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## RESEARCH ARTICLE

### SEXED SEMEN USAGE FRAUGHT WITH CHALLENGES OF GENETIC NATURE

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##### Abbreviations

BT: Bacillus thuringiensis gene inserted crop

DNA: Deoxyribose Nucleic Acid

GM: Genetically modified

RNA: Ribose Nucleic Acid

#### ABSTRACT

Semen application of sex sorted category is a new breakthrough in dairy sector that is being used on larger scale world over these days. Alongside dairy, this technology also has a scope to be implemented on animals like pigs, horses, camel, sheep, goats, dogs etc and even on humans. The aim of this technology in dairying is no doubt to increase dairy productivity by increasing selective herds of milch and meat animals. The high yielding milch animals are produced with the objective to produce more females of them because more female animals definitely mean more milk. Also in case of beef cattle more males are preferred for obvious reasons and this technology tends to promise the production of more males too. The advantages are well known and this is the reason that this technology of the production of sex sorted semen has come to find a very important role in the field of dairy farming which has become very competitive in terms of economic survival and efficiency and farmers all over have been fascinated by this methodology which certainly promises them more profits and return on their investments. But like all other things in the world, this technology has also come to display diverse outcomes and very interesting facts have come to light in the recent years; many of which have genetic colors and overtures. Such is the aim of the present review to judge the impact of such a development on animals very close to human race in economic and social relationship and also to study these effects on the present and future progenies of these animals and humans of course. The ramifications are vivid and of course obvious and deserve to draw the attention of one and all in the domains of science and social life.

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#### INTRODUCTION

Reproductive physiology is a field of science which is replete with numerous instances of attempts to alter sex ratios (Ericsson, 1973; Gordon, 1958). In the profession of dairying this has scope for economic and commercial application. With the promise of the production of sexed progenies in dairy animals, bigger and secure profits can be secured for dairy farmers and also for already exploded human populations especially in poor and third world countries; more milk and meat productions can be achieved to fight hunger, starvation and in a way to alleviate poverty as well. To achieve this noble cause the attempts in last years have centered on the production of sexed semen. Sexed semen is the one containing accentuated proportions of either X or Y bearing spermatozoa. In case of dairy animals like cows and buffaloes, there are already many companies in the field marketing semen to farmers. Now these companies have started to sell the sexed variant of this as well.

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The farmers are also responding very eagerly to give a try to new technological breakthrough and everything seems to go very well until this but of late, there have been cases of the emerging of such a data and facts that point also in the flip direction of all of this. There have come to light the instances of the damage and death of gametes, zygotes, embryos, fetuses and even neonates etc upon the application of this technology. The reason behind this seems to be the sperm damage that accrues upon the spermatozoa during the process of sexing that is used to manufacture sexed semen. The process involves procedures and equipments like super high pressure macro nebulizers, electric field applications, laser lights, chemical treatments, accelerating equipments and cushion falls at super high speeds like 100 kilometers per hour etc. which subject the extremely delicate micro entities called spermatozoa to harsh manipulation and damage. The extent of this damage is so severe that it even takes the shape of chromatin and genetic damage to these sperms. The outcome is quite obvious to anybody well versed in the art. The gravity of the situation can be understood with the realization of the fact that it is the nature that is the super master force in universe and it is once again the same which has developed and also preserved the genetic pool and balance for all the species of plants and

animals throughout hundreds of millions of years of organic evolution. Genetics, no doubt being the basis of all organic life certainly demands a central place in thought and practice modules in human life and philosophy and any damage or threat to the natural gene pool and design of any living species can unleash the wrath of the fury of the forces of nature upon the species involved and also of course upon man and no tempering with this can even be thought of as allowable. So, the situation here is quite serious as well as grim and deserves an honest reflection of mind on this pivotal issue.

