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Research Article

Factors Affecting Pre-weaning Kid Mortality in Boer Goats and their Cross with Native Ethiopian Goats Under an Intensive Management

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Abstract

A retrospective study was conducted from November 2013 to April 2014 at Hawassa university goat farm. The aim of the study was to assess the variation of birth weight, weaning weight and pre-weaning mortality of Boer goat and there cross with native Ethiopian goats. Records of 537 kids that were born alive from 2008 to 2013 were used in this study. The factors considered for birth weight, weaning weight and mortality of kids were birth type, parity, sex, season of birth, year of birth, genotype and dam weight while birth weight was also used as risk factors for kid mortality and weaning weight of kid. In this study the mean birth and weaning weight of kids was 3.04 (± 0.4sd) kg and 13.27 (± 0.18sd) kg respectively. All factors except season of birth had significantly (at least $p < 0.05$) affect birth weight of kids. Parity and season of birth had not significant ($p > 0.05$) effect on weaning weight of kids but all the other factors were significant effect at weaning weight of kids. Birth weight, parity and year of birth significantly ($p < 0.05$) affect pre-weaning mortality rate of kids but not other factors. Male kids had higher ($P < 0.05$) birth weight (3.1 ± 0.8 kg vs. 2.9 ± 0.7 kg), and weaning weight (13.65 ± 0.25 kg vs. 12.81 ± 0.23 kg) than female kids, but sex had not significant ($p > 0.05$) effect on pre-weaning mortality rate of kid. Single born kids were heavier birth and weaning weight than twins and triplets, however, type of birth was not significant ($p > 0.05$) effect on pre-weaning mortality rate of kids. In this study birth weight was increased as parity increased. Dam weight had linear relationship with birth weight and also birth weight had linear relationship with weaning weight. The overall pre-weaning mortality rate of kids in this study was 24.4%. Out of 126 deaths encountered before three months of age, 80 (15.5%) deaths occurred within 30 days of age and the highest mortality (65.4%) was recorded for kids had 2kg or less birth weight, while the lowest mortality rate (13.2%) was recorded for kids had 3 kg or more birth weight. Pre-weaning mortality (birth to 90 days) was affected ($p < 0.01$) by parity of does, high Pre-weaning mortality was recorded in kids born from the second and first parity of does. Season of birth had not significant effect on pre-90-day mortality of kids. Generally, mortality rate was found to be highest in kids weighing ≤2 kg birth weight and in kids born in the later year. So, improving supplementary feeding for pregnant, very young and old does is recommended to get moderate birth weight and to minimize pre-weaning kid mortality rate.

Keywords: Birth Weight; Weaning Weight; Pre-weaning Mortality; Goats

Introduction

Boer goat (*Capra hircus*) is considered to be one of the most desirable goat breeds for meat production but milk and skin are also important products. It has gained worldwide recognition for excellent body conformation, fast growing rate and good carcass quality. It has been demonstrated that Boer goats can improve productive performance of many indigenous breeds through cross breeding. Somali are goat are two types (short and long eared goats). They are drought tolerant and, when milked, can each yield one to three kilograms of milk daily, even when access to water is limited. Both the Short- and Long-eared Somali goats are milked extensively. Ar-si-Bale goats are reared for meat, milk and skin production mean

height at shoulder is 73.2 cm and 66.1 cm for adult bucks and does, respectively [1]. Within African society small ruminant comprise a greater proportion of the total wealth of the poor families, because of the low input requirements such as small initial capital, fewer resources and maintenance cost. They are also able to produce milk and meat in readily usable quantities using marginal lands and poor pasture and crop residues. Furthermore, their production cycle makes them need only short periods to reconstitute flocks after disaster and respond quickly to the demand [2].

