A study of the factors affecting the fertility rate of different breeds of sheep under the system of repeat births

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Abstract

The study was conducted in one of the fields of Barakat Abi Al-Fadl Al-Abbas station, affiliated to the Al-Kafeel Company for Private Investments of the Abbasid shrine in the holy province of Karbala for the period from April 1, 2021 to June 1, 2022. To study the possibility of repeat births for three groups of sheep and the effect of some genetic factors represented by the genetic group and non-genetic factors represented by the age of the ewe, the weight of the ewe at mating and the season of birth, on the fertility rate, fertile birth rate, fertility rate, barrenness ewes, abortion rate, birth rate and twins rate.The study included 60 ewes of three genetic groups, 20 local Awassi ewes, an Iranian Karakul, and an Iranian Karakul cross a local Awassi. The ages of the ewes ranged from 2-5 years, and their weights were less than 45 and 45-50- and more than 50 kg. The results showed the following:

1-The Iranian Karakul ewes group arithmetically excelled in Al-Awassi and Al-Mutarib ewes groups in the first and second seasons, as the number of ewes born in the first and second seasons was 26, 23 and 25%, respectively. 4 year-old ewes mathematically excelled in a repeat of births for the two seasons over ewes of 2, 3 and 5 years of age, with percentages of 32, 14, 19 and 9%, respectively. The weight of ewes from 45-50 kg is arithmetic in the repeat of births over ewes with weights less than 45 and more than 50 kg, as the percentages reached 40, 14 and 20%, respectively.The genetic group had a significant effect (P≤0.05) on the fertility rate, where the Karakul and the battered sheep outperformed by 65 and 62.5%, respectively, compared with 57.5% for Awassi ewes.The age of the ewe had a significant effect (P≤0.01) on the fertility and fertilization rates, as the 4-year-age ewes recorded the highest rate of 88.8% .It was found that the weight of the sheep at fertilization had a significant effect (P≤0.01) on the fertility rate, where it reached the highest percentage of 68.9% for ewes whose weights reached 45-50 kg, and the percentages reached 43.7 and 66.6 for ewes with weights less than 45 and more than 50 kg, respectively.The birth season had a significant effect (P≤0.01) on the fertility rate, as the first (autumn) season was superior to the second (spring) season, which amounted to 88 and 35%, respectively.The genetic group had a significant effect (P≤0.05) on the fertility rate at birth, as it reached 108, 100 and 104% for local Awassi, Iranian and raccoon ewes, respectively .The age of the ewe had a significant effect (P≤0.05) on the fertility rate, and the ewes at the age of 5 years recorded the highest fertility rate as it reached 111.1%.The weight of the ewe at fertilization had a significant effect (P≤0.05) on the fertility rate, and the highest percentage was 114% for ewes with weights less than 45 kg. The genetic group had a significant effect (P≤0.05) on the fertility rate, where the Iranian Karakul sheep group, excelled on the Awassi and cross groups, and the percentages reached 72.5, 62.5 and 67.5%, respectively. The genetic group had a significant effect (P≤0.05) on the percentage of Hail ewes, as the percentages were 37.5, 27.5 and 32.5% for local Awassi, Iranian Karakul and cross ewes, respectively. The age of the ewe had a significant effect (P≤0.01) on the percentage of barrenness ewes, as the percentages reached 43.3, 41.6, 11.1 and 38.8% for ewes aged 2, 3, 4 and 5 years, respectively. The weight of the ewe at fertilization had a significant effect (P≤0.01) on the percentage of barrenness ewes, as the percentages reached 46.8, 27.5 and 26.6% for ewes with a weight less than 45, 45-50 and more than 50 kg, respectively.It became clear from the results of the study that the genetic group and the season of birth did not significantly affect the abortion rate.The age of the ewe had a significant effect on the abortion rate (P≤0.05), as the percentages reached 10, 5.5, 0 and 11.1% for ewes of age 2, 3, 4 and 5, respectively. The weight of the sheep at fertilization had a significant effect (P≤0.05) on the abortion rate, where the percentages reached 9.3, 3.4 and 6.6% for ewes with weights less than 45, 45-50 and more than 50 kg, respectively.The genetic group did not significantly affect the birth rate.The age of the ewe had

