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Role of Veterinarian in Food Safety: An Update

Pratibha Yadav[1], Sanjay Singh Yadav[2], Alok Kumar Yadav*[3] and Sunil Kumar[4]

1: M.V.Sc. Scholar, Department of Veterinary Biochemistry, GBPUA &T Pantnagar (U.K.)
2: Veterinary Medical Officer, Department of Animal Husbandry, Lucknow (U.P.)
3: Ph.D. Scholar, DCB Division, ICAR- NDRI, Karnal -132001
4: Ph.D. Scholar, ARGO Division, ICAR- NDRI, Karnal -132001
**Corresponding author: - alokvet1000 @gmail.com*

The Veterinarians have a key role at every link in the chain among the standards of animal health, animal welfare and public health. Safe food can only be produced if healthy, clean, residue and stress free animals are delivered to the slaughterhouse where a dedicated inspectorate, headed by a veterinarian, can ensure that high standards of animal welfare and food safety are maintained. Vets are trained to recognize disease. Diseases of great interest to them are zoonoses, which are diseases that can affect both animals and man. Food animal markets, worldwide, are well known for spreading disease from farm back to farm or further down the "farm to fork" food chain. Therefore this is an area where additional measures are sometimes required such as "rest days" during which markets are kept empty while they are thoroughly cleansed (Buncic, 2011). Now with globalization, more processed food, more and more food imports and exports worldwide, greater movement of animal and humans, it appears that it is the turn of the veterinary profession to be one of the most crucial to society. Their work with food of animal origin is an indicator of the influence they now have and will probably have in the future. Vets are not only trained to deal with all mammal species except man but also with birds, fish and exotic animals. They are trained in an extremely wide set of disciplines up to a degree level: examples would be risk assessment, bacteriology, virology, toxicology, immunology and public health (Mckenzie & Hathaway 2006).

Veterinarian means a person registered or licensed by the relevant veterinary statutory body to practice veterinary medicine/science in that country. The role of the Veterinary Services has traditionally extended from the farm to the slaughterhouse, where veterinarians have a dual responsibility – epidemiological surveillance of animal diseases and ensuring the safety and suitability of meat. Training of veterinarians, which includes both animal health (including zoonoses) and food hygiene components, makes them uniquely equipped to play a central role in ensuring food safety, especially the safety of foods of animal origin.

In addition to veterinarians, several other professional groups are involved in ensuring food safety throughout the food chain, including analysts, epidemiologists, food technologists, human and environmental health professionals, microbiologists and toxicologists.

APPROACHES TO THE FOOD SAFETY

Eliminating or controlling food hazards at source, i.e. a preventive approach, is more effective in reducing or eliminating the risk of unwanted health effects than relying on control of the final product, traditionally applied via a final 'quality check' approach. Approaches to food safety have evolved in recent decades, from traditional controls based on good practices (Good Agricultural Practice, Good Hygienic Practice, etc), via more targeted food safety systems based on hazard analysis and critical control points (HACCP) to risk-based approaches using food safety risk analysis.

MEAT INSPECTION

Slaughter house inspection of live animals (*ante-mortem*) and the carcass (*post-mortem*) plays a key role in both the surveillance network for animal diseases and zoonoses and ensuring the safety and suitability of meat and by-products for their intended uses. Control and/or reduction of biological hazards of animal and public health importance by *ante-* and *post-mortem* meat inspection is a core responsibility of the *Veterinary Services* and they should have primary responsibility for the development of relevant inspection programmes.

At Farm level

Veterinary Services play a key role in ensuring that animals are kept under hygienic conditions and in the early detection, surveillance and treatment of animal diseases, including conditions of public health significance. The *Veterinary Services* may also provide livestock producers with information, advice and training on how to avoid, eliminate or control food safety hazards (e.g. drug and pesticide residues, mycotoxins and environmental contaminants) in primary production, including through animal feed.

Certification of animal products for international trade

Providing health certification to international trading partners attesting that exported products meet both animal health and food safety standards.

Certification in relation to animal diseases, including zoonoses, and meat hygiene should be the responsibility of the *Veterinary Authority.* Certification may be provided by other professions (a sanitary certificate) in connection with food processing and hygiene (e.g. pasteurisation of dairy products) and conformance with product quality standards.

Maximizing the contribution of the Veterinary Services to food safety

Veterinary Services to make the best possible contribution to food safety, the foremost important thing is education and training of veterinarians. The Veterinary Services should comply with the OIE fundamental principles of quality given in Chapter 1.3.3 of the OIE Terrestrial Code. Guidelines for the evaluation of Veterinary Services are provided in Chapter 1.3.4 of the OIE Terrestrial Code and in the OIE Tool for the Evaluation of Performance of Veterinary Services (the OIE PVS Tool).

Every profession has its golden age when its work is recognized to be vital to society and how people view the world. Now with globalization, more processed food, more and more food imports and exports worldwide, greater movement of animal and humans, it appears that it is the turn of the veterinary profession to be one of the most crucial to society.

CONCLUSION

Now with globalization, more processed food, more and more food imports and exports worldwide, greater movement of animal and humans, it appears that it is the tur n of the veterinary profession to be one of the most crucial to society. Their work with food of animal origin is an indicator of the influence they now have and will probably have in the future. Vets are not only trained to deal with all mammal species except man but also with birds, fish and exotic animals. They are trained in an extremely wide set of disciplines up to a degree level: examples would be risk assessment, bacteriology, virology, toxicology, immunology and public health to mention a few.

At the beginning of this issue, you were asked to consider what word you would associate with vet. It was likely you associated it with dogs, cats, and their health. Now you may perhaps consider associating many foods with the word vet. For hopefully in one sense much of the food you will eat in the future will have been “vetted”. That is it to say it will have been thoroughly checked by a vet.

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Marker Assisted Breeding in Cultivated Groundnut (Arachis hypogaea L): An Overview

M. S. Darvhankar[1] and J. H. Kamdar[2]

[1]Ph.D. Student Dept. of Genetics and Plant Breeding,
College of Agriculture, JAU, Junagadh, Gujarat
[2]JRF, ICAR-Directorate of Groundnut Research, Junagadh, Gujarat
*Corresponding Author : mayurdarwankar@gmail.com

Groundnut (*Arachis hypogaea* L.) is an annual legume crop, which is also known as 'peanut', 'earthnut', 'monkey nut' and 'goobers'. It is the 13th most important food crop and 4th most important oilseed crop of the world. Groundnut seeds (kernels) contain 40-50% fat, 20-50 % protein and 10-20 % carbohydrate. Groundnut seeds are a nutritional source of vitamin E, calcium, phosphorus, magnesium, zinc, iron, riboflavin, thiamine and potassium. Groundnut kernels are consumed directly as raw, roasted or boiled kernels or oil extracted from the kernels is used as culinary oil. It is also used as animal feed (oil pressings, seeds and fodder) and industrial raw material (enzyme production). These multiple uses of groundnut plant make it an excellent cash crop for domestic markets as well as for foreign trade in several developing and developed countries.