Ethiopia owns huge number of small ruminants, estimated to be 42 million heads of sheep and goats. Small ruminants are found mainly in the lowland agro-ecology which constitutes 65% of the area, where 25% sheep and close to 73% goat's population exist [3]. Sheep and goats cover more than 30% of all domestic meat consumption and generate cash income from export of meat carcass, edible organs, live animals and skins [4]. Hence, an increase in small ruminants' production could contribute to the attainment of food self sufficiency in the country particularly in response to protein requirement for the growing human population as well as to enhance the export earnings [5].

Goats are known to be potential genetic resources for meat, milk, skin and fiber throughout tropical and developing countries. Goats play an important role in generating employment, income, capital storage and improving household nutrition [6].

The small body size, broad feeding habits, adaptation to unfavorable environmental conditions and their short reproductive cycle provide for goat's comparative advantage over cattle and sheep to suit the circumstances of especially the poorer mixed crop-livestock production environments of the highlands. These attributes make it easier to adjust goat flock size to match the available resources, facilitate the integration of livestock production into small scale production systems (low capital, low risk) and enable flexible production [7,8].

Goat has been described as poor man's cow, a befitting description of their immense contributions to the poor people's economy. Even if goats have many advantages, their production is affected by both genetic and environmental factors. One of the most important production factors that adversely affect goat production is high pre-weaning mortality of young kids. Kids' mortality, in addition to the immediate economic loss, has a direct effect on genetic progress by its effect on selection pressure that is the percentage of the kids, which must be retained as replacement. More over high kids' mortality rate can seriously affect the economic viability of small ruminant farming; jeopardize the beneficial impact of fecundity and litter size of the flocks. Non-genetic factors are largely expected to contribute to kid mortality [9,10]. A high mortality may also represent a compromised animal welfare which poses ethical concern in animal production [11].

Several factors had been reported by different researchers' that to affect mortality rate in goat kids such as type of birth, sex of kid, birth weight of kid, parity order, and season of kidding and age of the kid [12-15]. Generally, higher kid mortality occurs at birth and from birth to weaning while mortality is relatively low from weaning to breeding age in many production systems [15,16]. Improving the survival of lambs/kids is essential for the economic viability of a flock and for its long-term genetic improvement. However, studies have shown that up to 28% of lambs and 47% of kids die before weaning in Ethiopia [17].

The death of kids before weaning is perhaps the single biggest cause of economic loss to goat farmers and may be reduced by improvements in the management and feeding of the kidding flock [18,19]. Very little work on mortality, morbidity and their causes in goat kids has been published from Ethiopia [19,20]. Even though, some preliminary work has been done in Ethiopia to improve local goats through the use of cross breeding of Boer goats with native Ethiopian goats, but the result is not analyzed. Therefore, the objective of this study was to assess breed variation in kid growth and to estimate pre-weaning kid mortality of Boer goats and there cross with Ethiopian native goats and to identify the related genetic and non genetic factors which influence mortality of kids in intensively managed goat flocks in the study farm.

Materials and Methods

Description of study area

The study was conducted at Hawassa University nucleus goat farms. The University is located in Hawassa city. Hawassa is located in the Southern Nation's Nationalities and Peoples Region on the shores of Lake Hawassa in the Great Rift Valley; 273 km south of Addis Ababa. It lies geographically between 4° 27' and 8°30' latitude North and 34° 21' and 39° 1'East longitude. The annual rainfall and temperature of the area varies from 800-1000 mm and 20.1-25^{0}c, respectively. According to unpublished document from Hawassa City Administration Finance and Economic Development Department in 2012, the livestock population of the City Administration accounted for 64179 cattle, 13683 sheep, 21521 goats, 2341 horses, 2418 donkeys and 29 mules. The reported showed that majority of the livestock population is kept in the peri-urban

areas of the city. According to the same source of data, the human population of the city administration is estimated at 316,842 (in 2012), with 63% living in urban areas. The human population of the city is growing at the rate of 4.0% (4.8% in urban and 2.8% in peri-urban parts) [21].

Study design

A retrospective study was conducted on Hawassa goat nucleus farm from November 2013 to April 2014.