**The sexing technology and scope:** The sexing technology no doubt has great scope in a world of dairy productivity as we know today but on the other side of it, it employs such a process and methodology that the sperm gets damaged as a result (Seidel, 2014). So, a very well thought and balanced approach should essentially be followed in allowing or not the application of this for increasing dairy productivity. Increasing productivity is a good idea but not at the cost of the dangers of genetic pollution the likes of which were encountered during the World War II in nuclear bombings of Nagasaki and Hiroshima and also in radiation debacles of Chernobyl and Fukushima. It may well be argued that we have no other recourse except to follow this because this is the technology that has been flouted as the one and only methodology to separate ordinary semen into concentrations rich in either X or Y sperm but certainly there are concerns that are more valuable than the commercial gains. Given the scope of the technology, various commercial compulsions have also joined in so as to implement this on mega application levels. Numerous business corporations, lobbies and governments have jumped in and joined the band wagon. This has happened because dairy sector has taken the shape of more or less an industry. Sexed semen has no doubt practical commercial advantages, so, we see the spread of this on greater and greater levels day by day but the future of this should be decided only after considering the both sides of it. It will not be a bad idea if approaches other than sexing sperm are tried and followed for achieving the said goals.

**The genetic question & reaction of nature:** The genetics is the impression of life. It is just like the biological signature stamp of the forces of existence of life. Every species may be it is plants or animals or even a virus or prokaryote; has a distinct and elaborate genetic constitution in the form of either RNA or DNA molecular structure. In higher animals especially in mammals, the DNA constitution is highly organized and distinctive. It definitely varies between species to species. Also, the evolution of various species has actually been the genetic evolution of the concerned species and as one species has originated from another species alive or extinct; it is an established fact that common families, genera and even sub species share the common elementary DNA molecular structure of the concerned animals. So, it is derived here that family mammalia has a lot of common DNA structure in all of its members. So, a dog shares its DNA with a lion, a hyena shares its DNA with a buffalo or a cow shares its DNA with a bear. There is indeed a basic elementary DNA structure within all members of mammalian family. The particular differentiation in this that has arisen across millions of years of biological evolution demarcates a particular mammalian genus from another still keeping the common basic structural attributes of it. So, it finds that there are lots of DNA similarities between a cow, buffalo, dog, tiger, monkey or man

because all of them are mammals. So, if one fine day, such changes are done away with or they are tempered in such a way that they resemble each other as perfectly overlapping or one species' DNA is altered so as it is customized to fit another species' DNA; may be to an extent by making certain deletions or additions to it, then the resultant offsprings will be more belonging to the next species and not the one from where it has gotten originated. If such a drastic transformation is not even possible then even then, such a process can churn out an outcome where a particular one or many traits of one species can get loaded in the other species. So, we can say that a particular flesh eating trait or urge can get generated in a grass eating cow or we can have a vegetarian lion cub formatted genetically by such a process. This will be definitely playing with the natural genetic biological balance of the living species; a thing which is so precious and pious to the nature because it is the Mother Nature that has evolved and perfected this natural genetic balance over a period of hundreds of millions of organic evolution. Nature will certainly not like any intrusion on this by the artificial forces of human intervention and it will act by unleashing the wrath of natural forces and mechanisms within the control of nature and the result will definitely not be a friendly one. The various repercussions of such an exercise are well understood by anyone who is even a little versed with the knowledge on natural forces and their behavior.