Groundnut is unique among all the leguminous crops and designated as "wonder legume" in that after flowering, fertilization and fruit set, the pegs (gynophores) elongate and penetrate in the soil (positively geotropic) where the fruit enlarges and matures. The crop can be grown successfully in places receiving the rainfall of 500 to 1250 mm. The crop performs best on the sandy loam and loamy soils and also black soils with good drainage and takes from 90 to 135 days for maturity. Cultivated groundnut originates from South America. The Portuguese apparently introduced it to West Africa and by Spaniards introduced it to south-western India in the 16th century from Brazil. It is one of the most popular and universal crop cultivated in more than 100 countries in six continents. In groundnut several attempts have been made to construct genetic linkage maps in diploid species using RFLPs (Restriction Fragments Length Polymorphisms), AFLPs (Amplified Fragment Length Polymorphism), RAPD (Random Amplified Polymorphic DNA) and SSRs (Simple Sequence Repeats) (Halward et. al. 1993, Milla *et. al.,* 2003, Moretzsohn *et. al.,* 2005, Garcia *et. al.,* 2005, Gobbi *et. al.,* 2006 and Kamdar *et. al.,* 2014) but very few studies have been reported in tetraploid species using RFLPs and AFLPs (Burrow *et. al.,*2001 and Herselman *et. al.,* 2004). However, low level of polymorphism in the tetraploid (AABB) groundnut has limited the integration of SSR marker into genetic maps. To date, the number of SSR marker loci integrated into a single cultivated groundnut genetic

map has not been sufficiently high (Varshney *et. al.,2009a,* Khedikar *et. al.,* 2010, Sarvamangala *et. al.,* 2011, and Hong *et. al.,* 2010).

The paucity of DNA (Deoxyribonucleic Acid) polymorphism in cultivated groundnut may be due to the suspected single event of polyploidization. Further isolation from its wild relatives also poses a considerable obstacle to genetic mapping in groundnut. For instance, earlier studies using RFLPs, RAPDs and AFLPs marker detected limited DNA variation in *Arachis* species (Kochert *et. al.,* 1991). Among types of marker systems, the simple sequence repeat (SSR) or microsatellite marker that are co-dominant and hyper-variable are considered to be the potential marker of choice for application in various breeding programs (Gupta and Varshney 2000). They have detected higher levels of polymorphism in most crops compare to RFLPs , RAPDs and AFLPs (Hopkins *et. al.,* 1999, He *et. al.,* 2003, Ferguson *et. al.,* 2004 and Mace *et. al.,* 2006). More than 4000 SSR markers in both public domain and / or accessed from various collaborators are available (Hopkins *et. al., 1999, He et. al.,* 2003).

Genomic studies in cultivated groundnut are quite challenging because of the large genome size, narrow genetic diversity in the primary gene pool, paucity of DNA polymorphism and lack of knowledge on the genetic basis of most important traits. Therefore, developing a dense genetic map such as a "consensus map" that can be used as a reference resource for many genetic studies in different genetic backgrounds would provide the framework for transferring genetic information between different marker technologies. Such a map also allows the rapid localization of markers between various published maps and facilitates the selection of markers for high-density mapping in defined regions.

The construction of genetic linkage maps has become an essential steps for molecular breeders in order to use various molecular breeding strategies for improving abiotic and biotic stress resistant varieties and also in identification of potential regions in the genome which may be further transferred into important cultivar varieties and / or used in map based cloning of the resistance genes. Therefore, appropriate molecular markers and genetic maps integrated with molecular markers are pre-requisites for MAS (Marker assisted breeding).

Consensus maps were developed in several crop species such as Brassica oleracea (Kianian and Quiros 1992), maize (Beavis and Grant 1991), soybean (Song *et. al., 2004 and Choi et. al., 2007*), barley and wheat (Somers *et. al.,* 2004). However, groundnut is still lagging behind except for a recent report of a comprehensive genetic map developed by Hong *et. al.,* 2010 with 175 loci using there mapping populations. Therefore, one objective of the present study is to construct a high- density genetic linkage map for cultivated groundnut using exclusively SSR markers.

Due to the demand to increase groundnut production under various stresses, several mapping populations have been developed using diverse parents for a combinations of traits. However, most of the studies are focused

on biotic stresses such as tomato spotted wilt virus, leaf rust, late leaf spot, aphid vector of groundnut rosette disease and nematode resistance. Only a few studies on abiotic stresses such as drought tolerance, even though drought being a major abiotic constraints of groundnut production that weakens the plant making it more vulnerable to disease infestation and insect pests. Now- a –days developing drought tolerant varieties is the most recommended and sought after strategy to mitigating drought stress in groundnut, and is becoming even more important due to the ever changing weather patterns. Thus, more attention has been paid to drought tolerance by groundnut breeders and physiologists over the past few years.

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Grazing Behaviour In Dairy Cattle

Thulasiraman P.[1]*, Dhinesh Kumar R.[1], Aasif Ahmad Sheikh[1], Mohammad Rayees Dar[1], Lakshmi Priyadarshini[1] and Chandrasekar T.[1]

[1]Ph. D Scholar, National Dairy Research Institute (NDRI), Karnal, Haryana – 132 001
[2]Ph. D Scholar, Veterinary College & Research Institute (VC&RI), TANUVAS, Namakkal, Tamil Nadu – 637 002
*Corresponding author e-mail id: drtraman@gmail.com

Ruminants are grazers, whose diet is dominated by grasses. It evolved as herd animals so it always grazes in groups. It often forms bonds with herd mates during grazing. The various factors which influence the grazing behavior are Preferences, Social factors, Grass waste by fecal deposits, Grazing time and water. A cow's selection of plants is partly instinctive and partly learned. Usually it spends 7-9 hrs for grazing and 5-9 hrs for rumination in 24 hrs. It selects young plants due to its rich nutritional content. Cattle are gregarious, uneasy and restless if separated from the herd yet they also need their individual space. They do best in relatively small groups rather than concentrated in small pastures in large groups. Poor distribution of water within the pasture is the primary cause of poor livestock distribution in most grazing systems. For large pastures, a common rule of thumb is to provide one watering point for every 50 head of cattle or 300 sheep. We conclude that grazing based livestock husbandry plays an important role in the rural economy of India with huge livestock populations. So, Knowledge on cattle grazing behavior and habits can be used to be advantage when managing cattle on pasture

Keywords: Grazing behavior, cow, plants, diet

Ruminants typically fall into one of three groups based on their preferences for different forage types. These groups include *grazers* (cattle and horses) whose diet is dominated by grasses, browsers (goats) whose diet preference primarily on forbs and shrubs, and intermediate feeders (sheep) who does not exhibit any particular preferences among grasses, forbs, or shrubs

Table 1: Shows grazing choice of range plants by kinds of domestic livestock

Grazing% Plants	Cattle	Sheep	Goats
Grass	70	60	20
Weeds	20	30	20
Browse	10	10	60

(Source: Bell, 1978)

Cattle don't have upper front teeth, instead it having dental pad. Cattle can't nip off plants as a horse does but use their flexible tongue to wrap around a "bite" and break it off with a movement of the head. They cannot graze as closely as a horse or sheep does.