Animals and management

The genetic groups involved in this study were Boer, Boer x Somalia and Arsi Bale x Boer goats. The Boer goats were the sire line. The dam lines were the Boer, Somalia and Arsi Bale goats. The goats used for this study were managed at intensive conditions. In the night, they were kept in closed pens within the animal house but allowed to graze on legume-grass-mixed natural pasture during the day within the farm premises. In addition to grazing, goats were supplemented with mineral licks and provided with concentrate fed two times per day in morning and the afternoon after grazing. Kids were allowed to suckle their dams up to the age of three months. Routine health care practices such as vaccination/medication, ecto-parasite control and de-worming were also regularly carried out. Fresh drinking water was provided with watering trough. After weaning kids are kept and housed separately from their dam.

Data collection

Methods of Study: Data on different factors that influence kids' mortality rate, birth weight and weaning weight of kids such as season of kid birth, birth year, birth weight, birth type, sex, weight of does, parity of does and genotype was collected to evaluate the effect of these factors on kid's mortality rate, kid birth and weaning weight.

Records of 537 goats born from 2008 to 2013 were used for the study. Only kids born alive are used in this study. Birth date, birth weight, birth year, parity of does, genotype of kids, season of birth, birth type, litter size, sex of kids weaning weight of kids and weight of dams were taken from record book of the farm for each kid. Death date of kids was also taken from record book as it occurred.

Data analysis

Recorded data were entered in excel spread sheet as database and used to analyze different attributable factors. The response variables considered were kid birth weight, kid weaning weight and mortality of kids to a specific age (birth to 30, and birth to 90 days). The factors considered for birth weight, weaning weight and mortality of kids were birth type, parity, sex, season of birth, year of birth, genotype and dam weight while birth weight was also used as risk factors for kid mortality and weaning weight of kid. ANOVA were used to determine the effect of the independent variables on birth weight and weaning weight while chi-square used to see the effect of the risk factors on mortality of kids. Linear regression was used to see the effect of birth weight and dam weight on weaning weight of kids and it was also used to see effect of dam weight on birth weight.

Results

Factor	Level	N	Mean	SD	P value
Sex	Male	279	3.1	0.8	0.0119
	Female	258	2.9	0.7	
Parity	1	220	2.9^{a}	0.8	0.0005
	2	164	3.0^{ac}	0.7	
	3	88	3.3^{b}	0.8	
	≥4	63	3.2^{bc}	0.8	
Litter size	1	275	3.2^{a}	0.8	0.0000
	2	227	3.0^{b}	0.7	
	3	35	2.4^{c}	0.7	
Season of Birth	Dry	156	3.0	0.8	0.0829
	Light rain	176	3.0	0.7	
	Heavy rain	205	3.1	0.8	
Genotype	50%	204	2.8^{a}	0.6	0.0000
	75%	95	2.7^{a}	0.7	
	100%	238	3.4^{b}	0.8	
Birth year	2008	61	3.2^{a}	0.8	0.0000
	2009	167	3.0^{ac}	0.7	
	2010	158	3.2^{a}	0.8	
	2011	72	3.0^{a}	0.8	
	2012	54	2.6^{b}	0.7	
	2013	25	2.7^{bc}	0.6	
Over all		537	3.04	0.4	

Table 1: Birth weight of kids by sex, genotype, parity, season of birth, type of birth and birth year.

^{a,b,c,} means with in a column and within the same factor followed by different alphabets differ significantly $p < 0.05$.

Birth weight

The overall mean birth weight (n = 537) of all kids was 3.04 (± 0.34 SD) Kg. There was significant difference in birth weight between male and female kids (P < 0.05). Birth weight was significantly (P < 0.001) affected by parity of the dam, weight of the dam (does), genotype, year of birth and type of birth (litter size), but birth weight was not significantly (p > 0.05) affected by season of birth. Generally, birth weight increased with increased parity and kids born single were heavier than kids from twins and triplets. Kids born in the early year were heavier than kids born in later year (Table 1).

