*Egyptian J. Nutrition and Feeds (2008) 11 (2) : 415-420*

# ADDITIVE AND MULTIPLICATIVE ADJUSTMENT FACTORS FOR SOME GROWTH TRAITS IN *AWASSI* SHEEP.

**K. I. Z. Jawasreh[1], F. T. Awawdeh[1], F. S. AL-Barakeh[1], M. Al-S00b[2] and N. Al-Hababebah[1]**

*[1] National Center for Agricultural Research and Technology Transfer Jordan.*

**(Received 30/8/2007, Accepted 14/11/2007)**

## SUMMARY

A total of 1324 birth weights (BWT), 1227 weaning weights (WWT), 1324 Marketing weights (MWT) and 1018 yearling weights (YEAWT) of *Awassi* lambs records utilized from Al-Fjaj Station (Jordan) through five successive seasons (2000-2005) were used for this study. Phenotypic variances were tested for their homogeneity among dam ages and parities, between single and twin groups, and between male and female classes, that used for judging the adjustment factors. According to the significances of phenotypic variance, multiplicative adjustment factors were recommended to adjust all studied traits for the effect of age and parity of dam. Additive adjustments proposed to adjust the traits for the effect of sex and type of birth.

***Keywords**: Awassi sheep, homogeneity of variance, adjustment factors.*

## INTRODUCTION

*Awassi* sheep is a fat tailed local breed, adapted to the harsh environments, and have great ability for improvement (both in meat and milk) through selection and another breeding programs, because of high variation that observed within this breed, in meat and milk production, under the Jordanian conditions (Jawasreh *et al.*, 2005 a and b).

In Jordan, the annual red meat production is only 15478 ton and this represents only 33% of the annual meat consumption (46641 ton) (MOA, 2001).

The accurate estimates of animals breeding values depend mainly on accurate adjustments for non-genetic factors. Ewes in their first lambing are not physically or biologically mature. Nutrients they consume are partitioned not only into lactation, maintenance and gestation, but also to there own growth therefore lambs born from young ewes are generally smaller both at birth and weaning and have disadvantages compared to their contemporaries with older dams. Ram lambs generally grow faster than ewe lambs and also single born lambs grow faster than twins do (Jawasreh, 2000). Adjustment factors help to correct this bias and needed for fair genetic evaluation.

The objectives of this study were to test the homogeneity of phenotypic variances among or between sub classes of fixed factors and to derive additive and multiplicative adjustment factors to correct the effect of sex, type of birth, age and parity of dam of *Awassi* lamb growth traits.

## MATERIALS AND METHODS

A total of 1324 birth weights (BWT), 1275 weaning weights (WWT) (60 day), 1324 marketing weights (MWT) (180 day) and 1018 yearling weights (YEAWT) (360 day) of *Awassi* sheep records, raised at Al-Fjaj Station (Ministry of Agriculture, Jordan) through five consecutive years (2000-2005), were used after adjusting all weights to their actual weights. BWT, MWT and YEAWT were adjusted according the Dalton's, (1980) formula.

### *Statistical analysis:*

The data were analyzed by using SAS, (2001) program. F-max test (Robert and Rolf, 1981) was used for estimating the homogeneity of phenotypic variances, for each sub class. Additive adjustment factors, were derived by selecting a base of comparison, and then computing differences of other groups from the base. These differences were then subtracted from records to adjust that effect. Male lambs, single born lambs, the fourth parity and 4 year old dams were taken as bases for comparison of sex, type of birth, age and parity of dam effects, respectively. Multiplicative adjustment factors were derived by adding the phenotypic mean of the base group to all estimated differences from the base group. Then dividing the resulting means into the mean for the base group. The same base groups were used as for additive adjustment factors (Aziz, 1986).

## RESULTS AND DISCUSSION

The F-max test was applied in order to estimate phenotypic variances of sex classes, type of birth, age and parity of dam for BWT, WWT, MWT and YEAWT (Table 1). Phenotypic variances differed significantly ($P \leq 0.001$) among dam age and parity classes for all studied traits, while variances differences between male and female and single and twin born lambs appeared to be non-significant for all studied traits.

The constants of additive adjustments (Table 2) should be used to adjust the traits for the effect of sex and type of birth because of the homogeneous variances among sex and type of birth subclasses. Eikje and Johnson, (1979) and Aziz *et al.*, (1989) used and recommended additive adjustment factors for BWT, WWT and YEAWT. Additive adjustment factors were also recommended by Aziz, (1986) for 50 and 100-day weight.