Cattles are herd animals, so it always grazes in groups. If one individual is separated/isolated from it group then it is an indicator of itself for sick/lame. On pasture cattle often form bonds with the herd mates and graze.

PREFERENCE

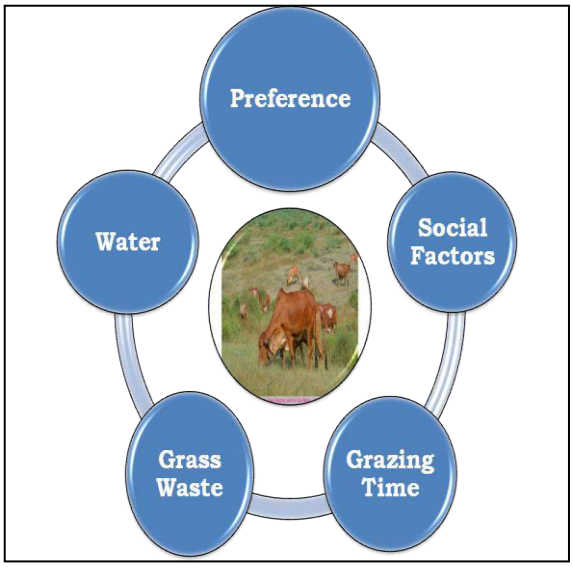

Fig 1: Shows the various factors which influences the Grazing behavior of cattle

A cow's selection of plants is partly instinctive and partly learned from experience with various feeds. In general, cows spend 7-9 hrs/24 hrs for grazing, with resting and 5-9 hrs/24 hrs for rumination in between.

Heavy grazing occurs during early morning or at late evening and under some conditions during the nights (especially hot days). Most of the Rumination occurs at night when cattle are resting, but it also does rumination between meals during the day.

e.g.: Mature cow which never fed grain, when we offer grain feed it refuses to eat it. But cow grew up in eating grain will readily eat it when offers.

e.g.: Young stocks learn much of their feed preferences by mimicking other herd mates, especially their mothers. Calves samples their mothers hay when only a few days old and stick their noses in water when mothers drinks, by contrast a hand reared calf may not try hay or grain (or water) until several weeks old or older, because it does not have a role model to copy, in this case we stick the feed in its mouth a few times.

Cattle usually prefer new tender or regrowth plants and avoid older as well as mature plants because the level of most nutritive components of a plant declines as it matures (especially protein) and it selects the plants that are low in fiber content. Rotational grazing works better than season long-grazing because in long grazing, the plants are over grazed. Due to overgrazing the plant become coarse and dry. Once it becomes coarse and matured, the cow won't prefer to eat it unless there is no other choice left to eat it.

SOCIAL FACTORS

Cattle are group grazers. They evolved as herd animals for protection against predators, staying together while grazing, eating quickly consumable plants, then remasticate during its rest time at safe

place. They graze over the pasture in a common direction, with a specific inter-animal distance between herd mates. Cattle are gregarious, uneasy and restless if separated from the herd. Yet they also need their individual space. They do best in relatively small groups rather than concentrated in small pastures in large groups. In contrast, If we put them too many in a small area, they become restless and do more walking and trampling the grass rather than grazing.

Grass waste by fecal deposits

In large pasture, cattle have lot of area to graze hence fecal material dispersed over a wide area, whereas in smaller pastures, fecal deposits may hinder grazing. Cattle don't like to graze plants near their manure/fecal deposits because it have the choice of other cleaner areas to graze and it is a nature's way of limiting parasite infection that is of from fecal origin. But cattle will eat grass around manure of other species such as horses or sheep, whose parasites can't complete their life cycle in cattle.

Grazing time

Cattle need adequate grazing time to eat enough forage to meet their needs. If feed is good, they get fully quickly and spend more time in resting. If feed is scarce, they spend more time on grazing because they don't have enough feed for remastication. If cattle are spending part of their normal "resting time" in eating, this is a clue they don't have enough feed.

Cattle use weather to best advantage while grazing. In extreme heat, cattle spend more time in the shade then grazing and do grazing at night when it's cooler. In winter, when the environment are cold and short days, cattle stand around waiting for sunshine instead of grazing. In order to survive during winter they tend to eat roughages (high in fiber) because digestion of fiber generated high heat without any loss in production.

In Stormy or Heavy rain, cattle usually halt grazing. But a little rain often encourages them to graze, because the temperature drops due to light rain during the hot day.

The position of head oriented towards sunshine during cold, whereas during cold wind and rain, they stand with hindquarters to the wind to shield their faces and during hot days they oriented their head opposite to the sunshine.

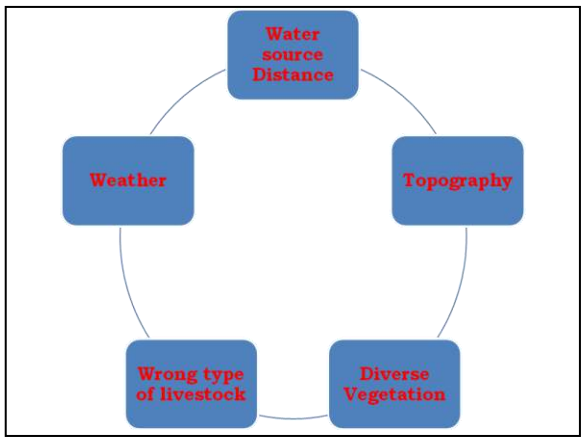

Fig 2: Shows the various factors which influences Poor Grazing of cattle (Marks S Thoren, 2009)

Water

Poor distribution of water within the pasture is the primary cause of poor livestock distribution in most grazing systems. Grazing tends to be highest near water sources and decreases with distance from water, resulting in zones of

over-utilization nearby water and under-utilized pasture farther away.

The normal watering points distance should be 1 mile in hilly areas and 2 miles in flat areas. For large pastures, a common rule of thumb is to provide one watering point for every 50 head of cattle or 300 sheep.

