

REVIEW ON THE IMPACT AND CONSEQUENCES OF THE OCCURRENCE OF MULTIPLE BIRTHS IN CATTLE AND GOATS

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ABSTRACT

Background: The large animal species such as cattle, buffaloes and horses are monotocous with one or sometimes two newborns per birth whereas small farm animal species such as sheep, goats and pigs are usually polytocous animals are highly prolific and especially pigs often produce a dozen newborns at each farrowing. Cattle usually produce only one calf per gestation resulting from ovulation of a single follicle. The most common form of twinning in cattle occurs due to multiple ovulations which may produce dizygotic twins. The twin births in dairy cattle often negatively impacts the reproduction, production, health and reduces the productive lifespan of cows. Therefore, there is a great interest to know the multiple ovulations and multiple births to reduce the twinning rate in dairy cattle herds.

Objective: This review updates the status of multiple births and its impact and consequences on production of dairy cattle and goats.

Materials and Methods: The related literatures on the multiple births in cattle and goats have been reviewed for which the search was carried out in Google Scholar, PubMed, CrossRef, Banglajol and also the online daily newspapers.

Results: Although multiple births with up to quadruplets have been reported from different countries, the prevalence of twin births are commonly reported in dairy cattle. The prevalence of twinning rates are varied widely in different breeds like twin calving in Holstein Friesian cattle is 3 to 5%, 5.6% Spanish dairy herd and 3.9% in Iranian Holsteins, whereas triplet and quadruplet births represent 0.015% and 0.004% of the total births, respectively. Twin calving shorten gestation length, increased dystocia, stillbirths, decrease birth weight, perinatal calf mortality, retained placenta, decrease milk production, increases the occurrence of metabolic diseases, reduced conception rate, increased calving interval, shorten the productive lifespan of the dam and increases overall culling rate. Two strategies- the transfer of a single embryo produced *in vitro* and follicular drainage of co-dominant follicles at AI have been suggested to prevent twin pregnancies.

Conclusion: Multiple births in dairy cattle is not desirable due to negative effects on both cows that calve twins and calves born as twins that result in economic losses in dairy herds. Regardless of the direct effect of multiple births on health and fertility, reducing the occurrence of multiple ovulations to decrease the risk of twin births is desirable to mitigate the negative consequences of twinning in dairy cattle. The estimated losses due to twinning range between US\$ 59 to 161 per twin pregnancy and attempting manual embryo reduction decreased the economic losses of a twin pregnancy by US \$ 23 to 45. Bangladesh scientists discovered a new technique to produce twin calves but the future research on this aspect need to consider the negative effects of twin births in cattle.

Keywords: Multiple births, Occurrence, Cattle, Goats, Impact, Consequences

Article Info: Article Code No. © LEP: JVMOHR/0030/2022

Received: 10 April 2022 Revised: 11 May 2022 Accepted: 10 June 2022 Published: 30 June 2022

Citation: Samad MA (2022). Review on the impact and consequences of the occurrence of multiple births in cattle and goats. *J. Vet. Med. OH Res.* 4 (1): 1-19 [doi:10.36111/jvmohr.2022.4(1).0030]



