



The Association of the Single-and Twin-Bearing with the Lipid Profile on the Status of the Reproductive Hormones in Iraqi Awassi Ewes

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Abstract | The lipid profile assay is considered as good indicators of the physiological state and reproductive performance of livestock. Therefore, this study aimed to evaluate the association of progeny type with the lipid profile on the status of the reproductive hormones in Iraqi Awassi ewes. A total of 200 sexually mature ewes (114 ewes with single progeny and 86 ewes with twin progeny), non-pregnant and non-lactation, aged between 2.5 to 5 years were included in this study. The blood samples were collected and the sera were separated from blood to determine lipid profile assay and reproductive hormones. The result referred to the significant differences ($P \leq 0.05$) in cholesterol and sex hormones levels between ewes with single compared to the twin progenies. The strongly positive correlation ($P \leq 0.01$) was recorded between ewes with twin progeny with cholesterol ($r=0.52$, $P=0.01$), high-density lipoprotein (HDL) ($r=0.31$, $P=0.04$), estradiol ($r=0.46$, $P=0.02$), and progesterone ($r=0.50$, $P=0.03$) respectively. In conclusion, birth progeny type is associated with lipid profile and sex hormones levels in Awassi ewes. The ewes with twin lambs are associated with the highest cholesterol and sex hormones levels than ewes with a single lamb.

Keywords | Awassi sheep, Estradiol, Litter size, Lipid profile, Progesterone

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INTRODUCTION

Lipids play major role in the animal body by providing energy, making several essential reproductive hormones, participating in cellular membrane component and reproductive performance (Guzel and Tanriverdi, 2014; Nemeth et al., 2017). Reproductive performance in livestock is strongly associated with litter size (Nowak et al., 2020). Increased reproductive performance can be obtained from ewes with the potential for increased litter size (Atoui et al., 2018). Litter size (birth type) is one of the most important economic traits because it has a noticeable

impact on profitability in the sheep industry, which is influenced by reproductive hormones and ovulation rate (Ekiz et al., 2005; Tesema et al., 2020, Al-Thuwaini, 2021). Besides, reproductive performance could be assessed from the levels of reproductive hormones in livestock (El Tahawy and Sharkawy, 2014). High levels of reproductive hormones exert marked effects on the development and maturation of ovarian follicles that result in increasing litter size (Luo et al., 2018). The ovaries and placenta are used cholesterol for reproductive hormone synthesis (Arfuso et al., 2016). Moreover, the higher concentration of serum lipids especially cholesterol, triglyceride and high-density

ty lipoprotein cholesterol (HDL-c) in livestock could play a vital role in fetal number and growth (Geraghty et al., 2016). Few reports evaluate the changes in serum lipid levels concerning physiological status in livestock. Petkova et al. (2008) and Arfuso et al. (2016) revealed a significant difference ($P < 0.05$) in blood lipid profile in lactating cows and late pregnancy and the early postpartum in dairy cows. Based on the above aforementioned, no research yet on the association of the litter size with the lipid profile and reproductive hormones levels have been reported in Awassi ewes. Therefore, the objectives of this study were to evaluate the association of progeny type with lipid profile levels and reproductive hormones in Awassi ewes.

MATERIALS AND METHODS

ANIMALS AND LIPID PROFILE ANALYSIS

This study was approved and conducted at the Al-Qasim Green University's and followed the international recommendations for the care and use of animals with approval number Agri, No. 020,7,18, during the period from July 2020 to March 2021 on Awassi ewes. A total of 200 sexually mature ewes (114 ewes with single progeny and 86 ewes with twin progeny), non-pregnant and non-lactation ewes aged between 2.5 to 5 years were included in this study. Animals were collected randomly from two stations for raising sheep (Babylon and Karbala, Iraq). They were fed ad libitum on seasonal grass, concentrate food (2.5% of their live body weight daily, comprising a mixture of barely (59%), bran (40%), salt (1%) concentrates), and fresh water. Blood samples were collected in the morning before feeding from the jugular vein of the sheep using vacutainer tubes with EDTA. Serum was separated from blood by centrifugation at 3,000 rpm at room temperature for 15 min where it was kept frozen at -20°C to determine lipid profile and hormonal assays. Serum concentrations of total cholesterol, high density lipoprotein cholesterol (HDL-c), and triglycerides were analyzed according to the manufacturer's instructions of RANDOX Laboratories kits. Low-density lipoprotein cholesterol (LDL-c) was calculated using the equation of Friedewald et al. (1972): $\text{LDL-Chol} = \text{Total CHOL} - \text{TRIGS}/2.2 - \text{HDL-Chol}$. Bioassay Technology Laboratory company ELISA kit (with catalogue number E0047Sh, E0015Sh, E0105Sh, E0106Sh) was used to measure the reproductive hormones.

STATISTICAL ANALYSES

The association of progeny type with traits of interest was analyzed through the general linear model (GLM) procedure by SPSS (version 23.0) with the following model and compared by Tukey-Kramer test:

$$Y_{ijk} = \mu + B_i + P_j + A_k + e_{ijk}$$

where Y_{ijk} = value for studied traits, μ = overall mean, B_i = fixed effect of i^{th} progeny type (i = singleton, twin), P_j

= fixed effect of j^{th} parity ($j = 1, 2, 3, 4$), A_k = fixed effect of k^{th} age group (2.5-3.5, >3.5-5), and e_{ijk} = random error associated with Y_{ijk} observation and assumed to be NID ($0, \sigma^2e$). Preliminary statistical analysis indicated the effect of factor interaction, season and nutrition did not have a significant effect on studied traits, so they were excluded from the model. The correlation was analyzed using the Pearson correlation coefficient, and significance was set at $P \leq 0.05$.