CONCLUSION

Grazing should mitigate the hunger i.e. to maintain proper energy balance, predator free and proper rest. Grazing based livestock husbandry plays an important role in the rural economy of India with huge livestock populations. So, Knowledge on cattle grazing behavior and habits can be used to be advantage when managing cattle on pasture.

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Managemental Strategies To Improve Conception Rate Through Artifical Insemination in Bovine

V. Boopathi, P. Sankar and P. Ravi

Veterinary College and Research Institute, Orathanadu-614625

Artificial insemination (AI) is the best tool available to raise healthy and economic livestock in least possible time. Without doubt, AI's greatest contributions has been in increasing the milk and meat production, in reducing the incidence of venereal or coital diseases and in facilitating the movement of good quality genetic material between herds and between countries. Hence, for more than 50 years AI has had a major impact on breeding of cattle and buffaloes, which ultimately led Indian to rand top in milk production. India Possesses largest cattle and buffaloes population in the world i.e. 200 million and 105 million respectively. There is a lot of scope to improve milk production of country by upgrading of genetic makeup of indigenous cattle and buffaloes population in the world i.e. 200 million and 105 million respectively. There is a lot of scope to improve milk production of country by upgrading of genetic makeup of indigenous cattle and buffaloes by inseminating with semen from exotic/proven sires through AI technique. The main advantage of AI is that the maximum utilization of best sire can be achieved, as approximately 200 cows can by inseminated from a single ejaculate of a bull. Spread of various venereal diseases is also contained in this procedure since the bull to be used in the AI programme undergoes rigorous screening for several potential diseases before induction into the program. Further this technique is easy cheap and very much user friendly provided the technician has sufficient knowledge about the reproductive system of the animals. However, the success of this technique depends upon several factors, which are detailed in this folder.

PRESENT STATUS OF AI IN INDIA

Although the AI technique has started from 1939, its coverage in the country is still very low. Around 25% of the total breedable population of cattle and buffaloes are only bred by AI while the remaining population is being bred by natural service with the remaining population is being bred by natural service with mostly inferior bulls thus slowing the genetic progress. In addition to the poor coverage, the conception rate (CR) in the animals bred by AI is also very low, around 30 – 35% only. Among the several factors contributing to the low success with this technique, the proper method of handling frozen semen, identifying animals at proper stage of receiving semen and proper method of insemination are the most determining factors for achieving high conception rate. In addition to the Veterinarians, Para-veterinarians and inseminators with different degree of skills are also performing AI in the country.

Inseminating right animals at right time

This is the biggest bottleneck in achieving high conception rate (CR) in AI. The cow or buffalo in heat express several signs, the duration and intensity of each sign vary with breed as well as individual animals within a breed. It is very difficult to pinpoint a particular sign to depend upon for insemination. Among the cardinal signs of estrus, the typical arborisation pattern of cervical mucus and standing to be mounted are the two most reliable signs in cattle and buffaloes. For best fertility rate with AI, cattle should be inseminated during mid to last half of standing heat. The A.M. and P.M rule has been developed as a guide. As per this rule, cows that have come into heat in the morning (A.M.) should be inseminated in afternoon (P.M.) and those who have come into heat in the evening should be bred next morning. However there exist a lot of differences between "coming into heat" identifying in heat". Generally under Indian conditions the onset of estrus is not precisely looked for; but only those animals that have already came into heat is observed/identified as in heat based on some behavioural signs. In this case, it is better to inseminate the animals immediately after identification of heat as one is not sure about the onset of heat. If still the animal continues to show heat signs, the insemination can be repeated after 12 h. In village conditions, generally, the animals are brought to the Veterinary Hospital or AI Centre from a distance. Inseminating these animals immediately after arrival or taking back the animals immediately after arrival or taking back the animals immediately after insemination is not desirable, as adrenaline and cortisol levels increase in these animals leading to altered LH surge ultimately decreasing the chances of conception. Thus all animals brought for AI should be given res for 10 – 15 minutes before performing AI.

Proper handling of frozen semen straws

Handling of semen right from the storage containers to loading of the gun should be done by qualified veterinarian / trained persons. Frozen semen is stored in Liquid nitrogen containers at – 196^{0}C in a goblet of canister. If the goblet is lifted beyond the neck of the container, semen straws are exposed to room temperature. Repeated exposure can lower the fertility due to thermal shock injury. Therefore, it is advised to use a forceps to lift individual straws from goblet. It has been observed that often inseminators pick the straw with fingers, roll it in between palms and carry the thawed semen in ice cubes in a thermos flask. In this method, spermatozoa are exposed to fluctuations in the temperature and results in lowered/nil fertility. While doing AI at doorstep of farmer, it is advisable to carry the semen in liquid nitrogen container and thawing should be done at doorstep of farmer and insemination should be carried out within two minutes after thawing. Although thawing can be done at different temperature and time combinations, the standardized combination that results in good conception rate is thawing the frozen-semen straws at 37^{0}C for 30 seconds. Thermometer and watch should be used to exactly adhere to this thawing method.

After thawing, the semen straw need to be wiped with cotton / paper,

since exposure of spermatozoa to a small drop of water can result in lowered fertility. It should always be remembered that water is lethal to spermatozoa. If the air bubble is located in the single plug (Laboratory seal) side of the straw, then it can be cut with clean scissors. If it is located in the middle of the straw, it should be moved towards the single plug side by shaking gently before cutting. The straw should be gently placed in the gun and slided into the sheath and the sheath should be secured with the gun tightly using 'O' ring. Before loading, the AI gun should be warmed. There should be no gap between the cut end of the straw and the sheath otherwise part of semen may remain in the sheath thus reducing the number of spermatozoa per insemination. If the inseminating crate is not covered with a roof, wrap the prepared inseminating gun with a clean dry paper towel to protect against dirt, ultraviolet rays of sun and temperature fluctuations.

METHOD OF INSEMINATION

All efforts to make AI successful using proper collection, handling and processing of semen are worthless if insemination is not properly carried out. The cow or buffalo to be inseminated should be restrained well; otherwise there is every chance to damage the uterus by AI gun improper deposition of semen leading to poor CR. Before introducing the gun, perineum and vulval area of the animal has to be wiped properly to avoid infection carried through the gun. Insemination gun should be inserted at 30-45^0 angle after opening vulval lips to avoid urethral opening. Once the insemination gun reaches fornix of the vagina, it should be placed on the external os of the cervix and gently guided through the cervical canal. Slight forward pressure may be applied on the gun while manipulating cervix slightly ahead of gun. Accurate placement of AI gun tip is probably the most important skill involved in the whole AI technique. Inseminator should be able to identify this target area by feeling for the end of cervix and the tip of the gun as the gun emerges through the internal os. In case of frozen semen, the site of deposition is the body of uterus, just next to the internal os of the cervix. After withdrawing the gun, uterus can be massaged gently as it may hasten the sperm transport. Once the gun tip is placed at the internal os of the cervix, semen can be deposited gently over a period of 5 seconds.