Factor	Level	N	Mean	SD	P value
Sex	Female	192	12.8	3.2	0.0131
	Male	185	13.7	3.7	
Parity	1	157	13.8	3.6	0.0532
	2	101	12.6	3.3	
	3	70	13.2	3.3	
	≥4	47	13.0	3.1	
Litter size	1	199	14.3^{a}	3.5	0.0000
	2	158	12.1^{b}	2.8	
	3	20	11.6^{b}	3.1	
Season of Birth	Dry	115	13.3	3.5	0.067
	Light rain	123	13.2	3.1	
	Heavy rain	139	13.2	3.7	
Genotype	50%	145	13.5^{a}	3.3	0.0067
	75%	59	12.0^{b}	3.7	
	100%	173	13.4^{a}	3.4	
Birth year	2008	52	13.4^{ab}	3.4	0.0000
	2009	125	14.6^{ad}	2.9	
	2010	106	12.8^{be}	3.2	
	2011	48	12.9^{cd}	3.8	
	2012	29	10.9^{e}	3.3	
	2013	17	10.9^{e}	4.0	
Over all		377	13.27	0.18	

Table 2: Weaning weight of kids by sex, genotype, parity, season of birth, type of birth, and year of birth.

^{a,b,c,d,e} means with in a column and within the same factor followed by different alphabets differ significantly p < 0.05.

Weaning weight

Body weight at weaning is an economically important trait as a primary determinant of value for market kids and a principal criterion for selecting replacement breeding stock. The lack of a direct breed effect on weaning weights prevents the identification of any breed as a favorable or unfavorable sire breed for pre-weaning kid performance [22].

The overall mean weight at weaning (end of three month of age) (n = 377) was 13.27(± 0.18SD) kg. There was significant difference in weaning weight between male and female kids (P < 0.05). Weaning weight was significantly (P < 0.001) affected by birth weight of the kid, birth year of kid and type of birth (litter size) and it also affected by genotype (breed) of the goat (p < 0.01), but birth weight was not significantly affected by season of birth and parity of the dam (Table 2).

Kid mortality

The overall pre-weaning mortality rate of kids in the present study was 24.4% (126/517). Out of 126 deaths encountered before three months of age, 80 (15.5%) deaths occurred within 30 days of age. It indicated that the first month of post kidding are critical periods which determinately affect the survival rate of kids. A highest mortality (65.4%) was recorded for kids less than or equal to 2 kg while the lowest mortality rate (13.2%) was recorded for kids more than 3 kg at birth. In this study sex, litter size, and season of birth, are not significant (P > 0.05) effect on pre-30 and pre-90 days kid mortality. Parity and year of birth are not significant (p > 0.05) effect on pre-30 days mortality but parity and year of birth had a significant (p < 0.05) effect on pre-90 days kid mortality. Pure Boer breed had the least mortality rate than their cross with native Ethiopian goats but it is not statistically significant (Table 3).

Discussion

Factors affecting kid birth weight

The overall mean kid birth weight of (3.04 kg) recorded in this study is slightly lower than the report of [23,24], who indicated the birth weight of the Somali goat breed in Hawassa and Haramaya University was 3.05 kg and 3.19 kg respectively, but the overall kid birth weight of this study is slightly lower than the finding of [25] who reports the average kid birth weight of Boer goats was 3.47. However, lower birth weights than the present finding had been