**The forces of natural rejection and death:** It may not sound appealing but it is a truth that nature reacts and reacts it must with a force to any intrusion on the natural genetic balance that it has perfected over a very long period of organic evolution and any such new creation will definitely be considered as a genetically misfit organism or entity by it. Nature does not entertain genetically misfit organisms or parts thereof and it has developed hundred and one mechanisms by which it gets rid of such a genetic pollution. Suppose we have a genetically damaged sperm, it may get killed due to this defect of it and further if such a sperm even survives and fuses with an ovum to form a zygote with a damaged DNA, the chances are that it will be rejected by forces of nature and destroyed and aborted. If it is little less genetically manipulated, it may survive another step in biological development and progress into an embryo but here again depending upon the extent of its genetic contamination, it may get killed and eliminated. The relatively further less contaminated embryos may get further grown into the stage of fetal development but such a fetus will also be destroyed by forces of nature and aborted as stillbirth. Even the comparatively less contaminated ones may be able to take births as neonates but such neonates will also succumb to the forces of death and even such ones that are further less contaminated may grow into young or mature animals and then die and even it may be possible that they may live full lives and die after spending seemingly complete life cycles and even deliver normal looking off-springs but such normal looking offsprings may contain genetic malfunctions that can be transmitted to further progenies and carried forward and we may encounter a genetic catastrophe in next one, two or more generations and on such a point, the damage will certainly be irreparable. The following paragraph will make this point much clear.

**The lysis and assimilation:** Nature is no doubt a great organizer and master at disposing off anything that it thinks of as worth the task. The genetic tempering with the sperms leads

them undoubtedly to a situation of having damaged chromatin and DNA. In various write ups on the issue, a lot of distinguished researchers have already established that genetic tempering with the DNA of sperms subjected to process of sorting does occur and it is a known fact in the prior art on the subject (Aulakh, 2018). The term damaged DNA means a DNA other than the one decided and devised by the great forces of nature through the elaborate and prolonged process of biological evolution leading to the evolving of tens or perhaps even hundreds of millions of distinctive and diversified animal and plant species in the world. This is the secret of the beauty, elegance and of course the greatness of the existence of organic life on earth. Perhaps there is no other planet or galaxy; at least our present knowledge tells us such, where such marvelous and unique phenomenon known as organic life does exist. Till now, there was nobody in the world who could interfere in the internal matters of the behavior and interaction of the forces of life designed by great nature. But recently it is the entity called man who did this during the atomic bombings of Nagasaki and Hiroshima and now he is again trying to emulate this feat via the route of developing genetically modified plants and animals. Till recently, there was the talk of developing genetically modified crops, an event that met with a very strong opposition from forces of the 'Green Brigade' like Greenpeace, Save Earth, Save the Planet and PETA (people against ethical treatment of animals) etc and the result was that no government in the world could sanction the licensing of any such crop that can be used as a potential food or fodder purpose. Of course, there are crops like BT Cotton, GM Maize etc that are allowed in various parts of the world but we all know that cotton is used primarily for clothing and not for eating and maize is used in countries like USA almost entirely for ethanol manufacture. For similar reasons it could not be commissioned in India because here in this country, it is also a food and fodder source.

The other crops like GM wheat, rice or brinjal could not be commissioned due to similar reasons. But the event of the development of the genetically modified cow has not attracted such opposition from such organizations because probably they are not still aware of this development and sadly enough, this act is hundreds of times more dangerous than the development of genetically modified crops because cow is a source of food and it provides us with a major food of mankind that we know by the name 'milk'. It is a common knowledge that even beef is eaten by humans and also it is a fact that milk is an accepted major and daily food and the one and only single food article that is proudly entitled as the 'perfect food' for mankind. Man can certainly live without eating a brinjal or maize for weeks, months or even years but certainly he cannot live without eating milk because milk is such a product that is a compulsory constituent of food as not only in eating in the pure form of it but also in the form of curd, curd milk, butter, milk fat (ghee), sweets, chocolates, cakes, tea, coffee, milk shakes and lot many things that we eat many a times routinely on daily basis. So, the development of a genetically modified cow should raise a very big brawl not only in the minds of humans worldwide but it should form the essential platform for raising big opposition and agitations to stop such a heinous and destructive act by anyone; maybe they are business corporations, lobbies, syndicates, governments or anyone for that matter. The nature has already expressed its distaste for the development by many ways and processes that