POST – INSEMINATION FOLLOW UP

After insemination, the AI gun should be withdrawn gently and while withdrawing it is suggested to make the gun glide over the clitoris, which helps in the release of oxytocin that favours sperm transport. Alternately the clitoris can be massaged manually. The AI gun should be examined for any blood tinge or pus on the tip of gun or backflow of semen between AI sheath and straw. If there is any indications of mild infection, post-insemination antibiotic therapy can be undertaken. For this purpose, one gram Ampicillin dissolved in distilled water can infused into the uterus after an hour of insemination. The owner of the animal should be advised to monitor the animal for heat signs and if the animal is found in heat even after 12h of insemination, the animal should be re-inseminated. If all these procedures are followed strictly, the success of AI can substantially be improved.

Role of Women in Renewable Energy Development and Management

Dr. Bhawana Asnani

Assistant Professor,
Polytechnic in Home Science, J.A.U., Amreli, Gujarat
E-mail id- bhawana_asnani@yahoo.com

Renewable energy or non-traditional or that energy that can regenerate is on the one hand seen as an effective option for meeting a society's ever increasing energy demands ,on the other hand , it also provides a degree of national energy security. Women are the mainstream users of the energy and without their involvement, renewable energy projects risk being inappropriate and failing. Energy policymakers who ignore women's need will be failing to make use of a powerful force for renewable energy development. They perform the roles as consumers, micro-entrepreneurs, extension workers, leaders etc. Cooking with traditional fuels creates various health hazards and others obstacles. Thus, the need of using renewable energy techniques are emerging and flourishing these days. Though, initial cost is high, but if used for long period it is beneficial overall. Also saves nature in turn.

Energy is the crux of human life and it is an integral part of the major activities of household. A bulk of the gross energy consumed is most of the developing countries is derived from locally available traditional energy sources but the dependence on these traditional energy sources has several ecological and social consequences and other health hazards on our society, specially on women.

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WOMEN AND ENERGY INVOLVEMENT-

Women are the mainstream users and often producers of energy because they are the main users of household energy. In developing and industrial countries, they influence or make many family purchases related to energy (Balakrishnan, L.). They are also experienced entrepreneurs in energy related enterprises. The various domestic technologies available in India which directly benefit Women, amongst others are:

1. Improved Cook Stoves
2. Biogas
3. Solar thermal devices:

Box type solar cookers, parabolic cookers and solar storage cookers. And Solar water heater and Purifier

4. Vermi Composting and nursery raising using biogas slurry,

5. Solar PV systems- Solar lanterns, charging station, Home light systems etc.

DIVERSE ROLES OF WOMEN IN RENEWABLE ENERGY ACTIVITIES-

a. ***As Energy Consumers and Beneficiaries-*** Improved stoves programs and solar cooker projects have been more effective and produced more benefits when they have obtained women's input to product design.
b. ***As micro entrepreneurs-*** women may be effective renewable energy entrepreneurs, due to their experience as users of energy in households and their own enterprises, in some countries women are already marketing solar home systems successfully.
c. ***As extension workers and caretakers:*** women have been effective in operation and maintenance roles of biogas, hydroelectric and solar installations.
d. ***As leaders and networks-*** women have a role in determining the use and benefits of the renewable energy project and in managing these arrangements, and that they receive and control benefits.

WHY WOMEN NEED RENEWABLE ENERGY?

1. <u>Fuel scarcity, health and safety-</u> About 80 percent households fuel consumption of our country uses biomass fuel mainly for cooking and heating. Biomass cooking create high exposure to indoor air pollution. The main indoor pollutants are carbon monoxide, benzene and formaldehyde.

Various health problems / physical discomfort, viz., headache, stiff neck, chest pain, backache, skin irritation, skin fungal infection, cough, sinus, repetitive strain injuries etc. affect the housewives of age between 30 to 50 years. Viewing the health hazards faced by women, she needs renewable energy to address their critical need for cooking energy that is less labour intensive, more convenient and safer. Biogas plants that use cow dung, are based on biomass and easily available to poor landless women to use as a cooking fuel (Cecelski E., 2000).

2. <u>Human energy crisis -</u>

Human energy is essential to survival in the rural production .much of this human energy is un Paid family labour by women. Women work longer hours than men. Women in rural areas of developing countries spend long hours working in survival activities such as firewood collection, water hauling, food processing and cooking. Of the total burden of work, women carry more than half. Three fourths of men's work is unpaid market activities, compared with only one third of women's work. As a result, men receive the share of income and recognition for their economic contribution while most of women's work remains unpaid, unrecognized and undervalued.

Women need renewable energy to address their labour saving and human energy

needs, such as pumping water from household uses, food processing and grain grinding and transport.

3. Energy for micro enterprises

Both rural and urban women need adequate supplies for their small and medium scale enterprises and home industries. These informal sector activities are highly fuel intensive.

These biomass and energy based small industries have been severely affected by rising energy costs, fuel shortages and deforestation. Also these industries tend to be low wage, labour and effort –intensive and tiring, as well as sometimes dangers to women health.

Implications for renewable energy development-

- To improve profitability and safety in their energy –intensive microenterprises
- To save labour.
- Use of vegetable dryers, improved fish smokers and renewable energy powered grain grinders and millers for improving production in food processing activities.
- Lighting by photovoltaic system for more efficient work in evening in home and industries.

4. Need of energy for the modern sector

Women still need efficient energy in our country because they play the key role in household energy use in modern and modernizing societies. They make critical decisions about fuel substitution and purchase of stoves and other appliances, based on their fuel preferences and budget constraints. So it is more important to involve women in renewable energy and energy efficiency programs, because women influence –

- The use of lighting, heating and air conditioning, hot water and electrical appliances, including the choice of time of use, and therefore peak use.
- Household purchases of goods and services, which may be more or less energy –intensive or wasteful, eg. packaging.
- Household management habits, such as recycling and composting.
- The use of household transport and choices about the use of private automobiles, bicycles, or public transport.

ENERGY MANAGEMENT: NEED OF THE HOUR

Women are the producers and users of fuel whether commercial or non commercial, in all rural households. Therefore the following strategies would benefit in improving their energy management-

- Energy management aspect is of almost importance to them and requires focus through education on the present energy situations and the need and ways of energy conservation.
- Technological options can prove successful, only when women understand them .
- Renewable energy programs should be based on local needs resources, and skills of specific areas and villages.
- Women should be involved in energy related programme

planning, right from the planning stage itself.

