight. J. Anim. Sci. 40:383-391.

15. Shelton, M. And F. Campbel, 1962: Influence of environmental adjustment on heritability of weaning weight of range Rambouillet lambs. J. Anim. Sci. 21:91-94.

16. Sidwell, M. George and J.O. Grandstaff, 1949. Size of lambs at weaning as a permanent characteristic of Navajo ewes. J. Anim. Sci. 8: 373-380.

17. Smith, H.P. and E.R. Lidvell, 1964. Factor affecting birth weight, daily gain and 120 days weight of Hampshire lambs. J. Anim. Sci. 23:854 (ABSTR.).

العوامل البيئية المؤثرة على وزن العظام
لحملان البربري الليبية تحت ظروف المرعى

م. عبد الكريم احتاش، د. عياد مجيد

المستخلص

تضمنت الدراسة تجميع سجلات أوزان الفطام لعدد (39728) من حملان البربري الليبية من مشروع الحبوب بالعزيزية في سهل الجفارة من تسعة مواقع مختلفة.

وكان من أهم أهداف هذه الدراسة تقييم أهمية العوامل المؤثرة على وزن الفطام لحملان البربري الليبية تحت ظروف المرعى. ولقد استعملت طريقة تحليل أقل المربعات (Least Square Analysis) لتقدير أهمية العوامل المؤثرة على وزن فطام الحملان والتي من أهمها: الجنس، نوع الولادة، سنة الولادة، الموقع، العمر عند الفطام، وعمر الأم. ولقد أشارت النتائج إلى أن الذكور زاد وزنها عن الإناث بمقدار 2.4 كجم عند الفطام. وكذلك الحملان المفردة زاد وزنها بمقدار 4.46 كجم عن حملان الولادة العديدة.

وتعود الاختلافات السنوية في وزن الفطام إلى الظروف البيئية، بينما تعود الاختلافات في وزن الفطام بين المواقع إلى الاختلاف في كميات الأمطار واختلاف الإدارة بين المواقع.

ولقد بلغ متوسط الزيادة اليومية باستعمال معامل الانحدار حوالى 0.170 كجم يومياً لحملان البربري الليبية قبل الفطام.

وأوضحت الدراسة الأثر المعنوى لعمر الأم على وزن فطام الحملان حيث وجد أن الحملان من أمهات «خمس سنوات» زاد وزنها عند الفطام بمقدار 4.23 كجم عن الحملان من أمهات سنتين.

بالإضافة إلى أن هذه الدراسة اقترحت عوامل تصحيح تجمعية للتغلب على الاختلافات الموجودة في الوزن عند الفطام نتيجة العوامل البيئية المدروسة.

وقد ناقشت الدراسة أيضاً التداخل بين هذه العوامل التي ساهمت في اختلافات الوزن عند الفطام.