Multiplicative age and parity of dam adjustment factors (Table 3) appeared to be more appropriate for all studied traits because of the heterogeneous variances. Lasslo, (1982); Aziz, (1986); and Aziz *et al.*, (1989), support the use of multiplicative adjustments to remove the effect of age of dam for BWT and 120-day weights.

**Table (1): Phenotypic variances of birth weight (BWT), weaning weight (WWT), Marketing weight (MWT) and Yearling weight (YEARWT) by type of birth sex of lambs age and parity of dam classes.**

| Classes | BWT | WWT | MWT | Year WT |
|---|---|---|---|---|
| Type of birth | | | | |
| Single | 0.480 | 15.042 | 154.071 | 221.845 |
| Twin | 0.452 | 14.703 | 146.011 | 195.978 |
| Test[B] | 1.06 | 1.02 | 1.05 | 1.13 |
| Sex | | | | |
| Male | 0.532 | 17.225 | 164.751 | 220.593 |
| Female | 0.569 | 14.546 | 142.666 | 214.71 |
| Test[B] | 1.07 | 1.18 | 1.15 | 1.03 |
| Age of dam | | | | |
| ≤1.5 | 0.604 | 17.452 | 104.413 | 151.53 |
| 2 | 0.556 | 14.414 | 163.841 | 231.103 |
| 3 | 0.581 | 17.157 | 166.363 | 234.73 |
| 4 | 0.484 | 15.016 | 147.551 | 229.772 |
| 5 | 0.640 | 16.522 | 159.355 | 230.648 |
| 6 | 0.535 | 15.589 | 136.933 | 157.399 |
| 7 | 0.658 | 15.867 | 152.716 | 233.28 |
| ≥8 | 0.346 | 17.532 | 140.333 | 120.640 |
| Test[B] | 1.90** | 1.21** | 1.59** | 1.93** |
| Parity | | | | |
| 1 | 0.471 | 14.347 | 145.942 | 210.942 |
| 2 | 0.618 | 16.403 | 170.249 | 238.742 |
| 3 | 0.531 | 16.215 | 138.857 | 222.158 |
| 4 | 0.655 | 16.590 | 165.052 | 234.132 |
| 5 | 0.512 | 15.871 | 143.078 | 175.311 |
| ≥6 | 0.569 | 16.329 | 143.049 | 197.765 |
| Test[B] | 1.39** | 1.15** | 1.22** | 1.36** |

*[B] Barlit test for homogeneity of variances. *≤ 0.05 ** P≤ 0.01*

The obtained adjustment factors were derived to be used for the effect of age and parity of dam, sex of lambs and type of birth for BWT, WWT, MWT and YEAWT. Additive adjustments should be mad first, followed by multiplicative adjustments, because variances do not change when additive corrections used (Aziz *et al.*, 1989). The following is an example of how these factors could be used:

Suppose we sell a female lamb born, and reared as twin for ewe on its first parity, weight 3.5 kg at birth and 25kg at marketing (155 day of age). To adjust this record to female, single and to dam in its fourth parity equivalent will be derived using adjustment factors from tables 2 and 3.

**Table (2): Additive adjustment factors for growth traits of *Awassi* sheep.**

| Item | BWT | WWT | MWT | Year WT |
|---|---|---|---|---|
| Type of birth | | | | |
| Single | 0 | 0 | 0 | 0 |
| Twin | 0.755 | 1.48 | 1.31 | 1.02 |
| Sex of lambs | | | | |
| Male | 0 | 0 | 0 | 0 |
| Female | 0.235 | 0.688 | -0.056 | 0.008 |
| Parity | | | | |
| 1 | 0.0866 | -3.538 | 2.68 | 10.16 |
| 2 | 0.135 | -1.275 | 1.04 | 6.74 |
| 3 | 0.145 | -1.663 | 0.56 | 3.10 |
| 4 | 0 | 0 | 0 | 0 |
| 5 | 0.025 | 0.5007 | 2.63 | -5.01 |
| 6 | 0.248 | 0.560 | 4.13 | -6.28 |
| 7 | 0.280 | 2.558 | 3.07 | -9.43 |
| Age of dam | | | | |
| ≤1.5 | 0.282 | 3.994 | -2.072 | -8.748 |
| 2 | 0.373 | 1.892 | -2.530 | -7.909 |
| 3 | 0.174 | 0.093 | -1.181 | -3.179 |
| 4 | 0 | 0 | 0 | 0 |
| 5 | 0037 | -1.522 | -1.8327 | 3.380 |
| 6 | 0.155 | -1.780 | -3.536 | 9.343 |
| 7 | -0.091 | -2.429 | -4.066 | 9.731 |
| ≥8 | 0.009 | -4.417 | -3.438 | 11.660 |