- Macro concerns and technological achievements should be linked with local daily requirements.
- The high percentage of non-commercial energy used, particularly firewood, necessitates rigorous afforestation measures coupled with economical use through fuel efficient working devices like smokeless chulha etc.
- Programmes of energy plantations like biogas plants will serve apart from the environmental Impact, the dual purpose of afforsetation, fuel supply and also an additional benefit of providing income for women.

CONCLUSION

Thus it is concluded that women are the mainstream users of the energy and without their involvement, renewable energy projects risk being inappropriate and failing. Energy policymakers who ignore women's need will be failing to make use of a powerful force for renewable energy development. Energy researchers who leave women out of energy research and analysis will be failing to understand a large part of energy consumption and production. So much work remains to be done for the sure success of renewable energy projects and enterprises.

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Semen Metabolomics As Biomarker For Reproductive Efficiency In Dairy Animals

Dhinesh Kumar R[1*], Thulasiraman P[1], Chandrasekar T[1], Gopi M[2], Manobhavan M[3], Sathiya Barathi M[4] and Aasif Ahmad Sheikh[1]

[1]Ph.D. Scholar, ICAR-NDRI, Karnal-132001; [2]Scientist, ICAR- CARI, Izatnagar-243122
[3] Ph.D Scholar, IVRI, Izatnagar-243122; [4]MVSc Scholar, ICAR-NDRI, Karnal-132001
*Corresponding author mail: dhinesh.ramasamy@gmail.com

Early estimation of bull fertility is highly demanding for the conservation of male genetics of endangered species and of genetically superior sires in artificial insemination programs. Early estimation of fertility in bulls also helps in cost effective production of frozen semen. *In vivo* assessments of bull fertility is the most reliable but is expensive, laborious, and time-consuming method. Young bulls when rejected by breeding stations for their poor quality semen or fertility incur a heavy loss to farm in terms of their rearing expenses. Hence an *in vitro* method to predict the bull fertility will be very helpful in commercial farming conditions.

METABOLOMICS

Metabolomics is the study of small, low molecular weight, molecular metabolites that are the products of metabolism. Metabolomics reflects events downstream of gene expression and is considered to be closer to the actual phenotype than either proteomics (protein study) or genomics (DNA study). In addition to gene expression, post- transcriptional and post-translational events regulate metabolic fluxes. With the downstream results of gene expression, changes in the metabolome are amplified thereby increasing their sensitivity (Deepinder, 2007)

SEMINAL PLASMA AND METABOLITES

Seminal plasma are derived from accessory sex glands containing proteins that contribute to sperm motility, sperm membrane protection, protection from oxidative stress, capacitation and acrosome reaction, and oocyte penetration (Therien et al., 1995). It contains several proteins, amino acids, enzymes, fructose, and other carbohydrates, lipids, and major minerals and trace elements. The majority of seminal plasma constituents are derived from blood, whereas some are seminal plasma-specific (Rothschild and Barnes, 1954): Blood contributes albumin, antitrypsin, b-lipoproteins, and orosomucoids; all these components help with osmotic regulation, maintenance of pH, and transport of ions, lipids, and hormones. Seminal plasma-specific proteins include androgen binding proteins, osteopontin, clusterin, spermadhesin, as well as calmodulin-

binding proteins, forward-motility proteins, and heparin-binding proteins (Perumal, 2012); these specific protein components regulate oviductal sperm reserves, capacitation, uterine immune modulation, and sperm transport in the female genital tract, as well as in gamete interaction and fusion (Topfer-Petersen et al., 2005). In the seminal plasma, fertility-associated proteins are also identified from dairy bulls (Killian et al., 1993; Moura et al., 2006) and crossbred bulls (Muhammad Aslam et al., 2014). Abundance of bovine seminal plasma protein, clusterin, albumin phospholipase A2, and osteopontin is found in the accessory sex gland fluid of high fertility bulls (Moura et al., 2007).The concentrations of citrate, lactate, glycerylphosphorylcholine, and glycerylphosphorylethanolamine are reportedly higher in the seminal plasma of infertile than fertile males (Deepinder et al., 2007). The presence of citric acid, aglutamyl transferase, and acid phosphatase in seminal plasma (Mankad et al., 2006) and leptin in serum are also predictors of epididymal function, prostate function, and sperm morphology (Bhat et al., 2006).

Kumar and their co-workers (2015) in a study adopted the variable importance in projections (VIP) score in seminal plasma and serum as a measure of their potential as a bio-marker, on a scale of 2-5 based on the proton nuclear magnetic resonance values. Seminal plasma metabolites with a VIP score more than 2 included citrate (2.50parts per million [ppm]), tryptamine/taurine (3.34-3.38ppm), and isoleucine (0.74ppm) and leucine (0.78ppm). Heat-map analysis, based on VIP score, indicated citrate and isoleucine were low whereas tryptamine/ taurine and leucine were greater in high-fertility bulls than low-fertility bulls

Likewise, serum metabolites with VIP score >2 were identified as isoleucine (1.14ppm), asparagine (2.90- 2.94ppm), glycogen (3.98ppm), and citrulline (1.54ppm). Heat-map analysis, based on VIP score, indicated that isoleucine and asparagine were low and glycogen and citrulline were significantly greater in high-fertility bulls as compared to low-fertility bulls. Heat-map analysis revealed citrate to be the most important fertility-associated metabolite, with a VIP scoreof 5 and appearing at 2.50ppm as four peaks in 1D NMR spectra similar to the profile in human seminal plasma (Gupta et al., 2011).

METABOLITES AND ITS ACTION:

High-fertility bulls' seminal plasma exhibited low levels of citrate and isoleucine versus high levels of tryptamine, taurine, and leucine. Citrate is the main anion of seminal plasma, which chelates calcium ions and hinders sperm capacitation and spontaneous acrosome reactions (Ford and Harrison, 1984). Thus, low levels of citrate are favoured in bull sperm to undergo capacitation and the acrosome reaction for fertilization. Indeed, citric acid has been associated with the gelification, coagulation, and liquefaction of semen in rats (Hart, 1970), monkeys (Hoskins and Patterson, 1967), and humans (Huggins and Neal, 1942). High

citrate concentration in seminal plasma was measured in infertile men (Cooper et al., 1991), although no correlation between citrate levels and fertility has been reported from the clinic (Zopfgen et al., 2000). Interestingly, citrate abundance is a prominent biomarker for prostate cancer (Kurhanewicz et al., 1995). Tryptamine promotes the acrosomal reaction and regulates sperm motility in capacitated hamster sperm (Jimenez-Trejo et al., 2012). Taurine is abundant in the seminal plasma of humans (Holmes et al., 1992) and cats (Buff et al., 2001), and has been reported to enhance post-thaw motility and sperm survival when used as an exogenous supplement (Chhillar et al., 2012). Finally, the aminoacids isoleucine and leucine are responsible for delaying calcium uptake by ejaculated sperm by altering active calcium transport across the sperm plasma membrane (Rufo et al., 1982). Together, the abundance of these differential metabolites in seminal plasma likely control the fertility potential of sperm by regulating calcium availability, which affects sperm motility, capacitation, and acrosome reaction.

