ANALYSIS OF PREWEANING PERFORMANCE OF WEST AFRICAN DWARF GOAT KIDS UNDER SMALL- HOLDER OPERATION

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ABSTRACT

This study examined the effects of controlled suckling, season of birth, sex of kid, litter size and coat colour on the preweaning performance of West African dwarf (WAD) goat kids under the smallholder production system of southwest Nigeria. Two groups of 30 and 26 WAD goat kids under complete confinement and free range, respectively were compared from birth to weaning at a standard weight of 5.5 kg or 13 weeks of age. The confined kids were further allocated to three suckling regimes namely: Day-suckling, Evening-suckling and unrestricted suckling while the free roaming kids all enjoyed unrestricted suckling. Data obtained was analysed by least squares procedures. Effects in the model were suckling/management method, litter size, season of birth, sex of kid and coat colour. Dependent variables included kids' weight at weaning, growth rate, growth intensity, weaning age and survival rate. Suckling/management method, litter size and season of birth significantly influenced (P<0.05) the kids' weaning weight, growth rate and growth intensity whereas the weaning age was influenced only by the season of birth. The coat colour and sex of kid did not have any significant influence (P>0.05) on the preweaning performance of the kids. Free range kids gained more weights and were consistently heavier than the confined kids throughout the preweaning period. Performances and variabilities indicated that selection of superior WAD goats under the small holding operations of the south-western Nigeria would need to take high cognisance of the rearing method and the season of birth.

Keywords: West African Dwarf goat, preweaming performance, management system

INTRODUCTION

Small herd of less than ten animals remains the mainstay of small ruminants production in Sub-Saharan Africa. However scanty record is available on the myriads of factors affecting the productivity of such herds (WADGP, 1993). West African Dwarf (WAD) goats are the indigenous and adapted goat breed of the humid regions of West Africa. About 38 % of the estimated 38 million goats in this region are considered to be WAD (Gall, 1996) of which about 70 % are located in Nigeria (Jahnke, 1982). Going by ILRI (2000) estimate there would be about 52 million live goats in Nigeria in the year 2006 of which about 20 million is thought to be of WAD breed. Over 95 % of the WAD goats in Nigeria are in the hands of the smallholder, low income earners who keep between 2 and 10 goats under a management system broadly referred to as extensive, scavenging or free range system (ILCA, 1979; WADGP, 1993). The productivity of these goats varies widely but is generally regarded as low when compared to those raised intensively under optimum conditions (Mack, 1983; WADGP, 1993) and a complexity of factors involving climate, nutrition, diseases and pests, breeding method and management method is believed to be responsible.

Productivity could be improved through postpartum management practices suckling and weaning. Suckling restriction has been proved to reduce the postpartum interval and consequently increase the reproduction rate in ruminant dams (Lawson *et al.*, 1984; Diskin *et al.*, 2001). In the kids it encourages solid feed consumption, reduces milk consumption, weaning age and growth rate but increases their efficiency of weight gain (Lu and Potchoiba, 1988). The effect of this strategy on the performance of the preweaned goat kids under the smallholder husbandry systems, where creep feed is usually not offered, is not known. Even though a higher reproduction rate will be desirable in the smallholder stock higher premium is placed on the performance of the kids (Upton, 1988).

This study thus examined such factors as suckling and rearing method, season of birth, sex of kid and litter size as they affect the preweaning performances of WAD goat kids under the typical

smallholder management operation of southwestern Nigeria.

MATERIALS AND METHODS

Animals and management

Eighteen WAD does were maintained in complete confinement (on-station) and another twelve free ranging/scavenging WAD does (on-farm) were monitored at the same period. The period of observation and data collection lasted one year between March 2002 and March 2003. Two matured WAD buck were maintained on-station for the breeding of the confined does. The confined goats were housed on concrete-floored open-sided pens in groups of 3 does per pen (bucks were kept individually in separate pens) at the Goat barns of the Obafemi Awolowo University Teaching and Research Farm, Ile-Ife, Nigeria. The farm is situated between 7° 28'N and 4° 33'E at an altitude of 240 m above sea level. The confined goats were fed *ad libitum* on a cut-and-carry combination of *Panicum maximum, Gliricidia sepium,* and *Leucaena leucocephala* forages plus supplement ration at the rate of 150 g/dry doe and 200g/nursing doe per day, in accordance with the West African Dwarf Goat Project, WADGP (1993) recommendation. The supplement ration contained 35 % corn offal, 40 % palm kernel cake, 23 % wheat offal, 1 % bone meal, 0.65 % oyster shell, 0.25 % common salt and 0.1 % vitamin/mineral premix. Water was supplied daily. The scavenging does on the other hand belonged to 8 different farmers at Kajola village, Ede road, Ile-Ife which is situated about 6 km from the university farm. The bulk of the diet of these goats is from the scavengeable feed resources around the farmstead. Some of the goat keepers also supplement their goats with small amount of crop and household residues everyday.