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a significant effect (P≤0.01) on the birth rate, as the percentages were 46.6, 55.5, 91.6 and 55.5% for ewes aged 2, 3, 4 and 5 years, respectively.The weight of the ewe had a significant effect (P≤0.01) on the birth rate, as the percentages reached 50, 68.9 and 70% for ewes with weights less than 45, 45-50 and more than 50 kg, respectively.The genetic group had a significant effect (P≤0.01) on the percentage of twins, as the percentages were 8.6, 0 and 4% for local Awassi, Iranian and batting ewes, respectively.The age of the ewe had a significant effect (P≤0.01) on the percentage of twins, as the percentages were 0, 5.26, 3.1 and 11% for ewes aged 2, 3, 4 and 5 years, respectively.The weight of the ewe had a significant effect (P≤0.01) on the percentage of twins, as the percentages were 14.2, 0 and 5% for ewes with weights less than 45, 45-50 and more than 50 kg, respectively. the birth season had a significant effect (P≤0.01) on the proportion of twins, as the percentages reached 1.8 and 9.5 for the first and second seasons, respectively.

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: Introduction

The livestock sector is considered one of the most important agricultural sectors in Iraq, especially sheep production. This importance comes from the urgent need for its products for human consumption because it is one of the important and preferred sources of red meat in Iraq (Al-Rawi, 2011). Sheep are seasonal polyestrous animals. It shows a seasonal pattern in breeding to ensure the birth of lambs at the appropriate time for the environmental conditions of the year, represented in the appropriate temperature and the provision of food. The reproductive season of European sheep breeds usually begins at the end of summer or the beginning of autumn as a result of the response to the short day length. It ends at the end of winter or the beginning of spring. The breeding season is the most important challenge facing the sheep industry in the world, which makes the availability of animal products (meat and milk) take a noticeable seasonal pattern at different times of the year (Gomez et al., 2012). Awassi sheep are considered one of the most important sheep breeds in the countries of the Middle East and Iraq, and they constitute 58.2% of Iraq's sheep. They are three-purpose breeds that produce meat, milk and wool (Al-Zubaidi, 2013). It has a high ability to withstand harsh environmental conditions, and this strain differs in its reproductive and productive traits depending on the region and environment in which it lives (Haile et al., 2019). Reproductive efficiency is one of the mainstays in sheep breeding because of its direct impact on biological efficiency and its role in genetic improvement. As its increase leads to an increase in the number of lambs produced annually, which is one of the main and important factors in determining the income derived from the breeding herd (Al-Tai, 2002). Studies conducted on local sheep reported a decrease in reproductive efficiency (Al-Anbari et al., 2000). Therefore, improving reproductive efficiency is an entry point to increasing productive efficiency in sheep. The local sheep are characterized by their ability to reproduce throughout the year and their tolerance of harsh environmental conditions (Al-Rawi et al., 1997) Therefore, some researchers have mentioned the possibility of giving birth more than once a year or having three births within two years (Al-Rawi and Shuja'a, 2002). The Karakul sheep is one of the breeds that spread in Asian and African countries, which is characterized by having a fat tail. It is a medium-sized sheep resistant to harsh environmental conditions and bred to produce meat, milk and fibre. The Karakul has a long reproductive season with the possibility of giving three births in two years (Mirhoseini et al., 2015). The development of intensive production of sheep tends to vertical product with the aim of increasing the production of one head of sheep per unit time (Amin, 2003). Thomson et al., (2003) explained that the results of the fertility survey in the Al-Jazirah region in the northwest of Qatar, where the most significant number of Awassi sheep are found, are characterized by a low fertility rate of 60-70% and twins (2-9%.(The current study aims to determine the breed or genetic group that responded to repeat births, in addition to determining the appropriate ages and weights that showed the most response to repeat births, and whether the local and imported breeds located in the al-Abbas (Iraq) threshold (Iraq) tend to reproductive seasonality or not.