**Table (3): Multiplicative adjustment factors for birth weight (BWT), weaning weight(WWT), Marketing weight (MWT) and Yearling weight (YEARWT) by type of birth, sex of lambs and age and parity of dam classes.**

| Item | BWT | WWT | MWT | Year WT |
|---|---|---|---|---|
| Type of birth | | | | |
| Single | 1.000 | 1.000 | 1.000 | 1.000 |
| Twin | 1.163 | 1.087 | 1.031 | 1.017 |
| Sex | | | | |
| Male | 1.000 | 1.000 | 1.000 | 1.000 |
| Female | 1.054 | 1.040 | 0.998 | 1.004 |
| Parity | | | | |
| 1 | 1.012 | 0.782 | 1.061 | 1.178 |
| 2 | 1.030 | 0.921 | 1.024 | 1.118 |
| 3 | 1.033 | 0.897 | 1.013 | 1.054 |
| 4 | 1.000 | 1.000 | 1.000 | 1.000 |
| 5 | 1.006 | 1.030 | 1.060 | 0.912 |
| 6 | 1.056 | 1.034 | 1.095 | 0.889 |
| 7 | 1.064 | 1.157 | 1.070 | 0.834 |
| Age of dam | | | | |
| ≤1 | 1.064 | 1.247 | 0.996 | 0.851 |
| 2 | 1.085 | 1.117 | 0.935 | 0.865 |
| 3 | 1.039 | 1.005 | 0.969 | 0.945 |
| 4 | 1.000 | 1.000 | 1.000 | 1.000 |
| 5 | 1.028 | 0.905 | 0.953 | 1.057 |
| 6 | 1.035 | 0.889 | 0.909 | 1.158 |
| 7 | 0.949 | 0.849 | 0.895 | 1.165 |
| ≥8 | 1.002 | 0.726 | 0.912 | 1.198 |

First we have to adjust it as marketing weight (180 day of age):
Adj. 180 day weight = ((25-3.5/155)*180)+3.5=28.46kg. (Dalton, 1980).
Adjusted marketing weight =28.46kg.
Adjusted MWT for sex of lambs = 28.46+0.056=28.52kg.
Adjusted MWT for type of birth =28.52+1.31=29.83kg.
Adjusted MWT for parity of dam = 29.83*1.061=31.65kg.
The final adjusted record is 31.65kg and this procedure should improve the accuracy of estimating genetic parameters which interne lead to accurate breeding values.

## CONCLUSION

This study shows the ability of using additive adjustment factors to adjust birth, weaning (60 day of age). marketing (180 day of age) and yearling (360 day of age) weights for the effect of sex and type of birth, and recommends the using of multiplicative adjustments for the effect of age and parity of dam, in *Awassi* sheep.

## REFERENCES

**Aziz, D. A. (1986).** Ph.D. Thesis, University of Guilph, Canada.

**Aziz, D. A.; J. E. Al-Kass and H. N. Hermiz (1989).** Indian J. Anim. Sci., 59(10): 1285-1289.

**Dalton, D. C. (1980).** Granada Publishing, Great Britain.

**Eikje, E. D. and D. L. Johnson (1979).** Newzeland J. Agr. Res., 22: 391-396.

**Jawasreh, K. I. Z.; A. Z. Al-Khasawneh; F. S. Al-Barakeh and H. Al-Zioud (2005a).** The 1st Economic Jordanian Conference, 9-11, Aug. Al–Al-Bayt Univ. Al-Mafraq, Jordan, 2005.

**Jawasreh, K. I. Z.; A. Z. Al-Khasawneh. and F. S. Al-Barakeh (2005b).** The 1st Economic Jordanian Conference 9-11, Aug. Al–Al Bayt Univ. Al-Mafraq, Jordan, 2005.

**Jawasreh, K. I. Z. (2000).** M. Sc. Thesis, Baghdad University, Iraq.

**Lasslo, L. L. (1982).** Ph.D. Thesis, University of California, USA. Ministry of Agriculture, Department of Animal production, Annual Report, Jordan, (2001).

**Robert, R. Sokal and Rolf, F. James (1981).** Freeman and Company. USA. SAS (2001). SAS Institute Inc., Cary, NC, USA.