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INTRODUCTION

Mammalian species can be divided into two groups such as monotocous and polytocous by the number of progeny per birth. Those species that normally produce a single offspring at a birth is called monotocous species and those species that produce multiple offspring at a birth is called polytocous. Human, chimpanzee or orangutan, macaque, panda, horse, cattle and dolphin are selected as monotocous species, whereas mouse, rat, dog, cat, pig and Tasmanian devil are selected as polytocous species.¹ Many farm animals give birth to more than one offspring though even among those that usually produce single births like cows, buffaloes and horse but they occasionally produce multiple births. Even among those species that regularly produce multiples some mother may give birth to only one offspring at times such as sheep and goats. Pigs is the most prolific of all farm animals often producing as many as 20 piglets from one gestation, while cattle and buffaloes will typically give birth to only one calf. Sheep and goats produce 1 to 3 offspring per gestation but sometimes give birth to quadruplets and on rare occasions even more. Pygmy and Nigerian dwarf goats are especially likely to produce more than 3 kids per gestation.² However, farm animals have been greatly manipulated by human through controlled breeding and environment and accordingly, breeders may select to breed those small ruminants that tend toward multiple births over those who do not. Similarly, humans may manipulate estrus cycles to favor animals who have more pregnancies in a year over those give birth once annually. Multiple births may be defined as a birth where dam produces more than one offspring at a time. Terms used for the order of multiple births are largely derived from the Latin names for numbers. Two offspring (twins) is the most common form of multiple births to seven offspring (septuplets) being the rarest form of multiple births. Multiple births are named and numbers like two offspring as twins, three offspring as triplets, four offspring as quadruplet, five offspring as quintuplets, six offspring as sextuplets, seven offspring as septuplets, eight offspring as octuplets, nine offspring as nonuplets, ten offspring as decaplets, eleven offspring as undecaplets, twelve offspring as duodecaplets, thirteen offspring as tredecaplets, fourteen offspring as quattrodecaplets, fifteen offspring as quindecaplets and so on. However, twin pregnancies and subsequent twinning births are considered highly undesirable in the dairy cattle industry and also from the perspective of the cow.³ The high of early fetal loss, abortion during the middle period of lactation, dystocia, stillbirth and placenta retention have a negative impact on the performance and health of cows and calves.⁴⁻⁸ There seems to be no published reports on the occurrence of multiple births in large ruminant species from Bangladesh. However, recently an experimental report shows that ‘cow to give birth two calves: Bangladesh discovers new technique’⁹ which need to be discussed for its application. Considering these facts this review paper describes the impact and consequences of the occurrence of multiple births in cattle and goats.

MATERIALS AND METHODS

The related literatures on the multiple births in cattle and goats have been reviewed for which the search was carried out in Google Scholar, PubMed, CrossRef, Banglajol and also the online daily newspapers.

RESULTS AND DISCUSSION

The role of reproduction is to provide for the continued existence of a species. One of the most important traits for animal production is the number of offspring for a species. However, the birth of twins is a historic symbol of human fertility¹⁰ and even today there are cultures that consider having twins will bring good fortune.^{11,12} Twinning is also a very welcome event for the beef cattle farmers^{13,14} and small ruminants.¹⁵ Although during 1970 to 1980s some reports sought to increase the twinning rate to improve milk production and progeny per cow,^{16,17} currently most authors would agree that twin births are not desirable in dairy herds.^{8,18-20} Cattle tend to only give birth to one calf per pregnancy. While some cows are able to give birth to multiple calves but it's not common for cattle to have multiple offspring. Twin births are most frequent and triplets, quadruplets and quintuplets are progressively rare. Recently, multiple ovulations and subsequent multiple pregnancy with multiple births have increased in parallel with milk production. Some breeds of cows gave quadruplets births of calves in different countries are presented in Table 1.

Occurrence of some quadruplets calves

1. A cow in Northeast Texas has apparently defined great odds and given birth to four calves that have been named Eeny, Meeny, Miny and Moo (Table 1).²¹
2. A cow gives birth to quadruplet calves on a central Minnesota farm, USA. The calves- two male and two female- were born and these quadruplet calves and their mother were doing well (Table 1).²²
3. Saskatchewan cow gives birth to live quadruplets on 29 March 2019 in Canada. The total birth weight of calves were 41, 55,56 and 65 pounds that is total birth weight of 217 lbs (98 kg) which is amazing size and weight to carry by one cow (Table 1).²³
4. Beef cattle farmers David and Julie Ingram were left shocked after their purebred Hereford calved quadruplets in Gippsland Cattle Farm, posted Tuesday 24 September 2019 (Table 1).²⁴
5. A cow gave birth to South Korea's very first quadruplets at a local farm in Sangju, North Gyeongsang. The cow gave births two female and two male calves. The calves were born earlier than the originally expected due date. The mother is a 25-month old cow that gave birth for the first time. There is a less than 1.0% chance for Korean cows to give birth to twins. Giving birth to quadruplets is even rarer (Table 1).²⁵
6. Washington cow gives birth to quadruplets on 20 February 2020, a 7-year-old Angus-cross cow gave birth to quadruplets in Washington (Table 1).²⁶
7. A 8-year-old Black Angus cow gave birth to four live bull calves in Buhl which is published on 19 March 2021 (Table 1).²⁷
8. The Friesian heifer in County Limerick has given birth to 16 calves, potentially placing her in line for Guinness World Records. It is considered as the world's most fertile cow out to pasture in a field in the Republic of Ireland.²⁸ The Guinness Book of Records says that the most live births for a cow in a single delivery is five calves. These calves were born on 18 March 2005 at the Santa Clara Ranch in Reynosa Tamaulipas in Mexico. But the owner of the Limerick cow, Ger Kirby from Ballyneety says his seven-year-old is unique because she