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Materials and Methods

3-1: Experimental animals

The study was conducted in one of the fields affiliated to the Barakat Abi Al-Fadl Al-Abbas Station Company, which is affiliated with the Al-Kafeel Company for Private Investments of the Abbasid shrine in the Holy Karbala province for the period from April 1, 2021 to June 1, 2022. The study included 60 sheep of different types, weights and ages divided into three genetic groups, the first group included 20 local Awassi sheep, the second group 20 Iranian Karakul sheep, and the third group 20 cross sheep (Krakoul × Awassi), their ages ranged from 2-5 years and their weights ranged from 30 kg to more than 55 kg.

3-2: Herd Management

The animals were distributed in semi-open pens (40% roofed and 60% open) designated to house sheep. The barn is 50m x 20m. These barns contain 15 and 30m long manholes and troughs, respectively.

Where the management of the herd was applied according to a program that includes feeding, preparation for the feeding season, preparation for the stages of pregnancy and childbirth, as well as the use of veterinary medicines and health care.

3-3 : Nutrition feeding

The animal feeding system depends on the program followed in the station. As the feeding varied on the available green feed (such as Medicago sativa and alfalfa) according to the season and the concentrated feed, mineral salt briquettes were also available with the presence of free water, and hay was provided to the animals in sufficient quantities. In winter, animals were allowed to graze from eight in the morning until two in the afternoon, while in the summer, the animals were released for grazing from eight in the morning until twelve in the afternoon, and then returned to the pasture at four in the afternoon until seven in the evening. It grazes on the available weeds and the remnants of the grain harvest. Green and concentrated feed were provided to the animals and the concentrated feed whose chemical composition contains: crude protein (10%) and consists of (52%) of:

1- Wheat and barley bran (40%)

2- Soybean meal (5%)

3- Limestone (2%)

4- Table salt (1%) at a rate of 250 g / day / animal

The feeding of the females was conducted about two weeks before the breeding season, about four weeks before birth and during the lactation period, as the amount of concentrated feed reaches 1000 g / day/animal, divided into two morning and evening meals.

3-4 : health and veterinary care

The experimental animals were exposed to a health and prevention program that includes the necessary measures that preserve the safety and health of the experimental animals from infectious diseases and epidemics, as follows:

1- Monitoring rams prepared for fertilization and supervising them in terms of their safety and ability to fertilize, through:

A - Rams' hoofs tests

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B - The presence or absence of joint diseases that may affect the process of benefiting.

C - Presence or absence of communicable diseases such as brucellosis, urinary tract infections or other diseases

2- Dipping the animals using a solution of bithroid-cypromethrin at a concentration of 10% twice a year (May and October) to eliminate diseases and external parasites

3- Preparing the barns for the purpose of receiving births for the new season by spraying them with pesticides or disinfectants to combat diseases and limit their spread.

4- Organizing a preventive program to vaccinate pregnant ewes in their last month, especially three weeks before birth, where they are vaccinated with Cephapix against Enterotoxaemia to transmit immune bodies to the fetus. As well as vaccinating the rest of the previously vaccinated and adult animals annually.

5- All animals are vaccinated with sheep pox vaccine during the month of March.

6- Dosing animals with fendex for the prevention of liver and intestine worms in March and April, and it is repeated 21 days after the first dose.

7- Vaccinating the herd with the Fever Mouth Disease-FMD vaccine during the month of May

8- Treating mastitis cases when it occurs.