RESULTS AND DISCUSSION

ASSOCIATION ANALYSIS OF PROGENY TYPE WITH LIPID PROFILE LEVELS OF AWASSI EWES

The ewes with twin lambs have higher cholesterol levels, estradiol and progesterone concentrations (97.63 ± 1.54), (49.44 ± 0.53) and (6.51 ± 0.02) respectively compared to the ewes with single lambs. While no statistically significant differences were observed for the FSH and LH hormones ($P \geq 0.05$) as shown in (Table 1).

The result refers that the ewes with twin lambs were associated with the highest cholesterol level and sex hormones compared to the ewes with single lambs (Table 1). Blood biochemical parameters including lipid profile are good indicators of the physiological state and reproductive performance of animal (Piccione et al., 2009; Nemeth et al., 2017). Cholesterol levels increased in ewe with multiple lambs compared to the ewes with single lambs (Pesántez-Pacheco et al., 2019), this may be due to diminished target tissue response to insulin, which combined with increased fatty acid mobilization from adipose tissue provides new sources for fetal growth and the synthesis of the steroid hormones (Piccione et al., 2009). Steroid hormones directly influence reproductive performance and the prolificacy in animals that had significant correlations with increased litter size (Luo et al., 2018).

CORRELATION ANALYSIS OF PROGENY TYPE WITH LIPID PROFILE OF AWASSI EWES

The strongly positive correlation ($P \leq 0.01$) was recorded between ewe with twin lambs with cholesterol ($r=0.52$, $P=0.01$), HDL ($r=0.31$, $P=0.04$), estradiol ($r=0.46$, $P=0.02$), and progesterone ($r=0.50$, $P=0.03$) respectively, whereas it was non-significant ($P \geq 0.05$) for the other variables as shown in Table 2.

The result refers to the presence of a positive and significant correlation ($P \leq 0.05$) between ewes with twin lambs with sex hormones and lipid profile levels. This result consistent with the study of Kakous et al. (2003) and Petkova et al. (2008) that reported a positive correlation between sex hormones and total cholesterol concentration with better reproductive performance. Estradiol and progesterone

Table 1: Relationship of progeny type with lipid profile levels of Awassi ewes.

Indices	Birth type (LSM ± SE)		P-value
	Single (114)	Twin (86)	
Cholesterol (mg/dl)	85.32 ± 1.42 ^b	97.63 ± 1.54 ^a	0.04
Triglyceride (mg/dl)	33.82 ± 0.89 ^a	35.21 ± 0.74 ^a	0.34
HDL (mg/dl)	42.52 ± 0.11 ^a	44.63 ± 0.93 ^a	0.52
LDL (mg/dl)	40.67 ± 0.21 ^a	42.31 ± 0.50 ^a	0.81
Estradiol (pg/ml)	35.62 ± 0.74 ^a	49.44 ± 0.53 ^b	0.02
Progesterone (ng/ml)	3.21 ± 0.06 ^b	6.51 ± 0.02 ^a	0.01
FSH (ng/ml)	10.94 ± 1.24 ^a	11.62 ± 1.03 ^a	0.42
LH (ng/ml)	5.01 ± 0.31 ^a	5.61 ± 0.42 ^a	0.26

LSM ± SE, Least square means ± Standard error. Different superscript in the same row within each classification indicates significant differences ($P \leq 0.05$). HDL, high density lipoprotein, LDL, low density lipoprotein, FSH, Follicle stimulating hormone, LH, Luteinizing hormone.

Table 2: Correlation between progeny type and lipid profile in Awassi ewes

Variables	Birth type			
	Singleton		Twin	
	r	P-value	r	P-value
Cholesterol	0.37	0.03	0.52	0.01
Triglyceride	0.41	0.26	-0.11	0.18
HDL	0.25	0.05	0.31	0.04
LDL	0.18	0.43	0.10	0.28
Estradiol	0.21	0.04	0.46	0.02
Progesterone	0.36	0.05	0.50	0.03
FSH	-0.12	0.42	0.43	0.14
LH	0.23	0.51	0.09	0.21

$P \leq 0.05$: Significant, $P \geq 0.05$: Not significant. HDL, high density lipoprotein, LDL, low density lipoprotein, FSH, Follicle stimulating hormone, LH, Luteinizing hormone.

are synthesized from cholesterol and therefore affecting reproductive performance (Meza-Villalvazo et al., 2018). Moreover, blood parameters including cholesterol showed a significant correlation with litter size (Minuti et al., 2020).

CONCLUSION

Birth progeny type is associated with lipid profile and sex hormones levels in Awassi ewes. The ewes with twin lambs are associated with the highest cholesterol and sex hormones levels than ewes with a single lamb.

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CONFLICT OF INTEREST

There is no conflict of interest.

AUTHORS CONTRIBUTION

All authors contributed equally.

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