All animals (both confined and scavenging) were dipped in Makon 50® solution at six months intervals (against ectoparasite) and given routine Levamisole injection (against endoparasite) according to the manufacturer's recommended dosage. They were also treated with antibiotics when necessary. The confined does were hand-mated to WAD bucks on exhibition of standing oestrus and pregnancy monitored till term. The free range does run freely with the bucks in the village and were believed to be served by WAD bucks, since no other breed of goats was kept in the village. After kidding all does (both on-station and on-farm) were allowed to suckle their kids without interference for the first 20 days. On the 21st day the 18 confined does plus their kids were randomly allotted to three suckling treatments (details contained in the section on experimental treatments below) on the assumption that suckling frequency and activity in goats decreased from the end of the third week post partum (Delgadillo *et al.*, 1997). The scavenging does on the other hand continued with the unrestricted suckling because of the difficulty of restricting suckling under free range condition.

Experimental treatments

The 18 nursing dams under confinement plus their kids were randomly allotted to three suckling regimes on the basis of their kid's birth weight, litter size and sex. The suckling treatments were:

i) Day-Suckling - Suckling restricted to between 0900 and 1700 h. Dam wore udder apron between 1700 and 0900 h of the following day.

ii) Evening-Suckling - Suckling restricted to between 1700 and 0900 h of the following day. Dam wore udder apron between 0900 and 1700 h.

iii) Ad libitum-Suckling - Unrestricted access to suckling

The 12 scavenging dams and their kids with unrestricted suckling period formed the fourth group. These treatments continued till weaning of kids at the standard weight of 5.5 kg or 13 weeks of age (whichever is attained first). The aim of the suckling restriction was to reduce suckling activity and determine its effect on the performance of the kids. No creep feed was offered but the kids had access to the supplement ration and forage offered their dams.

Kidding was not synchronised in the does and thus the season of kidding was also taken into consideration during analysis of the data. The seasons were partitioned into four as follows: early rain – April to June; late rain – July to September; early dry – October to December; late dry – January to March.

Data collection and statistical analysis

Body weight of the suckling kids were measured weekly under both on-farm and on-station conditions until weaning at 5.5 kg liveweight or 13 weeks of age. Data on the preweaning growth traits were statistically analysed using the least-squares procedure of SAS (2000) software. Effects in the model included suckling/rearing method, litter size, sex of kid, season of birth and coat colour. Means separation was done with the Duncan and lsmeans options of the GLM procedure. The weight and weight gain of kids from birth to 13 weeks as well as their variances were plotted with the SigmaPlot (2000) software. Only the data on 26 and 30 kids (a total of 56 kids) that survived till weaning under free range and confinement systems, respectively was used in the analysis.

RESULTS AND DISCUSSION

Preweaning performance of the WAD goat kids

Table 1 shows the average preweaning performance of WAD goat kids with respects to suckling/rearing method, litter size, sex, season of birth and body coat colour. Suckling/rearing method, litter size and season of birth significantly influenced ($P<0.05$) the kids' weaning weight, average growth rate and growth intensity (time taken to double the birth weight) while the weaning age (time taken to attain 5.5 kg or 13 weeks of age) was only influenced by the season of birth. The highest average growth rate (65.56±7.41 g/day) and consequently the lowest weaning age (66.23±4.46 day) were recorded for kids with *ad libitum* suckling under the free-range management system. The Day-suckled kids had similar ($P>0.05$) weaning weight (4.36±0.31 kg) to the free ranging kids (5.22±0.24 kg) but at a longer ($P>0.05$) weaning age (80.82 Vs 66.23 days). The Evening-suckled and Ad lib-suckled kids under confinement had lower weaning weights compared to the free-range kids but similar to the day suckled counterparts. Singleton had higher birth weight, weaning weight and growth intensity as well as better growth intensity than kids of twin birth. Coat colour and sex of kid did not have any significant influence ($P>0.05$) on the preweaning performance of the kids. There was no statistical check on the survival rate of the kids however over 70 % of the kids survived till weaning in any of treatment group.

The least squares means of weekly body weight of the 56 kids showed that body weight increased linearly from birth till week 13 while the body weight gain decreased linearly from 54 g/day in week 1 to 20 g/day in week 6 and thereafter fluctuated around 25g/day until week 12 and dropping to 13 g/day in week 13. The phenotypic variance of bodyweights showed a linear increase from week 0 until the 13th week. The coefficient of variation of the body weight increased linearly from 14 % at birth to 30 % in week 5 and thereafter fluctuated between 29 and 32 % (Fig 1).

Figures 2 – 5 gives the graphical representation of the influence of suckling/rearing method, season of birth, litter size and sex of kid, respectively on the liveweights, weight gains and their variances of the WAD kids between birth and weaning. Unlike the average values given in Table 1, the figures provided a better picture of the effects of the factors on the preweaning traits of the animals and thus a better basis for discussion.