Factor	Level	Birth to 30 days					Birth to 90 days				P value
		N	Death	%	OR	P value	N	Death	%	OR	
Overall		517	80	15.5			517	126	24.4		
Genotype	50%	197	35	17.8	1		197	50	25.4	1	
	75%	95	18	18.9	1.08	0.1488	95	30	31.6	1.36	0.1007
	100%	225	27	12.0	0.63		225	46	20.4	0.75	
Sex	Female	252	31	12.3	1	0.0508	252	54	21.4	1	0.1279
	Male	265	49	18.5	1.62		265	72	27.2	1.37	
Birth weight	≤2	52	24	46.2	9.83		52	34	65.4	12.41	
	2-3	253	39	15.4	2.09	0.0000	253	64	25.3	2.23	0.0000
	>3	212	17	8.0	1		212	28	13.2	1	
Parity	1	210	38	18.1	1		210	53	25.2	1	
	2	159	27	17	0.93	0.0801	159	49	30.8	1.32	0.0079
	3	84	6	7.1	0.35		84	10	11.9	0.40	
	≥4	62	9	14.2	0.77		62	14	22.6	0.86	
Litter size	1	261	37	14.2	1		261	55	21.1	1	
	2	223	36	16.1	1.17	0.5544	223	58	26.0	1.32	0.0627
	3	33	7	21.2	1.63		33	13	39.4	2.43	
Dam weight	20-30	199	36	18.1	1		199	50	25.1	1	
	31-40	143	20	14.0	0.74	0.1746	143	33	23.1	0.89	0.4940
	>40	161	18	11.2	0.57		161	32	19.9	0.74	
Season	Dry	147	27	18.4	1		147	32	21.8	1	
	Light rain	172	24	14.0	0.72	0.5181	172	48	27.9	1.39	0.4013
	Heavy rain	198	29	14.6	0.76		198	46	23.2	1.09	
Birth Year	2008	58	7	12.1	1		58	7	12.1	1	
	2009	157	23	14.6	1.25		157	32	20.4	1.87	
	2010	153	23	15.0	1.29	0.9101	153	44	28.8	2.94	0.0195
	2011	71	13	18.3	1.63		71	18	25.4	2.47	
	2012	53	9	17.0	1.49		53	20	37.7	4.42	
	2013	25	5	20.0	1.82		25	5	20.0	1.82	

Table 3: Effect of different factors on mortality rate of kids.

documented by [26-28] for Arsi Bale, Angora and Tanzanian goats respectively. This birth weight variation may be due to breed difference including difference in twining and tripleting, variation of natural environments and management of the flock including feeding system.

Sex of kid had significant ($P < 0.05$) effect on birth weight of kids. In this study, males had (3.1 kg) heavier birth weights than female (2.9 kg) kids. This is in agreement with reports of [27,29,30-33]. But [26] reports no significance difference in birth weight of males and females.

Season of birth had no statistically significant effect ($P > 0.05$) on birth weight, this are in agreement with the report of [24]. The possible reason for lack of significant influence of season on birth weight of kids may be availability of hay, concentrate feed supplemented with mineral licks and fresh drinking water to the dams during the shortage of browse and at age of pregnancy and proper

health assessment of the flock in the study farm. But a seasonal effect on kid birth weights was reported by [29,30,34].

Birth type (litter size) had significantly (P < 0.001) affected on birth weight of kids. In this case, single born kids had heavier birth weights as compared to twins and triplets. This result is in agreement with reports of [24,26,29,30,32,35]. The probable reason for heavier birth weights of single born kids is due to absence of intrauterine nutritional and space competition in single born kids unlike that of twin born kids. [36] reported that for lambs in uterus, as the number of fetuses increase, the number of caruncles attached to each fetus decreases, thus reducing the feed supply to the fetus and hence reduction in the birth weight of the lambs.

Parity of dams had significantly (P < 0.001) affected birth weight of kids. According to several reports birth weight of Kids is decreased as parity increase [24,26,27,35], but in this study, birth weight of kids is increased as parity of dam is increased. Kids born from dams of first parity had lighter (P < 0.001) weights at birth compared to kids born from dams of third and fourth or more parities. There is no significant difference of kid birth weight in kids born from the third and fourth or more parity of the dam [32]. Reported that there was a tendency to increasing weight with the advance of parity at least up to the 3rd parity. This may be attributed to physiological maturity of older does and their ability to provide enough milk for the kids. The reason for the increasing of the birth weight of the kid as parity of the dam increase in this study may be due to many local female goats were bought from free grazing area at the age of puberty, this could be attributed to gradually acclimated to a new environment and poor body condition during first kidding of does. The partitioning of nutritional resources to support growth in the younger does in addition to growth of their fetus likely contributed to lighter kid birth weights [22].