has given birth to five calves twice. She had four calves in 2009 followed by five calves in 2010, then in 2011 she gave birth to twins before producing another set of five calves last month i.e. total 16 calves. Normally, a cow has seven to ten cows over her lifetime but she has given 16 calves (Table 1).²⁸ A cow could expect to give birth around 8 to 12 times in their 20 year lifespan, however they are usually culled much sooner than that in farming situations.

SN	Breed of cow	Country	Date of delivery	No. of newborn	Photo presented	Benefits & Risks	Ref. No
1.	Lubbock cow	USA	16.03.2015	4	Yes	-	21
2.	Minnesota cow	USA	07.06.2018	4	Yes	-	22
3.	Saskatchewan cow	Canada	29.03.2019	4	Yes	-	23
4.	Hereford cattle	USA	24.09.2019	4	Yes	-	24
5.	Korean cow	S Korea	18.02.2020	4	Yes	-	25
6.	Angus cross	USA	25.02.2020	4	Yes	-	26
7.	Black Angus	USA	19.03.2021	4	Yes	-	27
8.	Friesian	Ireland	18.03.2005	16*	Yes	-	28

*Total number of calves delivered in lifespan - = Not available / Not reported

The litter size is fairly constant in most mammals and is roughly correlated with body size, gestation period, life span, type of uterus and number teats. As for example, a large mammal with a normal pregnancy of more than 150 days, simple (or unicornuate) uterus and two teats rarely bears more than one young (a singleton) at a birth. The majority of primates, humans, large ruminants included, fit in this category, multiple births among them are exceptional and occur with decreasing frequency from twin on.²⁹

Many farm animal species give birth to more than one offspring especially pigs, sheep and goats whereas large animals like cattle, buffaloes and horses usually produce single births but some will occasionally produce twins or triplets or multiple births (Table 1).

Cattle are commonly mono-ovular uniparous animals but they can sustain twin or other multiple pregnancies to term. In cows with a single pregnancy, the embryo implants in the uterine horn that is on the side of ovulation where corpus luteum develops. Multiple pregnancies are classified into bilateral (one or more embryos in each uterine horn) and unilateral (all embryos in the same uterine horn, right or left) and in both cases, embryos occur on the side of their corresponding corpus luteum or corpora lutea.⁴ Recently, multiple ovulations and subsequent multiple pregnancy rates have increased in parallel with the increased of milk production on the back of genetic improvement. The increased twinning rate has been linked to increased milk productivity. The rate of double ovulation may be over 20% in higher producers³⁰ and 25% for cows in their third or later lactation.¹⁹

Most multiple pregnancies in cattle result from multiple ovulations, involving the simultaneous formation of two or more ovulatory follicles either from one or both ovaries.^{7,13,17}

Multiples births in cattle and goats

The occurrence of twin calving in Holstein Friesian cattle is 3 to 5%.³¹ Cows that would have twins became pregnant earlier, probably because of their better health and fertility, with shorter gestations and calving intervals. After calving, cows that had twins showed poorer reproductive performance.

Cattle are a monotocous species with occasional multiple pregnancies which result in the birth of multiple calves (most often twin calves).³² Multiple births are rare, with multiple birth rates ranging from 1.02 to 9.6% depending on the breed and study and are generally higher in dairy cattle than in beef cattle.³³ The occurrence of multiple births especially twin calving varies in different breeds of cattle with 3 to 5% in Holstein-Friesian cattle.³¹ Although the number of twins has consistently increased, triplet and quadruplet pregnancies represent 0.015% and 0.004% of the total births, respectively.³⁴ Multiple births are result of multiple ovulations and/or the spontaneous cleavage of one fertilized oocyst which is known as monozygotic twinning. Monozygotic animals are genetically identical and those derived from two or more zygotes are genetically different.