Effects of management method

The graphical representation showed clearly that kids under confinement had lower body weights throughout preweaning life when compared to those under free range. Under confinement however, kids with access to day suckling (i.e. between 0900 and 1700 h) were heavier than kids with *ad libitum* suckling or evening suckling (i.e. between 1700 and 0900 h) (Fig 2A). Mack *et al.* (1985) had equally reported significant higher body weights at 90 days for WAD goats kids under free range in Fashola, Oyo state in Southwestern Nigeria compared to those of restricted kids (tethered or confined) in Mgbaku, Anambra state and Okwe, Imo state in the Southeastern part Nigeria. They related the higher body weights of the kids in the southwest to the heavier (21 % higher) body weights of their dams since the growth rates were similar for kids from both regions. In our study the free range kids had higher growth rates especially in the first 5 weeks of age (Fig 2B). Thus the most probable explanation for our own observation would be the fact that the confined kids had restricted feed resource base as there was no access to neither creep feed nor selective foraging which could have favoured higher growth rate of the kids compared to a wider scavengeable nutritional base, which could sometimes include access to large amount of supplements such as crop residues, kitchen waste and concentrate feedstuffs, available to the free ranging kids. Higher variabilities in the body weights of the free range kids (Fig 2C) further confirm the wider fluctuation in the management method (including nutrition) of the goats since they belong to different owners although in the same community.

Day-suckled kids had comparable weaning weight to the free ranging kids though at a later weaning age (Fig 2A). This result suggests a possible compensatory suckling during the day in the day-suckling group to take care of the restriction imposed in the evening period, since most of the suckling activity would normally occur during the day. This could result in more milk intake and a consequent increase in weight gain especially in the immediate weeks after imposing restriction. On the contrary the evening-suckled kids may not be able to fully compensate the restriction of the day especially since the pens were not artificially illuminated during the night and the animals were assumed to go to sleep in the dark hours. Thus evening-suckled kid appeared to be the most restricted and they tend to grow slower than the rest groups. These results agreed with the reports of Lu and Potchoiba (1988) and Hary and Schwartz (2002) on milk feeding restriction in goats. They showed that the growth and weight gain of the kids during the milk-feeding period was linearly correlated to the intake of milk dry matter and more accurately to the energy intake level. In

this study kids with *ad libitum* and day suckling access probably had higher dry matter intake.

The birth weights of the kids were doubled (i.e. growth intensity) before the age of 5 weeks which was two weeks after the commencement of the suckling restriction. Before this period the kid relied mostly on the milk from the dam, the quantity of which depends on the nutrition of the dam (Sibanda *et al.*, 1999). Hence, the growth intensity was not different between the kids in the different suckling groups under confinement but was faster in the free-range kids. Majority (>80%) of the kids under suckling restriction survived till weaning age which may suggest that suckling restriction would not be a primary cause of preweaning mortality in WAD goat flocks under the smallholder management systems.

Effects of Season of birth

Analysis of the season of birth effect showed that kids born during the early rainy season had higher body weights (Fig 3A) and overall weight gain (Fig 3B) than kids born at any of the other three seasons. Climate and season affects the performance of animals in the tropics through the availability and quality of pastures and farm by-products. Whereas Adu *et al.* (1988) reported no difference in the birth weights and weaning weights (at 90 days) of WAD goat kids between the dry and wet seasons, Odubote *et al.* (1993) reported a significantly higher birth weights for kids born during the rainy season but a lower weaning weights for the same kids. In our study, there was no seasonal effect on the birth weights of the kids but the weaning weights was higher in the kids born during the early rain season. This is to be expected, since both the kids and dams will benefit from the high quality pasture in the rainy season. In this respect our report agreed with those of Lopes Junior *et al.* (2001) and Hary and Schwartz (2002). As used in our study each season (early dry, late dry, early rainy and late rainy seasons) occupies a quarter of the year as described by Egbunike (1979). Over half of the kids used in our study were born during the late dry season but, it is important to note that since each of the four seasons occupies equal quarter of the year which is also the length of pre-weaning period (90 days), kids born in the middle or towards the end of any season will be nursed/suckled into the next season. This overlapping effects may obscure the true effect of each season. For instance the higher variabilities in the body weights of kids born during the late rainy season (Fig 3C), which included those kids nursed during the period of abundant quality forage in the first half of late rainy season and those nursed into the period of decreasing quality forage of the early dry season, may support this notion.

