Effect of Location on some of Reproductive Efficiency and Performance Trails of Local Sheep Breeds in Babil Province

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Abstract

This statistical study was conducted using a random sample of sheep breeders from different regions of Babil Province: Hillah, Abu Gharaq, Al-Hashimiyah, Al-Hindiyah, Al-Shomali, Al-Mashroo, and Al-Musayab). The study dependent on data collected by agricultural statisticians working in the agricultural directorates of these regions. The aim were to investigate the distribution of sheep breeders and flock characteristics and to evaluate the effect of location on some reproductive performance indicators (abortion rate and twinning rate) in Local Iraqi sheep breeds (Awassi, Arabi, Hamdani, and Karadi) across different locations in Babil Province. The results revealed highly significant differences among the regions for all investigated traits ($P \leq 0.01$). A total of 162 sheep breeders were surveyed, with the highest proportion recorded in Al-Musayab (22.84%), followed by Abu Ghraq (19.75%) and Al-Shomali (18.52%). The lowest proportion was observed in Al-Hindiyah (2.59%), indicating a distinct variation in sheep production activities throughout the province. The total sheep population was 36,985 animals. Al-Musayab accounted for the largest proportion (37.3%), followed by Abu Ghraq and Al-Shomali, each representing 20.3% of the total population. The average flock size per breeder varied from 59 head in Al-Mashroo to 373 head in Al-Musaya. The location also significantly influenced reproductive performance indicators and abortion rates of Local sheep in Babil Province. Fertility rate varied considerably among the regions, with the highest value recorded in Al-Mashroo (92.07%), followed by Al-Musayab (89.92%) and Al-Hashimiyah (85.45%). The lowest fertility rate was observed in Al-Shomali (38.61%). The overall fertility rate was 62.81%. The Awassi breed exhibited substantial variation in twinning rate among locations, with the highest value recorded in Abu Ghraq (8.4%), followed by Al-Hashimiyah (4.4%) and Al-Hindiyah (3.8%). No twinning births were recorded in Al-Shomali or Hillah. The Arabi breed exhibited twinning only in Al-Hashimiyah (6.8%) and Al-Musayab (0.7%), whereas no twinning was recorded in the remaining locations. The Hamdani breed showed very low twinning rates, occurring only in Al-Mashroo (1.4%) and Al-Musayab (1.9%), with no twinning observed elsewhere. In contrast, the Karadi breed exhibited a remarkably high twinning rate in Al-Musayab (22.5%), while no twinning was recorded in any of the other studied locations.

Keywords: Location, reproductive performance, Babil

Introduction

Sheep constitute one of the most important components of the livestock sector because of their substantial contribution to the economies of many countries, both historically and in modern times. They are primarily raised for the production of meat, milk, wool, and hides [8; 7; 12]. In Iraq, and throughout the Arab region, sheep production is mainly oriented toward meat production, followed by milk production, whereas wool is generally considered a secondary product of sheep husbandry [26].

Sheep are among the earliest domesticated livestock species.

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Archaeological evidence indicates that they were first domesticated approximately 10,500 years ago in the Fertile Crescent, extending from southeastern Anatolia and the Zagros Mountains of present-day Iran to eastern Iraq [5]. Subsequently, sheep accompanied human migrations from Asia into Europe and eventually spread throughout the world [17]. Currently, approximately 863 sheep breeds have been identified worldwide (Food and Agriculture Organization [15]. Historically, sheep have been raised primarily for the production of meat, milk, and hides [21].

According to statistics published by the Arab Organization for Agricultural Development (AOAD), Iraq ranked tenth among Arab countries in terms of sheep population in 2006, following Sudan, Syria, Algeria, Morocco, Somalia, Saudi Arabia, Mauritania, Yemen, and Tunisia. The sheep population in Iraq was estimated at 6.2 million head, representing approximately 3.4% of the total sheep population in the Arab world during that year. Furthermore, [11] classified the Iraqi provinces into four categories according to sheep population density, placing Babil Province in the third category with an estimated sheep population of 232,896 head.

Three principal Local sheep breeds are raised in Iraq. The Awassi breed is predominantly distributed in the northwestern and central regions of the country and is characterized by its hardiness and ability to travel long distances in search of pasture. The Arabi breed is mainly raised in the southern plains of Iraq and is distinguished by its fine, short wool and greater resistance to harsh environmental conditions compared with other local breeds. The Karadi breed is primarily found in the mountainous northern regions and is generally characterized by a white body with a black head and extremities, as well as coarse wool. Iraqi sheep breeds belong to the fat-tailed sheep group and are well adapted to local environmental conditions. They are valued for the production of meat, milk, and wool, and are recognized for their satisfactory milk yield during each production season [4; 6].