3-5 : mating season

The mating season of ewes for the first season started on 1/5/2021. The rams that were selected and tested in advance were released with one ram per group (Awassi x Karakul and Karakul x Awassi) for a period of 51 days (three estrus cycles) after which the rams were isolated from the ewes and Monitoring the herd until birth After two months have passed, the same rams (second season) were re-launched to the sheep groups with the aim of mating the stranded ewes from the first mating season and the aborted ewes or those whose offspring died during childbirth or days after birth, as well as the possibility of reproduction for the parent ewes. Where the main objective of raising sheep herds is to obtain the birth of each sheep in the herd at least and then isolate the rams after 34 days and then monitor the herd until the birth.

3-6: The traits studied:

1- Fertility ratio = number of ewes born / number of ewes exposed to rams x 100

2- Fertility rate at birth = number of live births / number of ewes born x 100

3- Fertilization rate = number of birth and aborted ewes / total number of ewes exposed to rams x 100

4- Missing percentage = the number of barrier ewes / the number of ewes subjected to mating x 100

5- Abortion rate = number of aborted ewes / total number of ewes x 100

6- Birth rate = number of animals born / number of ewes exposed to rams x 100

7- The proportion of twins = the number of twin births / the number of females born x 100

3-7: The studied factors:

1- Breed: (local Awassi, Iranian Karakul, racket)

2- Age of the sheep: (2 to 5 years)

3- Ewe weight: (from 30 to more than 55 kg)

4- Season: The winter season includes the months of October and November

The second season includes the month of May

3-8: Statistical analysis

The statistical program Statistical Analysis System -SAS (2012) was used in data analysis to study the effect of different factors (genetic group, season, maternal age at birth and mother's weight at birth) on reproductive efficiency indicators studied according to a completely randomized design (CRD). The significant differences between the means were compared with the Duncan (1955) polynomial test (the rate of twins or fertility), while the significant differences between the percentages of all other reproductive efficiency indicators were compared with the Chi-Square test.

Mathematical model:

$Yijklm = \mu + Gi + Sj + Ak + Wl + eijklm$

Since:

Yijklm: Viewing value l.

μ: the general average of the trait studied.

Gi: the effect of genetic group i (1= Awassi, 2= Karakul , 3= Mudarab).

Sj: the effect of j birth season (first-second).

Ak: the effect of maternal age at birth k (2, 3, 4, 5 years).

Wl: the effect of the mother's birth weight l (1 = less than 45 years, 2 = 45 to 50 kg, 3 = more than 50 years).

eijklm: the normally distributed random error with a mean of zero and a variance of σ2e.

Results and Discussion

Factors affecting the fertility rate

:-1genetic group

The results of the study in the fertility rate showed that the differences were significant ($P<0.05$) between the three sheep breeds (Table 1), where the Karakul and cross sheep were significantly excelled on the Awassi sheep breed where the fertility rate of the Karakol and Mudarab sheep reached 65 and 62.5, respectively, and the fertility rate of the Awassi sheep was 57.5. In the Karakul sheep group, where 26 out of 40 ewes were born exposed to rams for the first and second seasons, and in the group of striking ewes, Awassi local x Iranian Karakol, where 25 ewes out of 40 ewes exposed to rams were born for the first and second seasons. The fertility rate in this study for Karakul sheep was lower than what was found by Al-Sharifi, (2020) when studied, and it reached 72.54%, and Erol et al., (2020) in Turkey, which reached 95.45%, and less than what Pascal et al., (2009) found in Romania. Where it reached 81.65%.The results of the current study of the Al-Assaf sheep breed showed a similar approach to what was reached by Al-Taie (2002), where the fertility rate of Al-Assaf sheep ewes was 63.88% and lower than what Al-Sharifi , (2020)found the fertility rate of a local Awassi cross x Iranian Karakul reached 82.50%. And lower than what

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was found by El Fadili et al., (2000) in the fertility rate, which reached 86% for D man × Timahdit scrambled ewes in Morocco and less than what was found by Kul and Seker, (2007), where the fertility rate was 97.5% when the two Awassi x East Friesian breeds were crossed. The results of the current study of the local Awassi ewes showed a close approach to what was reached by Al-Taie (2002), when the fertility rate of Al-Awassi sheep was 60.0%. It is less than what was found by Al-Shammari et al., (2013), as the fertility rate of Awassi ewes reached 69.82% and less than what was found by Al-Jaafari et al., (2008) reaching 75.12%.