Effects of Litter size

Kids born and reared as singleton were heavier (Fig 4A) and gained more (Fig 4B) than kids reared in twin litter. However the variability in body weight was higher in the single reared kids (Fig 4C). Litter size is known to be negatively related to the preweaning body weights of goat kids (Mukherjee, 1991; Odubote *et al.*, 1993; Hary and Schwartz, 2002). It does not appear that the increase in milk yield with litter size will adequately compensates for the extra kid(s) hence, growth rate and weaning weights usually decrease with increase in litter size especially if all the kids survived till weaning. The effect of litter size on the body weight gain waned from the sixth week of age in agreement with the observation of Singh and Singh (1974). It could be interpreted that the superiority in body weights of singleton over multiples is highly limited by the management system and/or nutritional allowance especially after the exclusive milk feeding stage.

Effects of Sex

The liveweights of the males and females kids separately plotted did not reveal any noticeable disparity (Fig 5A). there was also no significant disparity in their body weight gain (Fig 5B) and variability of body weight (Fig 5C). Ndlovu and Simela (1996) and Hary and Schwartz (2002) were unanimous in reporting that the preweaning body weight gain in the Small East African goat kids depended on the milk availability from dam, season of birth and litter size rather than sex of kid. It is also possible that differences in the growth rate between sexes require post weaning evaluation to become apparent.

Effects of Coat colour

There was no significant effect of the coat colour on the kid's performance in this study though the weaning weights (Table 1) were in favour of the more pigmented (black or brown) kids, which seems to agree with the conclusions of Ebozoje and Ikeobi (1998). These authors noted that weaning weights of WAD kids increased with increase in coat pigmentation. However Odubote (1994) and Ozoje and Mgbere (2002) noted that the slow growing kids will reach maturity later but are heavier at maturity.

CONCLUSION

Free ranging WAD goats kids performed better than their confined counterparts. Confined kids restricted to suckling access between 0900 and 1700 h from the third week of age to weaning grew and survive at a rate similar to the unrestricted suckling kids. The growth rate of the WAD kids under smallholder operation depended more on the

season of birth and to a lesser extent the litter size and sex. Kids born and suckled during the early rainy season of southwestern Nigeria will enjoy high quality forage of this season and thus perform better than kids born at other seasons. The high variability of between 10% at birth to over 40% at weaning observed in our study are most probably due to the low sample size of the data used. However the high variability in the preweaning performance of the WAD kids under the smallholder operation suggests that the selection of superior animals should take high cognisance of the rearing method and season of birth.

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TABLE 1: Factors affecting preweaning performance of WAD goat kids

Factor	n	Birth weight (kg)	Weaning weight (kg)	Weaning age (days)	Growth Intensity (days)	Growth Rate (g/day)	Survival Rate till weaning
a)Suckling/ Rearing method							
Day suckling under confinement	11	1.21±0.05	4.36±0.31^{ab}	80.82±2.56	24.73±3.10^{ab}	38.71±3.94^{b}	1.00
Evening suckling under confinement	9	1.18±0.36	3.62±0.27^{b}	70.44±9.14	34.93±5.00^{a}	31.33±3.77^{b}	0.90
Unrestricted suckling under confinement	10	1.11±0.05	4.15±0.45^{b}	79.55±1.95	29.14±5.52^{a}	38.16±5.78^{b}	0.82
Unrestricted suckling under Free range	26	1.25±0.25	5.22±0.24^{a}	66.23±4.46	16.32±2.44^{b}	65.55±7.41^{a}	0.89
b) Litter size							
Singleton	20	1.27±0.04^{a}	4.96±0.21^{a}	78.0±3.52	16.19±1.45^{b}	56.78±5.53^{a}	0.95
Twins	36	1.12±0.02^{b}	4.24±0.20^{b}	78.47±2.41	27.61±2.49^{a}	38.82±2.73^{b}	0.85
c) Sex							
Male	26	1.19±0.03	4.54±0.23	73.12±3.67	24.05±2.89	45.74±4.06	0.93
Female	30	1.16±0.03	4.46±0.22	77.47±2.12	23.08±2.35	44.80±4.07	0.88
d) Season of birth							
Early rain season	6	1.22±0.08	5.43±0.13^{a}	64.17±6.62^{b}	12.11±0.65^{c}	69.84±8.10^{a}	1.00
Late rain season	8	1.21±0.07	3.78±0.53^{b}	75.25±3.91^{ab}	33.34±7.11^{a}	34.78±7.32^{b}	0.75
Early dry season	11	1.08±0.03	4.76±0.32^{ab}	81.46±1.95^{a}	16.87±1.70^{bc}	45.77±4.31^{b}	0.73
Late dry season	31	1.19±0.03	4.41±0.20^{ab}	75.55±3.14^{ab}	25.60±2.30^{ab}	42.98±3.81^{b}	0.97
e) Coat colour							
Black	22	1.18±0.04	4.53±0.25	75.09±2.96	22.42±3.03	47.10±4.64	0.72
Brown	27	1.16±0.03	4.52±0.23	76.37±3.31	24.50±2.68	43.85±4.17	1.00
White and Black/Brown	7	1.21±0.08	4.30±0.45	73.0±5.26	23.27±4.71	44.70±8.24	1.00