Twin and multiple pregnancies are not desirable as they compromise the health and productive lifespan of the dairy cows. The mean productive lifespan of primiparous and secundiparous dairy cows delivering twins is about 300 and 200 days shorter, respectively.

Genetics appears to be a major regulatory factor for twinning rates.¹⁹ Candidate genes have been reported to be directly and indirectly related to ovulation. The EPH gene family has been reported to have undergone expansion in monotocous animals whereas the EPHA4 gene has ported to positively affect litter size in pigs and supports the possibility of the EPH gene playing a role in determining the number of offspring per birth.¹

Economics impact of twinning

Superficially from an economical viewpoint, the idea of multiple births of calves per pregnancy can seem advantages. Nevertheless, when the outcomes are analyzed, multiple births like twin calving have several negative consequences. Higher incidence of dystocia, freemartins, stillbirths, retained placenta and higher mortality of the calves at peri-parturition period have related to twin births.^{5-8,31,35-37}

Multiple births tend to be less developed than single born herd mates of the same age, they have higher mortality rate and rebreeding of the dam can be delayed leading to a longer calving interval and decreased profits.^{31,38} Animals with higher lactation performance and better fertility tend to be more predisposed to multiparous pregnancies which are overall considered to be a negative trait.³⁶ Longer calving to conception intervals, higher culling rates and a shorter mean production lifespan of 200 days have been reported for cows delivering twins compared to cows delivering singletons.^{5,8,18} In some herds, the twinning rate may exceed 12%³⁸ and 10% of cows deliver twins at least once during their life.⁸

The economic burden of a twin pregnancy has been estimated at up to \$225.³⁹ Twin pregnancies reduce herd profitability with an average loss of income attributed to cows delivering twins estimated at 74 to 108 US\$ and cost related to twinning amount of US \$ 55 million per year in USA.³⁷ However the economic losses during parturition, metabolic disorders of the cow, and low vitality of the twin calves, coupled with the decreased fertility

and elevated culling rate in cows after twinning may discourage breeding twins in dairy cattle.³¹ Twinning in cows is associated with a significantly increased risk of abortion if the twin pregnancy is unilateral (40.3%), while bilateral (1.3%) twin pregnancy does not increase the abortion risk during 135 to 249 (173 ± 32) days of pregnancy.⁴⁰ Unilateral twin pregnancy constitutes around 56% of the twin pregnancies in Holsteins and represents a non-infectious cause.⁴

The prevention or reduction of unilateral twin pregnancies has been suggested by follicular puncture and drainage of subordinate follicles at AI or manual rupture of the amniotic vesicle of one of the two twins at the time of pregnancy diagnosis.⁴⁰

Hormonal manipulation before AI that allows for timed AI is a primary strategy for decreasing twinning in dairy cows before it occurs by decreasing the incidence of double ovulation thereby decreasing conception of dizygotic twins and the associated negative economic consequences.⁴¹

Twinning in beef cattle

The low productive performance of beef cattle is one of the critical factors that greatly affect beef cattle production. Producing an extra calf in twin calving would be an opportunity to enhance the production output since an additional calf would be available for slaughtering purposes. Multiple births due to multiple ovulations with a frequency of not more than 1.0% in beef cattle, whereas the frequency is between 1 to 5% in Holstein Friesian dairy cattle. Returns less feed costs showed twin births to be associated with increased profit for cow-calf programs but returns less feed and overhead costs reported to higher for twin calves than for singles in the feedlot.⁴² Hormonal therapy have been used for the induction of multiple births in beef cows with FSH: calving rate and subsequent performance have also been reported.⁴³ The twinning affect the fertility of the cow negatively in both the dairy and beef cows but twin calving could reduce substantially beef meat production costs owing to more calf growth at weaning. Accordingly, some authors suggested that an economic gain from twin calf production could be enhanced by applying an appropriate management system to identify and cope with twin-bearing cows, correctly and nutrition program to feed them in proper manner.⁴⁴

Long-term selection programs in the USA and New Zealand have developed twinning herds. The USA Meat Animal Research Centre population had a calving rate of 1.56 per parturition in 2004. They have shown that the location of ovulation has an important effect on the success of pregnancy and ovulations ≥ 3 are probably undesirable. These cattle have issues associated with calving difficulty and calf survival, which present challenges for commercial application. Intensive management using exciting technology and/or future genetic improvement to address three traits are required to realize the potential benefits to beef production systems.⁴⁵