The superiority of the Karakul sheep breed on the local Awassi sheep breed in terms of fertility is significant due to the adaptation and adaptation to the Iraqi environmental and administrative conditions, and it showed its genetic ability, in addition to the continuous selection for several seasons, which led to improving its genetic susceptibility and raising its fertility rate.

Table (1) The effect of genetic group on reproductive efficiency indicators

Fertility percentage	Fertility rate	total number	genetic group
108	57.5	40	Awassi local
100	65	40	Iranian Karakol
104	62.5	40	cross (Kracol x Awassi)
*	*	-	significant level
P≤0.05), NS: Not) * significant			

2- The age of the sheep

Table (2) showed that the age of the ewe has a highly significant effect (P<0.01) on the fertility rate, where the 4-year-age ewes excelled on 2- and 5-year-age ewes, as the percentages reached 88.8, 46.6 and 50%, respectively.The 3-year-age ewes excelled on the 2- and 5-year-old ewes, where the percentages reached 52.7, 46.6 and 50%, respectively. The percentage increased with age, reaching a maximum at 4 years of age, and then declining again.The low percentage of young ewes may be due to the small number of estrus cycles, the short duration of estrus, the decrease in the rate of ovulation, the increase in the death of fetuses, and the incomplete growth and development of the reproductive system (Kareta et al., 2006). The results of the current study came close to what some researchers have concluded that the fertility rate increases with age, reaching a maximum of 4-5 years, and then begins to decline again (Waldron and Thomas, 1992, Bunge et al., 1993, Abdul Rahman, 1996, Al-Rawi et al., 1997, Narrator and Brave 2002).As well as an approach from what was found by Al-Shammari and others, (2013) that the highest fertility rate was recorded at ages (3 and 4) years.On the other hand, Colete and Devillires (1987) and Lewis et al. (1996) and Al-Khazraji et al. (2014) and Trabzon and Ozturk (2019) did not find any significant effects of the ewe's age on the fertility rate. The reason for the excelled of 4-year-age ewes is due to the complete maturity of the animal and the size of the abdomen and uterus becomes wide, mature and complete and has full avaibile to breed (Al-Khazraji et al., 2014).

Table (2) Effect of ewe's age at birth on reproductive efficiency indicators

Fertility percentage	Fertility rate	total number	age of the sheep
100	46.6	30	2
105.2	52.7	36	3

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103	88.8	36	4
111.1	50	18	5
*	**	-	significant level
P≤0.05), NS: Not significant) *			

3- Weight of the sheep

The results of the study showed in Table (3) that the weight of the sheep at fertilization had a significant effect (P≤0.01) on the fertility rate.The highest fertility rate was 68.9% for ewes whose weights ranged from 45 to 50 kg, which showed a significant superiority over the rest of the ewes' weights, where the fertility rate for ewes weighing less than 45 kg and more than 50 kg (43.7, 66.6%), respectively. The results of the study came close to what was found by many studies, including (Kassem et al., 1989, Abd al-Rahman, 1996, Atti et al., 2001 and al-Sayegh et al., 2002), who indicated a significant effect of ewe weight when mating. The high fertility rate in ewes whose weights ranged from 45 to 50 kg is due to their ability to efficiently convert food, which led to the ewes regaining their weight and improving the condition of the body and its connection with an increase in the rate of ovulation resulting from an increase in the level of secretion of reproductive hormones and fertilization by increasing their weight (Abd al-Rahman, 1996).While the results of the study did not agree, who indicated that there was no significant effect of the weight of the ewe when fertilization during fertilization (Ozsoy, 1987 and Fukui et al., 2010).