^{abc} Means ± SEM differently superscripted within the same column and factor grouping are different ($P<0.05$)

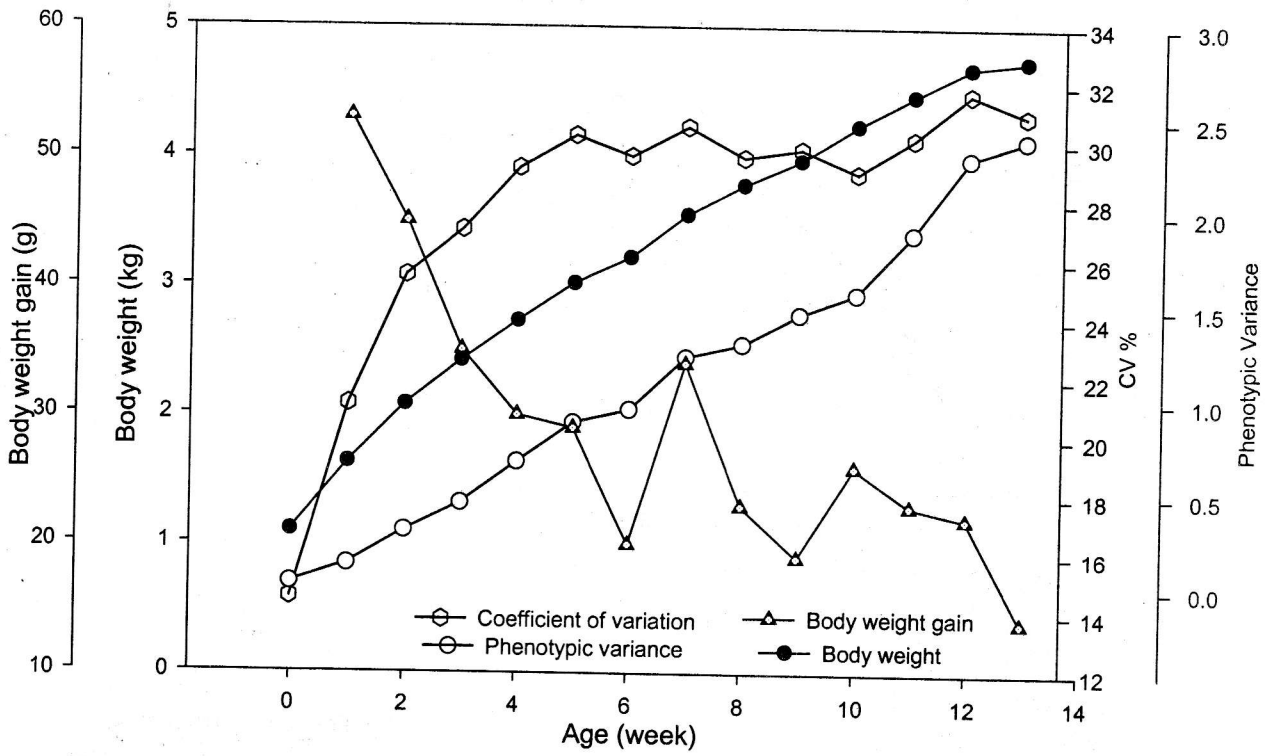

Figure 1: Least square means of body weights and weight gain, Coefficient of Variation and Phenotypic variance of body weight of WAD goat kids preweaning