METABOLITES OF OXIDATIVE STRESS

Excessive production of reactive oxygen species (ROS) leads to oxidative stress and impairs antioxidant defense mechanisms. These markers include –CH, -NH, -SH, C=C and –OH which are found in male reproductive tracts affecting sperm quality and function. (Agarwal A, 2005)

CONCLUSION

Citrate, tryptamine / taurine, isoleucine, leucine, aglutamyl transferase, acid phosphatase and oxidative stress metabolites in seminal plasma and isoleucine, asparagine, glycogen, citrulline in serum are some of the metabolites which can be used to detect early fertility in bulls. The detection of these metabolites will help the breeders to make reasonable decisions in choosing the superior quality bulls at an early stage and avoids the unnecessary spending on unproductive bulls rearing.

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Prospects of Organic Poultry Farming in India

Dr.Rajashree Rath[1], Dr.Vijay Singh[2] and Dr.Showkat Ahmad Bhat[1]

[1]Ph.D Scholar, Division of Livestock Production Management, NDRI, Karnal, Haryana
[2] Ph.D Scholar, Division of Poultry Science, CARI, Izatnagar, Bareilly.
Corresponding author: Dr.rajashreerath@gmail.com

Now a day the term "**organic**" has conquered our hearts and mind. Day by day the concept of **Organic Farming** is gaining momentum and paving its way to emerge, as one of the powerful tool of the twenty fast century. Be its meat, eggs or vegetables, organic products are among the top preferences of the consumers in today's market. It prohibits the use of synthetically produced fertilizers, pesticides, growth regulators and livestock additives. It is the ecological production management system that promotes and enhances biodiversity, biological cycles and biological activity of the soil. Poultry sector plays a significant role in improving the socio-economic condition of rural masses, by generating gainful employment and augmenting family income, particularly among the landless labourers, small and marginal farmers and women in rural areas (Biradar *et al.,* 2011). In Organic farming more focus is laid towards animal health and welfare, good environmental practices, and product quality and least towards economic measures, such as reducing costs and maximizing production (Sundrum, 2006). FAO/WHO Codex Alimentarius Commission defines organic farming as ***"a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity, and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs".***

Organic poultry practices focus on living conditions that permit natural behaviors and provide outdoor access, preventive health management with a prohibition of antibiotics or other drugs (although vaccines can be used), and organic feed. Organic feed is raised without synthetic fertilizers and pesticides and pastures to which birds have access must also be organic.

1. CONCEPT OF ORGANIC POULTRY FARMING:

The main aim of organic farming is to establish and maintain soil – plant, plant animal and animal- soil interdependence and to produce a sustainable agro-ecological system based on the local resources (Biradar *et al.,* 2011). The establishment of organic animal / poultry husbandry requires a specific period called as "**conversion period**". This period is the time taken between the start of the organic management on farm and certification of livestock farm and its product (Biradar *et al.,* 2011). Changing from conventional to organic management system for livestock

enterprises requires a careful and gradual approach. The length of conversion period should be at least 45days both for meat and egg production. In organic poultry farming the preference is given to local breeds. Animal must be born to organically managed dams if they are to be slaughtered for organic meat production (Chander *et al.,* 2006). Further, maximum care should be taken to provide environment where the birds can exhibit their innate behaviour.

2. ORGANIC POULTRY BREEDING

Breed should be chosen which are adaptable to local conditions. Breeding goals should not be in opposition to animal natural behavior and should be directed towards good health. In addition, breeds or strains of animals should be selected to avoid specific diseases or health problems associated with some breeds or strains used in intensive production. Preference is given to indigenous breeds and strains. The use of genetically engineered species or breeds is not allowed. Reproduction technique should be natural. Artificial insemination is allowed only upon veterinary necessity (Chander *et al.,* 2006). Hormonal treatment for more egg production should be prohibited. Three main constraints associated with poultry breeding for small scale production in India are availability of appropriate breeds, transport costs and suffocation losses and non availability of hatcheries supplying required small number of chicks. There are some breeds which are developed by different institutions such as Giriraja, Vanraja, Grampriya etc breeds that have been developed with organic and free range systems in mind.

Figure 1 Vanraja

Figure 2 Grampriya

Figure 3 Hitcari

2.1. Poultry equipments (feeder & water space):

Feeder and drinker space should be provided to reduce competition and aggressive encounters which could result in injury (guidance for organic poultry production 2009).

4 BASIC REQUIREMENTS OF AN ORGANIC POULTRY HOUSE

Adults laying birds in organic system of production should be provided a space of minimum 2ft per bird in the confined area and 3ft in the sunning /foraging area i.e. 5 sq ft/bird. The beddings must be kept dry at all times by removing the wet caked parts and turning the litter often to keep it loose, dry and well aerated. The poultry house should be well ventilated. Solid walls are only raised 3ft high from ground and chicken wire fitted up to the roofing base to avoid direct wind draughts into the poultry house. Walls should be constructed to allow maximum natural light penetration which is important in regulating the laying pattern. The foraging area can be constructed entirely of poles and chicken wire on walls and roof. It is recommended that the open area be planted with lawn grass to provide green forage to the birds which improves the yellow egg yolk quality. Sunning of birds in this area helps in control of external parasites in birds as well as acting as natural disinfectant for pathogens. Birds are also able to synthesis vitamin D in their bodies from direct sunlight which necessary in deposition of calcium and phosphorous on egg shell and bones of the birds. The roof especially where it is constructed of iron sheets should have an under lying layer of insulating material like Makuti or grass thatch to protect the birds from extremes of very cold or hot weather. The poultry house should be fitted with laying nest 18 inches from the ground. Each nest should measure 2ft x 2ft x 2ft and provide with dry litter and slightly covered with a gunny bag sheeting for partial darkness that birds prefer during laying time. One such laying nest is adequate for 10 laying birds. A provision for flexible brooding area should be made in the poultry unit. Adequate provision of feeding and watering equipments at the optimum ratio per number of birds should be considered in design and space of the poultry housing unit.

5 NUTRITIONAL FACTORS

5.1. Organic poultry diets

Soil Association organic regulations state that organic poultry must be fed a diet that contains a minimum of 60 % certified organic feed. No more than 20 % of the diet should come from approved non-organic feeds. Organically reared birds need 20-50 % more food per unit of weight gain than conventionally reared birds, mainly because of increased activity and the temperatures in the run. Layers that are not fully grown at the onset of lay must partition nutrients for maintenance, egg production and growth. Fully-grown birds do not need to divert nutrients to growth functions. Besides the ratio between protein and energy being important, birds should not receive excess feed, as they will pick out some parts over others, which might result in an imbalanced diet. Scattering grain and providing roughage is a good way of keeping the hens busy and healthy. However, if feeding a compounded diet, the nutrient content of

the 'scatter grain' will affect the overall nutrient intake of the birds, and could lead to imbalances.