Factors associated with twin births in cows

There are two main ways that a multiple pregnancy can happen in mono-fetal species: (a) One fertilized egg (ovum) splits before it implants in the uterine lining, and (b) Two or more separate eggs are fertilized by different sperm at the same time. These two different types of multiple pregnancy result in either identical or fraternal siblings. Identical twins or triplets

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happens when a single egg is fertilized and then later splits. These newly divided embryos are identical. Newborns that are identical multiples will look like each other and be the same sex. Fraternal multiples develop from separate eggs that are fertilized by a different sperm. These newborns won't look identical and can be different sexes from each other.

The natural frequency of multiparous births is influenced by a wide variety of genetic and environmental factors which are associated with 0.5 to 4.0% twin calving in dairy cattle. The factors having most influence over multiple births are age, parity, seasons and climate, feeding, milk yield, hormonal influence and genetic predisposition.³¹

Genetics

Higher occurrence of multiple births has been reported in dairy cattle than beef cattle,¹⁶ and also showed variation by breed especially multiple ovulations much more frequently reported in Holstein Friesian cows than in other dairy cattle breed.⁴⁶ Holstein cows had the highest percentage showing twice the risk of twin births compared to other breeds.

Parity of cows

Overall the twinning rate has been reported to be 3.9% and twinning increased with parity i.e. 1.1% for primiparous cows vs. 5.7% for cows in their $\geq 4^{\text{th}}$ lactations.⁴⁷

Age

Age is also considered as a contributing factor when dealing with the rate of occurrence of twins and multiple births. Cows that have had several parities have a higher number of twin and multiple births compared to that of heifers with first calving.⁴⁸ Older cows have a tendency to carry twins more frequently due to the cows' maturity and the increased occurrence of polyovulation,³¹ whereas in heifer cows higher embryonic mortality due to the uterus having insufficient functional capacity.

Seasonality

Comparatively more twin and multiple births occur in summer (2.41%), spring (2.04%) and autumn (1.79%) than in the winter months which has explained due heat to stress during summer months that could damage the embryo.³¹

Nutritional influences

Nutrition plays a great part with the aim of getting the maximum energy intake from the silage and feedstuff to optimize milk production and fertility performance of cattle herd. Better feed quality supplied in the autumn and optimum temperature (absence of heat stress) contributes to multiple ovulations in cows.⁴⁹

Milk yield

Milk production is the primary factors affecting the incidence of double ovulation in lactating dairy cows.³⁰ Cows with high milk yield show a threefold higher frequency of double ovulation than cows with medium to low lactation performance.³⁰ High milk production near the time of ovulation can increase the incidence of double ovulation which would therefore subsequently result in an increase in multiple births in cows. Cows with high 305-day milk yield showed 1.6

times the risk of twin births. Lactating dairy cows are at greater risk for twinning because of their greater occurrence of multiple ovulations compared with non-lactating heifers.⁴⁷

Hormonal influences

Hormonal treatment especially cows get two intramuscular injection and GnRH as well as one prostaglandin injection in a specific disorder to synchronization the ovulation in cows. Due to the effect of hormones on the cows' body, 14.1% of the cows have shown a double ovulation and 5.2% twin pregnancies have detected.³⁰

Progesterone levels can be influenced by high feed intake- it increases blood flow through the liver and subsequently reduces the amount of progesterone in the blood. This reduction of progesterone is proven to increase the likelihood of double ovulation and the conception of dizygotic (non-identical) twins. Therefore, the higher the feed intake, the more likely a cow is to produce twins- explaining the noticeable increase of twinning in high-yielding Holsteins. The level of milk production in the 14 days immediately before a natural estrus is positively associated with the incidence of double ovulation in Holstein cows. When cows reach 40 liters of milk production, there is about a 25% occurrence of double ovulation and at 50 liter this increases to a 50% occurrence.⁵⁰

Consequences of twinning and multiple births

Multiple births in dairy animals can have both favorable and unfavorable results, but it is not seen as a desirable trait in dairy animals. Cows having twins are at greater risk for many periparturient reproductive and metabolic disorders than cows having single calves. Abortion, stillbirth, neonatal calf mortality and reduced birth weights are recorded more with the birth of twins than with that of single calves.⁴⁹