The other genetic factor which significantly (P < 0.001) affected birth weight was genotype (breed) of the goat. In this study, pure Boer breed had significantly (P < 0.001) heavier birth weights than 75% and 50% cross of Boer with Somali and Arsi Bale goats but there is no significance difference between 50% and 75% cross. Similarly breed differences in kid birth weight are documented by [37] who reported Boer does delivered lighter kids at birth than Nguni does when bred to Boer bucks and [38] reported that Spanish does had lighter birth weight kids than Alpine and Saanen does across service sire breeds.

There was a statistically significant linear relationship between dam weight and birth of kids (p < 0.001) and (coefficient = 0.026). So, for each 1 kg increase in dam weight there is an increase of 0.026 kg birth weight of kids. The poor body condition of dams may be a factor responsible for a reduced birth weight of kids, due to reduction of feed supply to the fetus during fetal development. But [39] was reports the smaller body weight of the Spanish does at kidding did not seem to decrease birth weights of their kids relative to the larger Boer and Kiko does.

Year of birth had significantly (P < 0.001) affected birth weight of kids. The significant influence of year of birth-on-birth weight of kids was also reported in previous studies [27,35]. The variation in birth of kid among years might be attributed to inconsistency of management, body condition of the doe and irregularity of rain fall and vegetation for grazing lactating does [24]. In this study Birth weight of kids among years is not persistent. However, kids born in the later years have least birth weight as compared to kids born in earlier years. This may be due to reduction of management and supplementary feed for does.

Factors affecting weaning weight of kids

The overall mean weight at weaning (end of three month of age) was 13.27 (± 0.18SD) kg. The value for live weight at weaning in this study is higher than the reports of [24,28,40], who reported 11.14 ± 0.15 kg in Tanzania, 11.67 kg (end of fourth month of age) in Somalia goat and 9.5 kg in Kacang goat, respectively. However, live weight at weaning in this study is lower than the reports of [46], who reported 17.8 kg weaning weight for peranakan Etawach goats. This variation may occur due to genotype difference of the goat and environmental and management factors.

Sex of kid had significant (P < 0.01) effects on weaning weight (Table 2). In this study males attained significantly (P < 0.01) heavier weight at weaning than female kids, implying that sex effects exist even before the age of puberty. This is a natural phenomenon that males do have faster growth rate and heavier weights at maturity than female animals [24]. Similar influences of sex of kids on growth rates had also been reported by [24,28].

Similarly, single born kids weighed significantly (P < 0.001) higher than twins and triplets this finding is in line with [24]. For the reason that single born kids consume dam's milk alone whereas the latter ones shared limited amount of milk between two and three kids respectively [24]. Single born kids are also consuming enough colostrum and have heavier birth weight thane twins and triplets.

Season of birth had not significant effect ($p > 0.05$) on weaning weight of kids, similar results was reported by [30,34], but a seasonal effect on kid weaning weights was reported by [29]. This may be due to feed availability and proper feeding of the dam during pregnancy and supplementary feeding of kids in the study farm. Similarly, parity of the dam had not significant effect ($p > 0.05$) on weaning weight of kids.

In this study genotype had significant ($p < 0.01$) effect on weaning weight of kids. This finding is in agreement with [41] who reported that the crossbred f1 from Boer and Sichuan native goats grew faster than local breeds. Interestingly 75% cross was lower weaning weight than 50% cross and pure Boer breed but not significant weaning weight difference are observed between 50% cross and pure Boer goat.

There was a statically significant linear relationship between birth weight and weaning weight of kids ($p < 0.001$) and (coefficient = 1.8). So, for each 1 kg increase in birth weight there is an increase of 1.8 kg in kid weight at weaning. This finding is agreeing the result of [40] who reported that for each 1-gram increase in litter weight at birth there is an increase of 3.71- and 11.96-gram litter weight at weaning of kacang and peranakan Etawach goats respectively.