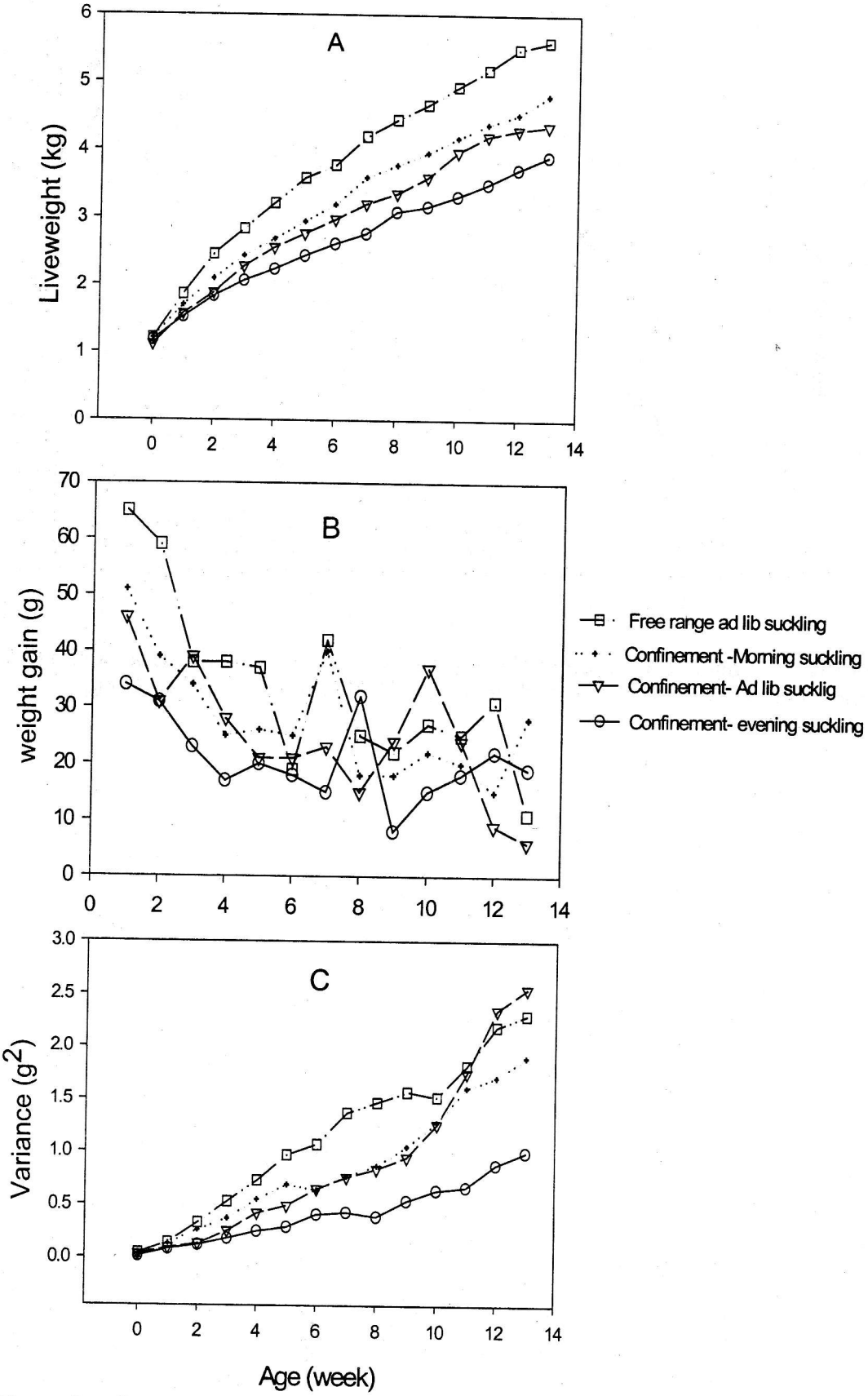

Figure 2: Effects of management/suckling method on body weight (A), weight gain (B) and variance in body weight of WAD goat kids.