Gestation length

Twinning cows' gestation length (274 days) has proven to be shorter than that of non-twinning (278.7 days) herd-mates.³¹

Dystocia and perinatal mortality

Dystocia means a difficult or abnormal delivery that occurs more frequently with twin births than with single births. Multiple births can cause difficulties if parts of more than one fetus enter the birth canal at the same time. The mortality rate is four times higher in twin-born calves due to an increased dystocia and a reduced gestation length and twin calves had a lower birth weight. Twin calves had a 9.1 times higher probability of perinatal mortality than singleton calves and the prevalence of dystocia and perinatal mortality were 3.4% and 4.3%, respectively.⁵¹ Calf mortality has been reported to be greater after twin births, with 28.2% of twin calving events reporting one or both calves as dead compared with 7.2% for singleton births.³⁸

Milk yield

Primiparous and multiparous cows with singletons produced more milk than cows with live twins or at least one dead twin. Primiparous and multiparous cows with singletons produced

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more milk than cows with live twins or at least one dead twin. Multiparous cows with dead twins produced less milk than cows with live twins.⁸

Fertility and reproduction

Higher incidence of abortions, reduced birth weight or higher numbers of stillbirths, mastitis, and problems related to dystocia, the increase costs in the case of multiple births adds up to 40% per cow.⁵² Cows delivering twins has been reported to cause a very high incidence of peripartum disorders such as dystocia, stillbirth and retained placenta and each of these twinning-related disorders impairs fertility and determines a higher risk of culling after calvings.^{5,7,8}

Freemartinism

When twins are born with different sexes, a sexual condition called freemartinism occurs between 90 to 97% of pregnancies causing sterility in the female calf. A freemartin may be defined as a female that is born as a twin with a male and is sterile as a result of exposure to masculinizing hormones. A connection between the two fetal circulatory systems develops early in gestation (anastomosis) and leads to the exchange of blood between the fetuses. Exposure of male hormones leads to underdevelopment of the female's reproductive tract.⁵³

The double ovulation occurs when two mature follicles are released at the same time in one cycle of ovulation.³⁰ Adhesion of the outer layers of the amniotic sacs can occur in twin and multiple pregnancies because of their proximity. This may result in fusion of the chorionic layers at which point an anastomosis of the vessels occurs in most cases leading to a union of the blood circulations of both embryo. In case of twins with different sex (bull and heifer), in 98% of all occurrences, heifers are not suitable for breeding because of freemartinism causing infertility in the female calf born with a male twin.³¹

Culling reasons and life span

Multiple pregnancies considerably decreased the chance of survival until the next calving and increased the culling rate. Multiple births gave rise to a greater proportion of cows culled due to udder diseases, infertility, reproductive disease, old age, metabolic and gastro-intestinal diseases and diseases of the locomotor system. The mean productive lifespan of primiparous and secundiparous dairy cows delivering twins is about 300 and 200 days shorter, respectively than that of cows delivering singletons.²⁰

Economic impact on multiple births in cows

Twinning in dairy cows is not desirable because of the negative effects on both cows that calves twins and calves born as twins that result in heavy economic losses. Economic losses due to twinning are estimated to range between US\$ 59 to 161 per twin pregnancy.⁴¹ Twin calving are associated with losses due to the higher occurrence of abortions, ketosis, reduced birth weight or stillbirths, mastitis and problems related to dystocia. Multiparous cows with dead twins produced less milk and increased time to conception compared to cows with live twins.¹⁸ Total losses have been estimated as an average of US\$ 108 per twin birth. Therefore, it may be concluded that it is not profitable to select to increase the number of twins in dairy

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Photo 1. A Black Bengal doe has delivered one kid in Bangladesh (Kim Irvine)



Photo 2. A Black Bengal doe has delivered two kids (Siddartha Reddy)



Photo 3. A meet Blackie's has delivered three kids of which two are suckling and one is depressed (Maguirefarm.com)



Photo 4. A Osmanabadi doe has delivered four kids showing all the four kids are struggling to suckle (ICAR-CIRG)



Photo 5. A Black Bengal goat has delivered eight kids in one gestation in Bangladesh.⁶¹