In this study year of birth had significantly ($p < 0.0001$) affect weaning weight of kids. Year of birth had similarly affected both birth and weaning weight of kids. The probable cause and effect are already discussed on the effect of year at birth weight.

Factors affecting kid mortality

The overall pre-weaning kid mortality rate encountered in the present study (24.4%) is lower than the values reported by [14] for Red Sokoto goats in Nigeria (38%) and [42] for Black Bengal kids in Bangladesh (28.3%), [26] for Arsi-Bale goats in Ethiopia (46.6%), but the result is higher than the values reported by (24) for Somali goats in Ethiopia (11.52%), [20] for Arsi-Bale goats in Ethiopia (22.4%) and [10] for Creole goats (13.6%), but the mortality in this study is in agreement with the value reported by [12] for Arsi-Bale goats in Ethiopia (25%).

Sex

In this study, sex of kids did not show any significant ($p > 0.05$) influence on pre-weaning mortality rate of kids which is in line with the findings of [14,15,24,26,43]. Other previous findings [10,12,42], however, indicated higher mortality rates in male kids as compared to female kids. [20,44] also reported that females had higher mortality rate than males in West African dwarf goats. The absence of significant difference in mortality rate due to sex of kids in the present study may be due to the presence of equal management of female and male kids in the study farm [24].

Season of birth

Season of kid birth did not any significant ($p > 0.05$) effect on pre-weaning mortality rate contrary to findings of [20,42] who reported higher survival rates of kids born in rainy season compared to those born during dry season, however [14] who reported that high rate of kids' mortality in the wet season. The cause of death of these kids during this time is probable due to parasitic diseases, infectious diseases and cold stress of the summer season of the years. After the end of the short rainy season, some infectious disease might be aggravating the death of growing kids due to the season is very conducive for multiplication of some bacteria and viruses [14]. Absence of significant difference in pre-weaning mortality rate due to season in the present study may be due to provision of supplementary feed and shelter for goats which minimizes nutritional variations and direct influence of weather factors such as ambient temperature and humidity among seasons and the presence of routine health care practices such as vaccination/medication, ectoparasite control and de-worming for all the adult and kids [24].

Year of kid birth

Year had exerted a significant effect ($p < 0.05$) on pre weaning mortality of kids. The higher and lowest number of pre weaning mortality was recorded (37.7% and 12.1%) in (2012) and (2008) respectively. The significant influence of year of birth on kid mortality was also reported in previous studies [27,35]. As already mentioned, the variation in survivability of kid among years might be attributed to inconsistency of management, body condition of the doe and irregularity of rain fall and vegetation for grazing kids and lactating does. Kid mortality among years is not persistent, but in this study, kids born in the later years have the highest pre weaning kid mortality as compared to kids born in earlier years. This may be due to reduction of supplementary feed for does and kids [24].

Birth weight

In this study birth weight of kids significantly ($P < 0.001$) affected mortality to all age groups considered (birth to 30 and birth to 90 days). The maximum mortality rate (65.4%) was recorded from kids weighing 2 kg or less at birth followed by kids weighing 2-3 kg. The least mortality rate (13.2%) was recorded in kids

with 3 kg or more at birth. The result found in this study is in line with [12,14,15,24,26,42]. The probable reason for higher rate of pre-weaning mortality of kids with lighter birth weights is due to inadequate energy reserves at birth to withstand environmental stress [24].

Parity of the dam

Parity of dam had not significant (P > 0.05) effects on mortality rates of kids on age of birth to 30 days, however it had Significant (P < 0.05) effect on mortality rates of kids on age of birth to 90 days, similar result was reported by [26], The difference between mortality rates of kids on age of birth to 30 days and birth to 90 days is unclear. Higher pre-weaning kid mortality was encountered in kids born from the first and second parity groups of dams, this finding contradict the result [12,15,26] who reports kid mortality increase as the parity of dam are increased. [14] reported that the mortality rate generally decreased with increasing parity. This may be attributed to physiological maturity of older does and their ability to provide enough milk for the kids.