The present statistical study aimed to investigate the influence of location on the distribution of sheep breeders and flock characteristics, as well as to evaluate the effects of location on reproductive performance indicators, abortion rate, and twinning rate in Local Iraqi sheep breeds (Awassi, Arabi, Hamdani, and Karadi) across different regions of Babil Province, Iraq.

Material and Methods

Study Design:

This statistical study was conducted using a random sample of sheep breeders from different regions of Babil Province, Iraq, including Hillah, Abu Ghraq, Al-Hashimiyah, Al-Hindiyah, Al-Shomali, Al-Mashroo, and Al-Musayab. Data were collected with the assistance of statisticians working in the agricultural directorates of these regions. The study aimed to investigate the geographical distribution of sheep breeders and flock characteristics, as well as to evaluate the influence of location on reproductive performance indicators, abortion rate, and twinning rate in Local Iraqi sheep breeds (Awassi, Arabi, Hamdani, and Karadi) across different locations in Babil Province.

Statistical Analysis:

Data were analyzed using the Statistical Analysis System [24]. The effects of the studied factors on the investigated parameters were evaluated using appropriate statistical procedures. Chi-square (χ^2) tests were employed to determine significant differences among percentages at the 0.05 and 0.01 probability levels. In addition, one-way

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analysis of variance (ANOVA) was performed, and Duncan's Multiple Range Test [3] was used for post hoc comparisons among treatment means. Statistical significance was declared at $P \leq 0.05$ unless otherwise specified.

Results and Discussion

Distribution of sheep breeders

The results revealed highly significant differences among regions for all investigated traits ($P \leq 0.01$; Table 1). A total of 162 sheep breeders were included in the survey. The highest proportion of breeders was recorded in Al-Musayab (22.84%), followed by Abu Ghraq (19.75%) and Al-Shomali (18.52%), whereas the lowest proportion was observed in Al-Hindiyah (2.59%), indicating considerable differences in the distribution of sheep farming activities throughout the province. The total sheep population comprised 36,985 animals. Al-Musayab represented the highest proportion (37.3%), followed by Abu Ghraq and Al-Shomali, each representing 20.3% of the total population. The average flock size per breeder ranged from 59 head in Al-Mashroo to 373 head in Al-Musayab, reflecting considerable variation in production scale among breeders. The substantial regional differences in flock size suggest that both environmental and management factors influence sheep production systems. Regions such as Al-Musayab, which recorded the largest sheep population, are likely to benefit from greater availability of feed resources and water, as well as better access to livestock markets. This interpretation is consistent with the Food and Agriculture Organization [15], which reported that livestock distribution is strongly associated with environmental and socioeconomic conditions. Similarly, [9] demonstrated that sheep production in central Iraq is closely linked to the availability of feed resources and crop residues. Previous studies have also suggested that such variation reflects differences in the economic capacity and technical expertise of livestock producers [19]. The wide range in average flock size per breeder (59–373 head) further indicates the existence of different production systems, ranging from traditional small-scale flocks to semi-commercial enterprises. [2] reported that such variability is common in rural livestock production systems and is primarily attributable to differences in financial resources, management capacity, resource availability, and production objectives. With respect to flock sex composition, females constituted the majority of the population (83.62%), whereas males accounted for only 16.38%, with a similar pattern observed across all study regions. This finding agrees with [1], who reported that sheep breeders generally retain females for breeding purposes in order to enhance flock productivity. On a broader scale, this observation is consistent with the findings of [20], who concluded that modern sheep production systems maximize the proportion of breeding females to improve production efficiency, despite the approximately equal male-to-female sex ratio at birth reported by [14].

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Table 1. Distribution of Sampled Sheep Flocks According to Number of Breeders, Total Flock Size, and Sex Composition of Local Sheep in Babil Province

Location	Breeders		Flock Size					P-Value
	(n)	(%)	Total Sheep (n)	Herd Share (%)	Sheep per Breeder	Males (n, %)	Females (n, %)	
Hillah	20	12.35	3970	10.7	199	540 (13.60%)	3430 (86.39%)	0.0001**
Abu Ghraq	32	19.75	7536	20.3	236	2787 (36.98%)	4749 (63.02%)	0.0001**
AlHashimiyah	12	7.41	999	2.7	83	281 (28.13%)	718 (71.87%)	0.0001**
Al-Hindiyah	16	2.59	2309	6.3	144	162 (7.02%)	2137 (92.55%)	0.0001**
Al-Shomali	30	18.52	7478	20.3	249	455 (6.08%)	7023 (93.91%)	0.0001**
Al-Mashroo	15	9.26	882	2.4	59	44 (4.98%)	838 (95.01%)	0.0001**
Al-Musayab	37	22.84	13811	37.3	373	1788 (12.94%)	12023 (87.05%)	0.0001**
Total	162	100%	36985	100%	—	6057 (16.38%)	30928 (83.62%)	0.0001
P-Value	—	0.0027**	—	0.0001**	0.0001**	0.0001**	0.0001**	—

NS : Non-significant ,* (P≤0.05), ** (P≤0.01).