we discuss just down under and it has already started to unleash the forces of death and destruction upon this technology by many ways just described below. The very first reaction of the forces of nature comes to the development of this technology when it produces 'damaged sperm' (Funston & Meyer, 2012; Seidel, 2014). Such sperm may be damaged in a way that their DNA remains intact but they incur damage on the somatic compositions of their bodies like tail or somatic sperm head or body. Even the entire chromatin may remain intact but there is proven truth that a great chunk of such sperms get damaged during the process of sorting and for this purpose a third collector bowl is provided to collect those sperms which are known as damaged, incapacitated and unsexed. It is another fact during the application of this technology that conception rate falls considerably in cows and even in heifers (Hafez, 1982). The fall in conception can be directly proportional to the extent of sperm damage as Seidel rightfully remarked, "the fall in conception due to damage to sperm during sexing". Percentage of sperm damage decides the fall in conception rate. Even on increasing sperm dosage, the conception rate does not increase. So, to know how much sperm is damaged or dead, we can know the data on conception and measure the percentage in fall of it and conclude in a way that percentage fall in conception is the percentage damaged or dead in the quantity of sperm subjected to the process of sorting. If there is twenty percent fall in conception, this means that the similar figure has gotten damaged, impaired, incapacitated or dead relatively.

This means that if 40% is the normal conception rate with normal semen and 20% is the conception rate with sexed semen, then it derives that almost half (20% is half of 40%) of the sperm count in normal semen that results in 60% fall in conception rate, has gotten damaged. So, in sexed semen with 20% conception rate that otherwise is 40% in case of normal variant of it, the sperm damage after sexing, more or less equals to nearly 30% of the total sperm count in semen prior to sexing. Such a derivation is further confirmed by DeJarnette et al, (2008) that "Sperm dosage had no effect on conception rates.....Conception rates of cows (29.4%) were not affected by size of sperm dosage". This is another fact that such damage may be of the genetic nature (Palma et al, 2008; Inaba et al, 2016). The conclusion here is that the forces of nature start to display their displeasure at an act of the destruction or infringement on the natural genetic material i.e. DNA and it reacts rather violently by killing those sperms that have gotten damaged beyond an extent that it considers as pardonable. So, the process of sex sorting proves as spermolytic and definitely it is not a welcome idea. The fury of the forces of nature travels even further. If by chance such a sperm that has not gotten damaged to an extent that the forces of nature think of it as survivable to let it go Scot free till this stage but damaged it is must but to a lower degree and this very sperm is able to unite with the ovum and form the zygote and this zygote hence gets as genetically damaged and misfit as described that "spermatozoa with damaged DNA can indeed fertilize the oocyte" (Henkel et al. 2004). Even the chemical treatment with chemicals like fluorescent dye could have caused a chemical change in the DNA molecular structure of the sperm prior to zygote formation as this dye can be detected in the zygote and embryo up to blastula stage (Garner, 2009) as DNA is nothing but an elaborate chemical structure only. Again this zygote will be killed and aborted by nature. There is no escaping this fate because the dear nature never allows any outward

tempering with its perfection module of the existence of life. So, this technology unfortunately proves zygolytic on this stage. Another reason for fall in conception rate (not in real terms but as evident outwardly as animal will come to heat again after few weeks) can be this also. But the rape of nature by man can travel another destination when such a zygote that nature deems of as still survivable and this happens to form an embryo. Such an embryo will also get killed and aborted. We all know of the phenomenon of developmental arrest of embryos (Telford et al, 1990; Inaba et al, 2016). Similarly the story of lysis and assimilation may travel farther when such an embryo which is not damaged to an extent and it happens to develop into a fetus. Such a fetus will also be killed and aborted. We in the field are well versed with the phenomenon of comparatively more stillbirths upon the use of sexed semen (Dejarnette et al, 2009). Hence the technology also turns out as proving fetolytic. A similar fetus with still allowable malfunction may further develop into a mature baby and gets delivered as a neonate but such a neonate will be born with much reduced vigor and viability and will also get killed as we know for certain that more and more number of farmers are complaining of the comparatively greater number of neo-natal deaths upon the application of sex sorted semen and their number is constantly increasing (Djedovic et al, 2016; Meyer et al, 2000; Steinbach et al, 2003; Zadeh et al, 2008) and we are left with no choice except to term this technology as neonatolytic.