The reason of higher pre-weaning kid mortality in first and second parity in this study may be due to lighter birth weight of kids of first and second parity as shown in table 1. Lower pre-weaning kid mortality was occurred kids born from the third parity groups of dams; however, the pre-weaning mortality rates of kids born from fourth or more parity groups of dams were higher than kids born from the third parity groups of dams. The occurrence of higher pre-weaning mortality rates in kids born from fourth or more parity dam is in agreement with Mekuriaw [24] who reports higher pre-weaning mortality in the fifth parity; however, it is contrary to the findings of [42], who reported absence of significant effect of parity on survival rates in Black Bengal kids. [14] also reported higher survival rate in Sokoto kids born from sixth parity dams. [24] conclude the increased incidence of pre-weaning mortality rates in kids born from fifth parity dams attributed to unsuitable uterine environment for the proper growth of the fetus and/or reduced milk yield post-kidding due to old age.

Birth type

In the present study, the type of birth was not significant (P > 0.05) effect on birth to 30 days and birth to 90 day of kid mortality rate. This finding is contrary the result of [12,14,15,24] who reported higher mortality in twins and triplets than singles. The competition for limited nutrients in the uterus and for milk after birth may be reasons for higher incidence of pre-weaning mortality in twin born kids. The absence of significance difference on kid mortality by litter size in this study may be due to dams that birth twins and triplets had feed additional concentrated feeds supplemented with mineral licks to enhance milk yield and the presence of good management system of kids in the study farm. The presence of very low percentage of triplets than single kids in this study is also may be other factors for the absence of significant effect of birth type on pre-weaning kid mortality.

Genotype

Genotype was not significant (p > 0.05) effect on pre-weaning mortality of kids in this study. This finding is contrary to the result of [45] who reported genotype difference in five goat breed and [46] who reported there was genetic difference in lamb mortality. The absence of significance difference on kid mortality by genotype in this study may be due to the sire line (boar) goats has excellent milk production and the dam line (Somali and Arsi bale) goat have good milk production which is suckled by kids only that feed the kids sufficiently [1].

Similarly, weight of the dam was also not significant (p > 0.05) effect on pre-weaning mortality of kids in this study. This is may be in the study farm the presence of feeding of additional concentrated feed supplemented with mineral licks to enhance milk yield of the does after birth, in order to feed the kids sufficiently.

Conclusion and Recommendation

Based on the finding genotype is the most important risk factor on birth and weaning weight of kids. Pure Boar (100%) goat has higher birth and weaning weight than 50% and 75% cross bread. But genotype had not significance difference in pre-weaning kid mortality. Generally the cross breed and pure Boer breed had heavier birth and weaning weight as compared other Ethiopian local goats reported by other researchers. Dam weight had linear relationship with birth weight of kid. Birth weight, parity and Year of birth had significant effect on pre-weaning mortality of kids. In this study, kids born in the later years have the highest pre weaning kid mortality as compared to kids born in earlier years. This may be due to reduction of supplementary feed for does and kids. Based on the finding first month of life was found to be critical for kid survival. From the above findings the following points are recommended:

- Improved management conditions and pay special attention to the pregnant does which would help maintain optimum body condition of dams to obtain kids with reasonable birth weights could be suggested.

- To improve weight gain in twin and triplet born kids, provision of special feeding management could be suggested.
- To improve weight gain and to reduce pre-weaning kid mortality does bearing multiple litters and those nursing twins and triplets should be supplemented appropriately.
- Strategic feeding of dams is very important to avoid problems of fluctuating birth weight and mortality of kids of among years.
- Finally further studies are recommended to understand the influence of genotype and environmental factors on kid birth weight and pre-weaning mortality of kids.