Effect of location on reproductive performance indicators

Fertility rate varied markedly among the studied regions (Table 2). The highest value recorded in Al-Mashroo (92.07%), followed by Al-Musayab (89.92%) and Al-Hashimiyah (85.45%), whereas the lowest fertility rate was observed in Al-Shomali (38.61%). The superior fertility observed in Al-Mashroo and Al-Musayab is likely attributable to better nutritional management and improved flock husbandry practices. Similar findings were reported by [23] and [9], who identified nutrition and management as the primary determinants of reproductive efficiency in sheep. Conversely, the reduced fertility recorded in regions such as Al-Shomali may be associated with poor pasture availability and inadequate concentrate supplementation. This result is supported by [19], who demonstrated that limited feed resources in the semi-arid regions of Iraq adversely affect reproductive performance. Likewise, the Food and Agriculture Organization [15] reported that livestock productivity in arid and semi-arid environments is strongly influenced by pasture quality and prevailing climatic conditions. The total number of lambs born during the study period was 14,089. The highest contribution was recorded in Al-Musayab (6,606 lambs) and Abu Ghraq (3,383 lambs). Regarding the sex ratio of newborn lambs, females were predominant in all study regions, with an overall proportion of 70.53% females compared with 29.47% males. Abortion rate also differed among locations. The highest abortion rate was recorded in Abu Ghraq (3.50%), followed by Al-Hindiyah (2.37%), whereas no abortion cases were reported in Hillah, Al-Hashimiyah, Al-Shomali, or Al-Mashroo. The twinning

rate exhibited considerable regional variation. The twinning rate was observed in Abu Ghraq, Al-Hashimiyah, and Al-Hindiyah, with 6.26, 5.63, and 3.80% respectively, whereas no twin births were recorded in Hillah or Al-Shomali. The relatively low overall abortion rate (0.75%) represents a favorable indicator of the general health status of the surveyed flocks. However, the elevated abortion rate observed in Abu Ghraq (3.5%) may reflect underlying health, nutritional, or environmental constraints. [20] identified reproductive diseases and inadequate nutrition among the principal factors responsible for increased abortion rates in sheep. Similarly, the regional variation in twinning rate likely reflects differences in both genetic background and nutritional management. Improved nutrition and enhanced body condition of breeding ewes are well recognized as important factors promoting multiple ovulations and increasing the incidence of twin births. These findings are consistent with those of [2], who reported that improvements in flock management positively influence reproductive performance, including twinning rate. The highly significant differences observed among the studied regions for most reproductive traits indicate that these variations are attributable to genuine differences in management practices, nutritional status, and environmental conditions rather than random variation. This conclusion is consistent with previous studies demonstrating that reproductive efficiency in sheep is strongly influenced by environmental and managerial factors [23; 27].

Table 2. Effect of Location on Reproductive Performance Trails and Abortion Rate of Local Sheep in Babil Province

Location	Lambed Ewes (n.)	Lambs				Aborted Ewes (n)	Abortion Rate (%)	Twin Lambs (n)	Twinning Rate (%)
		Total Lambs Born	Fertility (%)	Male Lambs (n, %)	Female Lambs (n, %)				
Hillah	1445	1309	72.13b	470 (35.91b)	839 (64.09b)	0	0.00c	0	0.00c
Abu Ghraq	1284	3383	56.28c	858 (25.36c)	2525 (74.64a)	45	3.50a	212	6.26a
Al-Hashimiyah	470	444	85.45a	181 (40.76a)	263 (59.23c)	0	0.00c	25	5.63a
Al-Hindiyah	1225	1237	77.32b	534 (43.17a)	703 (56.83c)	29	2.37a	47	3.80b
Al-Shomali	440	450	38.61c	150 (33.33b)	300 (66.67b)	0	0.00c	0	0.00c

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Al-Mashroo	768	660	92.07a	308 (46.67a)	352 (53.33c)	0	0.00c	14	2.12b
Al-Musayab	9609	6606	89.92a	1651 (24.99c)	4955 (75.01a)	41	0.43b	82	1.24c
Total	15241	14089	62.81b	4152 (29.47b)	9937 (70.53a)	115	0.75b	380	2.70b
P-Value	-	-	0.0001**	0.0001**	0.0001**	-	0.0498*	-	0.0418*

NS: Non-significant ,* (P≤0.05), ** (P≤0.01).