Photo 6. A Nigerian dwarf doe has delivered seven kids in USA.^{59,60}

goats in her first pregnancy produce only one kid and will then go on to have two or more kids at subsequent gestation. One of the primary reasons goats tend to average two kids is that only have two teats and in case more than two kids, they used to struggle constantly to suckle (**Photo 4**), which means bottle feeding for the rejected offspring would be required. However, the reproduction in goats is influenced primarily by genetic potential, nutritional status, environmental conditions, photoperiod and health status.⁶²

The litter size of Black Bengal goats (BBG) reported to be ranged from one to three in Bangladesh.^{15,55,63} However, 1.2 to 1.8 and 1.6 to 1.9 litter size in BBG have also been reported.^{64,65} An average of two litter size in BBG has been reported as standard due to availability of two teat in the udder¹⁵ and it compares well with the 1.60,⁶⁶ 2.16,⁶⁷ 2.0,⁶⁸ 1.06,⁶⁹ 1.68,⁷⁰ 1.06^{71,72} and 1.75⁷³ litter size reported earlier. Litter size may be affected by parity, age, genetic and environmental factors^{63,74} and also by buck used for service.⁷⁵

Number of kid borne has been reported to be significantly highest of twin kids (56.41%) in comparison to triplets (26.92%), single (11.54%) and quadruplets (5.13%) kids.¹⁵ These findings are also supports of other reports of 41.04% twin, 25.37% triplet, 20.15% single and 13.43% quadruplet kids,⁷⁶ 66.76% twin, 27.55% single and 5.68% triplet kids⁷⁷ and also 52.57% twin, 29.89% triple and 17.52% single kids⁷⁸ in BBG.

A doe has recently gives birth of eight kids in Lamonirhat district of Bangladesh and all eight kids are normal and sound in health (**Photo 5**).⁶¹ Although two Nigerian Dwarf does, one in Nigeria⁵⁸ and one in USA^{59,60} have delivered septuplets (seven) kids (**Photo 6**) which are recorded in the Guinness World Record.⁵⁹ However, this eight kids produced by the doe in Bangladesh which probably be the highest number of births in goats in the world but such information probably remains unrecorded in the Guinness World Record.

Maize feed prompts multiple births in goats have been reported from Australia. One group of goats is fed 250 gram of maize while the control group is fed lucerne and pellets to measure the effect of maize on fertility. Some of them have delivered birth twins or triplets and suggested that the maize energy effect improve their ovulation rate.⁷⁹

Nigerian Dwarf goats

The Nigerian Dwarf goat often gives birth to 3 to 4 kids per pregnancy and five kids aren't unusual in the breed with an average of two pounds weight of kid at delivery.⁸⁰ One of the Nigerian dwarf dairy goats of the Sinai Thunder Farm, Wilmore, KY gave birth to septuplets (seven) live kids on 8 April 2016 (**Table 2**).⁵⁸ It may even be a Guinness World Record.⁵⁹ The largest litter of goats is seven and was born to Miller's Fairy wood MP Angelica and her owner Elizabeth Miller (USA) in Gilbert, Arizona, USA, on 16 February 2019 (**Table 2**)^{59,60}

Effects of multiple births in goats

Reports on the effects of multiple births on the reproduction and production of milk are very limited.^{81,82} However, the multiple births in Nubian goats have been reported to be associated with higher milk yields but not milk constituents.⁸¹ Singleton and twin-born Florida goats had significantly longer productive lifespans than did triplet ($p < 0.05$) or quadruplet-born kids ($p < 0.01$).⁸²

CONCLUSIONS

There is no doubt that twinning definitely is an undesirable character in dairy cattle and efforts should be made to reduce its appearance by proper breeding methods and selection. However, twinning has encouraged to some authors in beef cattle to increase meat production. The economic losses during parturition, metabolic disorders of the cow and low vitality of the twin calves, coupled with the decreased fertility and elevated culling rate in cows after twinning may discourage breeding twins in dairy cattle even also in beef cattle. The occurrence of multiple pregnancies has been linked to increased pregnancy loss and reduced lifespan of dairy cows. Therefore, if twin pregnancies are prevented, the cow's general health and welfare state will certainly improve.

ETHICAL APPROVAL

This review article does not contain any research studies with animals or humans participants performed by the author. Therefore, ethical approval is not required for this review article.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

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