Table (3): Effect of ewe weight at birth on reproductive efficiency indicators

Fertility percentage	Fertility rate	total number	Ewe weight kg
114	43.7	32	Less than 45 kg
100	68.9	58	From 45-50 kg
105	66.6	30	More than 50 kg
*	**	-	significant level
P≤0.05),**(P≤0.01),NS:)* Not significant			

4- Season

The results of the study shown in Table (4) that the fertilization season had a significant effect on the fertility rate, where the results showed that the fertility rate of ewes born in the first season (autumn) was 88% higher than the second season (spring), when the fertility rate was 35%.This study agreed with several studies (Mukasa-Mugerwa et al., 2002, Yavuzer, 2005, Ajil et al., 2005, Duricic et al., 2018, Berhan and Arendonk, 2006) who noted a significant effect of the season of birth on fertility rate.. The fertility rate excelled in the first season (autumn) due to the increase in variance represented by environmental conditions, temperature, the harmony of the herd with the environment, as well as the health of the herd with repeated births.While the results of the current study differed from what was found by Abd-Allah et al. (2011) and Sharifi, (2020), who indicated that there was no significant effect of the harvest season on the fertility rate.

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Table (4) The effect of the season on reproductive efficiency indicators

Fertility rate	total number	birth season
88	60	Season One (Autumn)
35	60	season two (spring)
**	-	significant level
,(P≤0.01)**		

Fertility rate	total number	birth season
101.8	60	Season One (Autumn)
109.5	60	season two (spring)
*	-	significant level
,(P≤0.05)*		

While the results of the current study differed from some studies that indicate a significant effect of the age of the sheep on the fertility rate (Lee et al., 2000; Al-Rawi and Shuja'a, 2002; Al-Shammari et al., 2013 and Al-Khazraji et al., 2014).

3- Weight of the sheep

The results of the study showed in Table (3) that the weight of the sheep at fertilization had a significant effect (P≤0.05) on the fertility rate, as the fertility rate was (114 births / sheep) for ewes whose weights were (less than 45 kg), which excelled the two groups of ewes whose weights ranged (45-50 kg) and more than 50 kg, the percentage of which was (100, 105 newborns / sheep), respectively. The results of the current study showed congruence with many researchers (Vanli and Ozsoy, 1987 ,Gursoy, 1994 ; Al-Zobaie, 1999 and Ptacek et al., 2014) who indicated a significant effect of the weight of the sheep when fed on the fertility rate. While Gunn, 1986 and Inounu et al., 1993) indicated that there was no significant effect of the weight of the ewe when fertilization on the fertility rate.The reason for the increase in the fertility rate at birth for ewes with heavy weights when fertilized is that they have large and faithful wombs and a large space for the growth and development of the fetus during pregnancy, especially in the last period of pregnancy (Al-Rawi, 1997).

4 – Season

It is noticed from Table (4) that the birth season had a significant effect (P≤0.05) on the fertility rate, where the second birth season (spring) was excelled on the first birth season (autumn), as the percentages reached 116 and 101.8%. This study was consistent with several studies that observed a significant effect between the season of birth and fertility rate (Zapasnikien, 2002, Ajil et al., 2005, Gbangboche et al., 2006, Deribe et al., 2014 and Lallo et al., 2019).While the results of the current study differed with many researchers (Koycegiz et al., 2009 and Abd-Allah et al., 2011 and Moura et al., 2014 and Baneh et al., 2020 and Sharifi, 2020) who noticed no significant difference between the fertility rate and the season of birth.The reason for the difference in percentages and the excelled of the second season on the first season in this characteristic is due to the herd's adaptation to the environmental, climatic and administrative conditions.

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