The forces of death and destruction travel even beyond this point when such neonates may get a chance to develop into young or juvenile calves and even they can reach puberty and maturity and after mating may even deliver new babies. Even such babies may be defective genetically. They may mature further or not depending upon the iota of error in their genetic constitution but there are chances that they may even deliver further babies which will definitely pass on the load of genetic damage to progenies of future. Such a genetic damage may prove highly explosive and suicidal one fine day as expected from the postulates of "laws of heredity" discovered by great Gregor Mendel and perfected by further work in the field during centuries of painstaking research in the domains of human and animal genetics. So, the situation is grim and demands an outright decision and will power against the use of such a technology that is fraught with such great genetic dangers that turn out so lethal during all stages of zygotic, embryonic, fetal and neo-natal development and even they may travel to future progenies, generation after generation. It should also be remembered that if the DNA is not damaged and only somatic damage occurs to the sperm, the lysis forces can not get carried long way to many such stages. The fatality factor should have died down just around zygote stage only. We have now even started to hear about the application of this technology on other animals very close to man socially and economically and probably even on man for delivering sexed offspring. Such a genetic change in important animals like cow, sheep, goat, horse or buffalo is no doubt very dangerous for human race and such an elaborate discussion has already been reported by well known writers on the subject (Aulakh, 2018). The world has already decided to stay away from GM crops and now it is the most appropriate time to stay away from GM cow too for similar reasons only, albeit the reasons here are more strong and carry a message of extremely grim eventualities.

**The cumulative genetic defect & pollution therein:** The laws of heredity are very clear on a point. They tell us about recessive and dominant genes. A gene may remain dormant for many generations of course but that does not mean that it has gotten annihilated or ceased to exist. It may turn into a dominant one after many generations one fine day and if it is strong enough and gets the company of many like him and they form some notorious band of evil genes that may happen to express themselves as dominant ones all at the same time and we encounter the evil effects of them all of a sudden in one particular generation, then what will happen; nobody can tell? The result can be as unexpected and devastating as the development of a flesh eating carnivorous cow or a raw blood relishing human being. Are we ready to welcome such a breed of living Draculas in the human society of as of today? Are we? The answer is a big no. Then after many decades when perhaps no one among us will be alive, who will the coming generations blame for such a genetic pollution fiasco? Those among us who knew everything and kept mum and spoke not a word about this or the ones who were totally ignorant and knew not a thing; will be the decisive villains of such a tragedy, alike. The ones who raked in exorbitant profits in the bargain and led successful and lavish lives or the ones who helped them to unleash this genetic catastrophe on mankind by colluding with them; will be identified definitely one day and termed real time demons in the process? Genetic pollution is a pollution of worst degree. It is the pollution of pollutions. It is such a thing that deserves even not to be discussed as allowable. It deserves the total, outright and spot rejection. The world has not still forgotten the devastating effects of it in Nagasaki and Hiroshima. So, such pollution which is genetic by nature should be disapproved by one and all and every effort should be aimed to put an end to it.

**The genetic damage vs. economic gains: Is it worth it?:** The plain and blatant 'no' is the answer. There should be one and only one response of each and everybody that this should not be allowed and anybody indulging in such a trade activity that can plunge the humanity and the world into a Dooms Day Black Hole of destruction; should be stopped at once.

## **Conclusion**

It is a known virtue of wise men that they discuss each and every situation before endeavoring to act upon it. The situation may be very grim but certainly, still it may have a solution. At least, we can avoid such a thing. This seems to be the answer to the present catastrophe of genetic pollution that is lurking in broad day light over the heads of one and all and it is so powerful that it can totally eclipse the future of human race for ever and plunge future generations in unfathomable depths of darkness and despair. Any potential decision of wise men, bodies and governments should be rightfully based only after considering all these facts discussed in this write up.

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