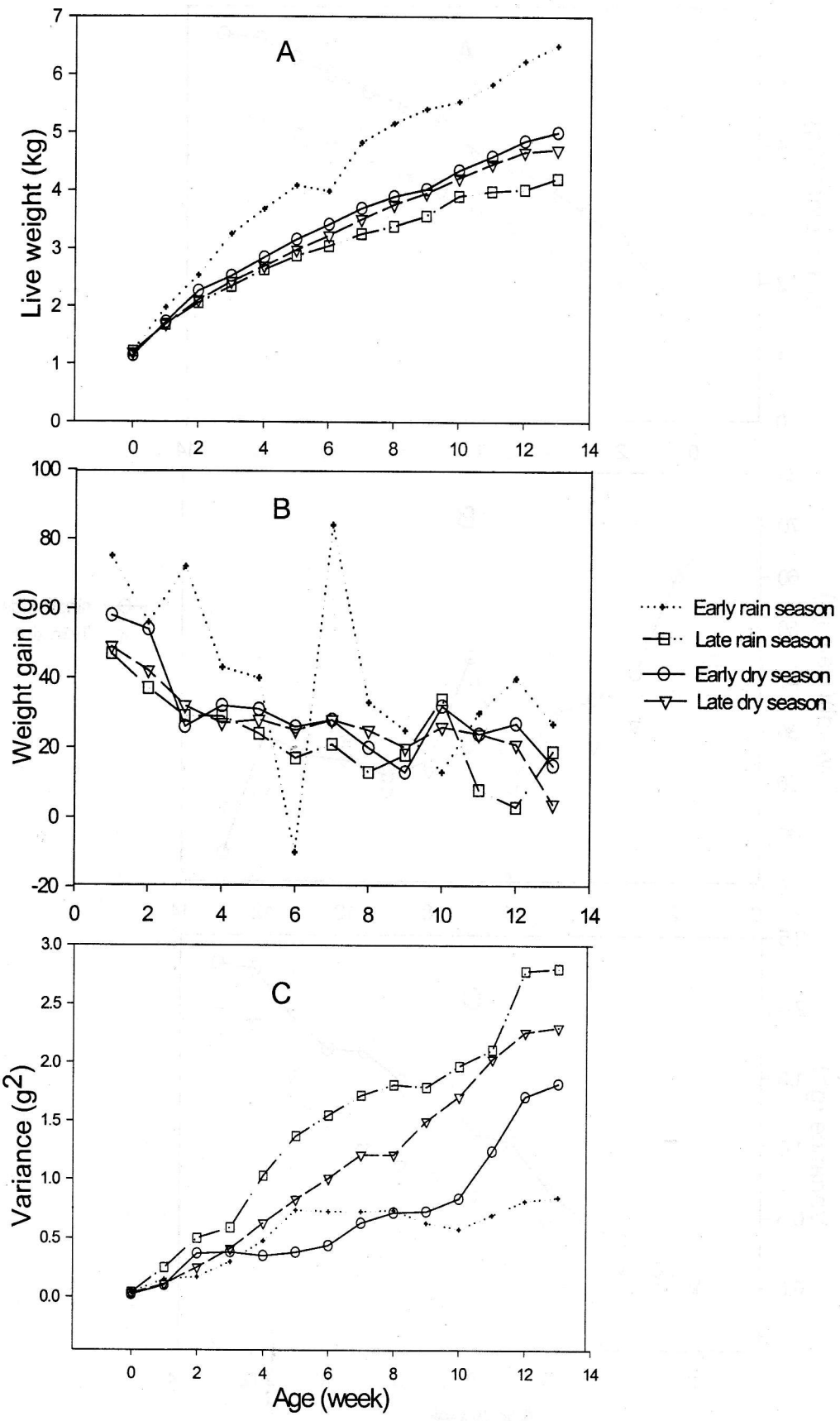

Figure 3: Effects of season of birth on body weight (A), weight gan (B) and variaces in body weight (C) of WAD goat kids.