Distribution of twinning rates

The Awassi breed exhibited considerable variation in twinning rate among the studied locations (Table 3). The highest twinning rate was recorded in Abu Ghraq, Al-Hashimiyah, and Al-Hindiyah, with 8.4, 4.4, and 3.8% respectively, whereas no twin births were recorded in Al-Shomali or Hillah. These differences were highly significant (P≤0.01), indicating a pronounced influence of location and associated environmental and management conditions on the reproductive performance of this breed. The Arabi breed exhibited twin births only in Al-Hashimiyah (6.8%) and, to a much lesser extent, in Al-Musayab (0.7%), while no twinning was observed in the remaining locations. These differences were also highly significant, suggesting that the reproductive performance of this breed is particularly sensitive to local environmental and management conditions. The Hamdani breed showed very low twinning rates, with twin births recorded only in Al-Mashroo (1.4%) and Al-Musayab (1.9%), whereas no twinning was observed in the other regions. The observed differences were significant at *P*≤0.05, indicating a comparatively weaker influence of environmental factors on this breed relative to the other Local breeds. In contrast, the Karadi breed exhibited a remarkably high twinning rate in Al-Musayab (22.5%), whereas no twin births were recorded in any of the remaining study locations. The regional differences were highly significant suggesting that the environmental conditions and/or management practices in Al-Musayab are particularly favorable for maximizing the reproductive potential of this breed. The findings of the present study demonstrate significant differences in twinning rate among local Iraqi sheep breeds and locations, confirming the combined influence of genetic and environmental factors on reproductive traits in sheep. Although twinning rate is generally regarded as a trait with relatively low heritability, it is strongly influenced by nutritional status and management practices [22]. The relatively high twinning rate observed in the Awassi breed at Abu Ghraq may be attributed to improved nutritional management and veterinary care. Numerous studies have demonstrated that improving the body condition of ewes before the breeding season through flushing enhances ovulation rate and consequently increases the incidence of twin births [25]. These findings are consistent with previous studies conducted in Iraq, which reported improved reproductive performance in Awassi sheep under appropriate management and favorable environmental conditions [13].

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The limited occurrence of twin births in the other local breeds and their restriction to only a few locations suggest that these breeds may be more sensitive to environmental influences than improved breeds. This observation is consistent with the findings of [18], who reported that certain Local sheep breeds exhibit a relatively limited response to fertility improvement programs because of their genetic background. Furthermore, Iraqi sheep are genetically predisposed toward single births, a characteristic that has been documented in regional studies demonstrating lower twinning rates in local breeds than in genetically improved sheep populations [10]. The present results further indicate that locations such as Abu Ghraq, Al-Hashimiyah, and Al-Musayab exerted significant positive effects on twinning rate, whereas no significant effect was detected in Hillah or Al-Shomali. These regional differences further emphasize the importance of environmental factors, particularly nutritional management and feed quality, which are among the principal determinants of ovarian activity and ovulation rate in ewes [25]. Conversely, the absence of significant differences in some locations may reflect similarities in environmental conditions or relatively uniform management practices. Overall, the present findings are in agreement with [16], who concluded that improvements in reproductive performance in sheep require the integration of favorable genetic potential with effective management strategies, particularly adequate pre-breeding nutrition and comprehensive animal health care.

Table 3. Distribution of Twinning Rates among Local Iraqi Sheep Breeds across Different Locations in Babil Province

Breed	Al-Musayab	Al-Mashroo	Al-Shomali	Al-Hindiyah	Al-Hashimiyah	Abu Ghraq	Hillah	L.S
Awassi	0.3 Cc	2 Ca	0 C	3.8 Ba	4.4 Ba	8.4 Aa	0 C	**
Arabi	0.7 Bc	0 Bb	0 B	0 Bb	6.8 Aa	0 Bb	0 B	**
Hamdani	1.9 Ab	1.4 Aa	0 B	0 Bb	0 Bb	0 Bb	0 B	*
Karadi	22.5 Aa	0 Bb	0 B	0 Bb	0 B	0 Bb	0 B	**
L.S.	**	*	NS	*	**	**	NS	---

NS: Non-significant ,* (P≤0.05), ** (P≤0.01).

Conclusion

Based on the findings of the present study, the following conclusions can be drawn:

1. All major local Iraqi sheep breeds (Awassi, Arabi, Hamdani, and Karadi) can be successfully raised under the environmental conditions of Babil Province.
2. location significantly influences several productive and reproductive characteristics of local sheep, highlighting the important roles of environmental conditions, nutritional management, and husbandry practices in determining flock performance.
3. Providing favorable environmental conditions, including adequate nutrition and appropriate veterinary care, can substantially improve fertility rates, reduce abortion rates, and ultimately enhance the reproductive performance and overall productivity of local sheep flocks.

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