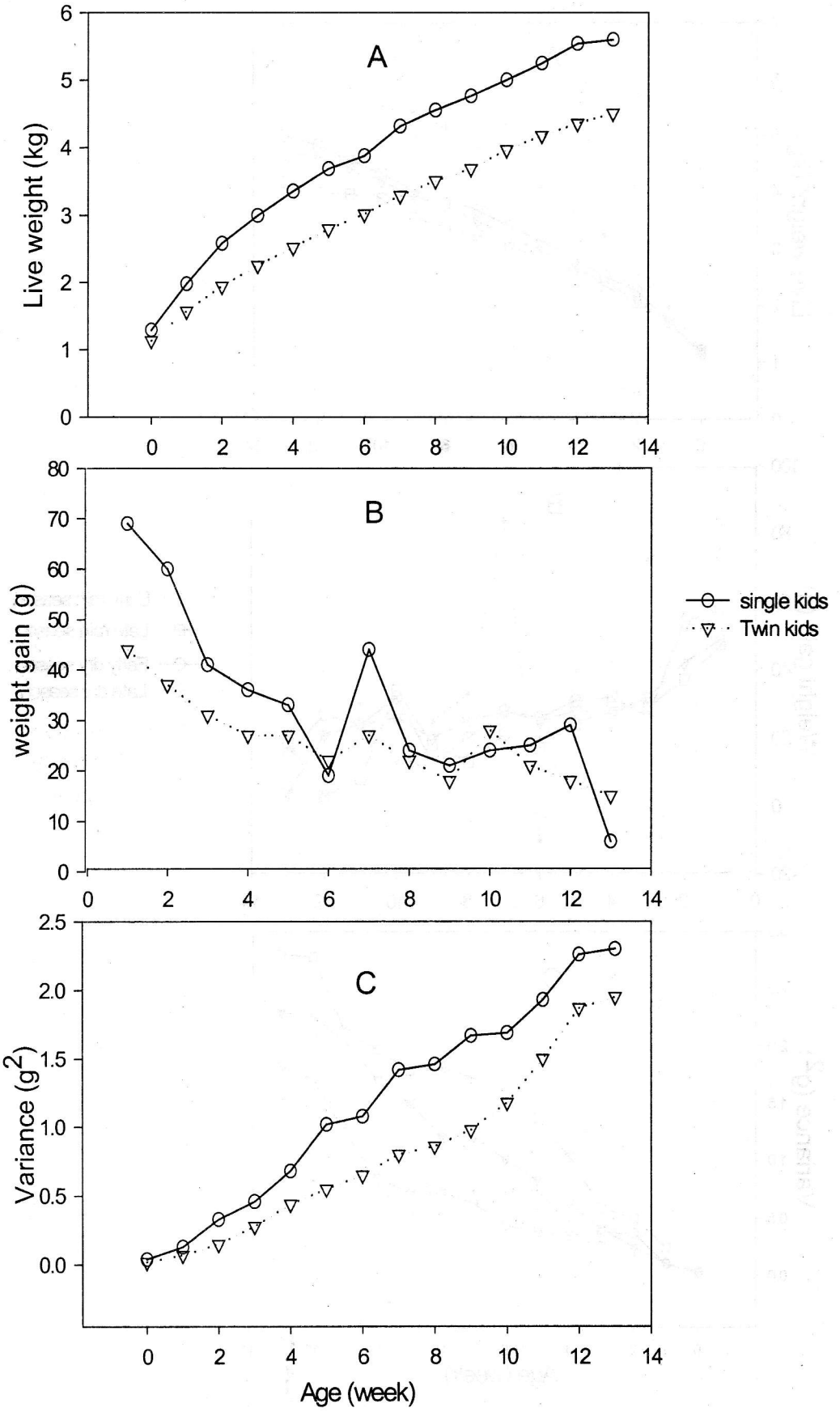

Figure 4: Effects of litter size on body weight (A), weight gain (B) and variances in body weight of WAD goat kids

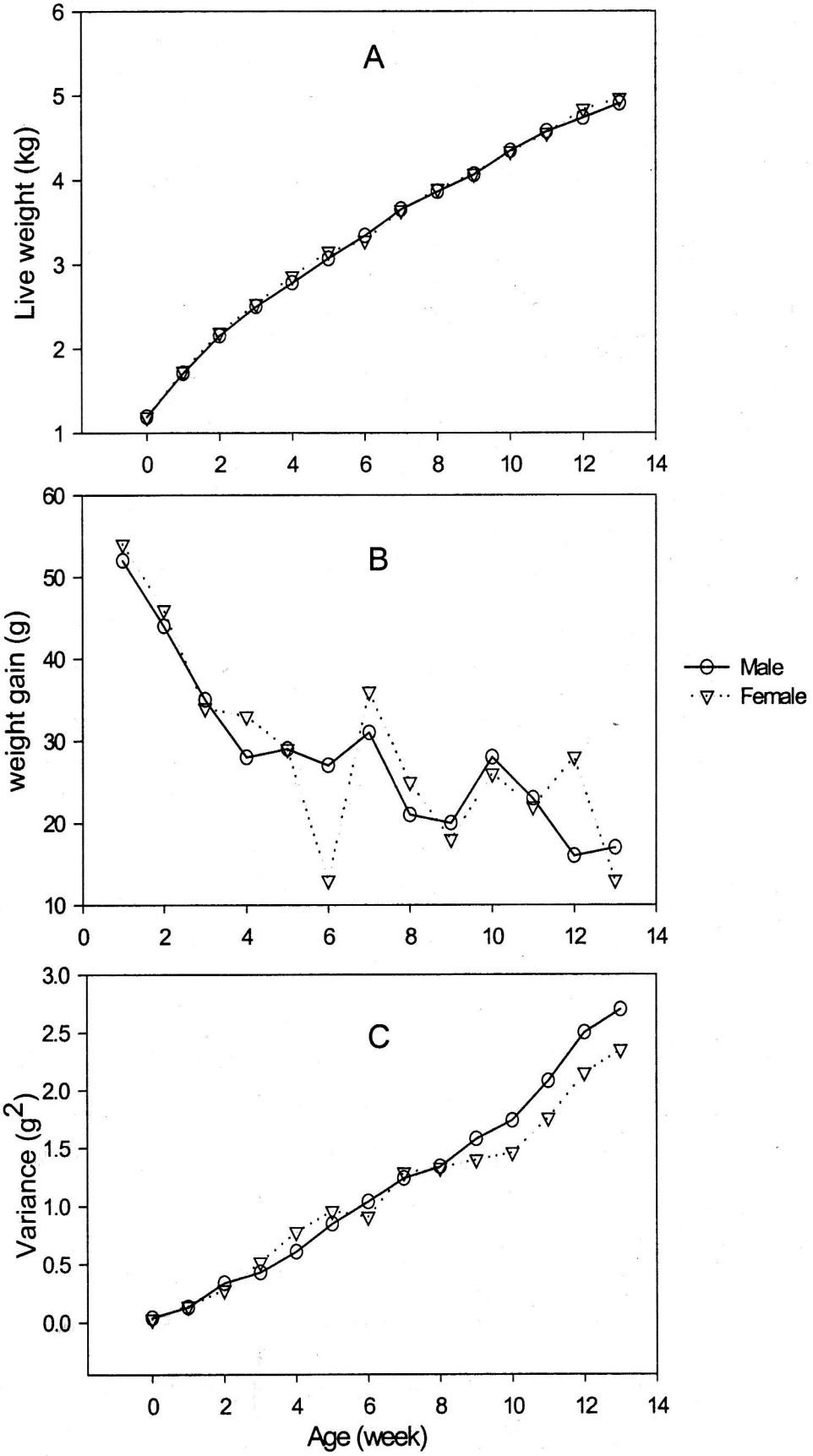

Figure 5: Effects of sex on body weight (A), weight gain (B) and variances of body weight in WAD goat kids