Table 4: Average daily feed intakes of conventional and organically reared bird (grams)

Bird type	Conventional	Organic
Layers	118	130
Table birds	77	85
Turkeys	138	152

(Source: Nutrient Requirements of Poultry 9th Edition)

5.2 Energy requirement

Metabolisable energy (ME) is the measure of feed energy used when comparing poultry diets. Birds excrete both faeces and urine via the cloaca, making it difficult to measure digestibility. An absolute requirement for energy in terms of kilojoules per kilogram of diet cannot be stated because poultry adjust their intake to obtain their necessary daily requirements. Poultry will increase intakes of diets with a lower energy content and therefore consume more nutrients, unless lesser concentrations of nutrients (e.g. protein, amino acids, etc) are used. Similarly, if diets contain higher energy content, the concentrations of other nutrients should also be increased to compensate for the decline in intake. Higher energy diets are generally more efficient in terms of weight gain per unit intake. Adding fat will increase the energy concentration of the diet. Temperature affects energy requirement, and since birds eat to meet their energy requirement, feed intake is also affected by temperature.

5.3 Protein requirement

Protein requirement has two components: (1) the essential amino acids needed by the bird (for maintenance, growth, egg production and immunocompetence) because it cannot synthesize them, or cannot synthesize them in sufficient quantities and (2) sufficient protein to supply either the nonessential amino acids themselves or to supply amino nitrogen for their synthesis. The biggest problem when formulating diets for organic production is in meeting the essential amino acid requirements of the birds while keeping dietary protein at a low level. Synthetic or crystalline amino acids are not permitted in organic poultry diets. Layers are generally fed ad libitum during the growing and laying periods. Broilers are also fed ad libitum to ensure rapid development to market size. Broiler-breeders, however, are maintained for hatching egg production. Since they can become obese, feed intake is usually restricted. However, some organic regulations require that a slow-growing strain must be one where parent lines are not feed restricted (Food Animal Initiative, 2004). In organic production, poultry are only kept for one laying season. They are not moulted and do not resume egg production.

6 DISEASE PREVENTION

The use of any type of antibiotics or chemotherapeutics is prohibited in organic farming. Unfortunately, birds treated with antibiotics can no longer be marketed as organic. Because of this, there has been a big push to find alternative treatment methods for common poultry ailments. So more emphasis is laid towards the use of natural medicines and methods including

ayurvedic, homeopathy medicines. Vaccination shall be used only when diseases are known or expected to be a problem in the region of the farm and where these diseases cannot be controlled by other management techniques. Vaccines consisting of or manufactured by the use of genetically modified organism may not be used in organic farming. Synthetic growth promoters should not be used. Probiotics, prebiotics and organic acids when added to feed and drinking water are known to improve the health status of the birds. The antimicrobial abilities of various plant extracts, especially essential oils, can act as an effective alternate treatment for common poultry ailments. Essential oils could be used to control *Clostridium perfringens*, the bacterium that causes necrotic enteritis in broilers (Mitesh *et al.,* 2004). Garlic oil inhibits *E. coli* and *Salmonella typhimurium* in vitro.

7 FUTURE MARKET DEVELOPMENT: OPPORTUNITIES AND THREATS

The organic poultry sector is dominated by only a few main players. There is room for more and scope for the current group to expand further. In the case of eggs, most of the larger producers had well established markets and there was little evidence of significant competition between them. In the case of poultry meat, most of the major players are in regular contact with each other, mainly to trade at a wholesale level. The biggest threat is from free-range and 'additive-free' poultry which is often mistaken for being organic. Consumers also confuse organic with vegetarian. In addition, the development of barn-reared systems promoted as affordable animal welfare at prices close to conventional represents a potential threat. It was also alleged that rogue wholesalers/butchers were selling conventional broilers as organic poultry meat and benefiting from the higher prices charged. In practice, many of the organic producers supply both organic and free-range/additive-free birds with organic prices 30-50% higher than free-range in the same outlet. This indicates that there is a group of consumers willing to pay more specifically for the organic product, although it is questionable whether consumer understanding of, and demand for, fully organic birds will develop as fast as it might if only the fully organic bird were available. In many cases organic producers have also differentiated their product by hanging the birds before evisceration to enhance flavour, and this has resulted in positive consumer and trade response.

8 CONSTRAINTS FOR ORGANIC POULTRY FARMING IN INDIA

There is lack of in-depth knowledge about organic poultry farming on the part of poultry farmers and awareness among consumers is a hurdle in both at the production and marketing level. Inadequate Supporting Infrastructure like lack of adequate financial support, inadequate local certifying agencies and lack of marketing channels. Strict measures mainly sanitary conditions, quality and traceability followed by developed countries is an obstacle for small and marginal Indian poultry farmers to enter into export of organic products. Training facilities for poultry farmers are not and to others who have a interest in the financial adequate. So the emerging importance of animal (poultry) welfare started showing its

adverse implications for trade at international level, as there is growing argument that intensive cage rearing, forced moulting etc., are unethical and against the animal welfare.

CONCLUSION

Organic livestock farming can be considered as a revolutionary step towards ecological production management system. Greater emphasis on organic poultry farming ensures production of safer poultry products without compromising the poultry welfare. India has tremendous potential in organic poultry production as large part of country is organic default. The ill effects of conventional farming are compelling the consumers to shift to the organic products. Regulations, infrastructure facilities, transfer of technologies, sectoral cum target oriented development programs should practice in basic thrust towards poultry welfare. Today's need is institutional & policy frameworks that can pave the way for promotion of organic poultry farming.

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Table 1: Maximum number of birds per hectare that can be kept under different certification schemes

Certifier	Layers	Broilers	Turkeys	Ducks	Geese	Guinea fowl
EU	2500	2,500 (unless in mobile housing when up to 4,000 may be permitted)	1000	2222	666	2,500 (unless in mobile housing when up to 4,000 may be permitted)
Organic farmers & growers (OF&G)	1000	2,500 (unless in mobile housing when up to 4,000 may be permitted)	1000	2222	666	2,500 (unless in mobile housing when up to 4,000 may be permitted)
Soil association	1000	2500	800	2000	600	2500

(Source: Soil association, 2009)

Table 2: Feeder and waterer space requirement for broiler birds

Type	Broiler Breeders	Broilers
Feed space	Pans: 12-16 birds/pan	Pans: 70 birds per pan
	Troughs: 10 linear cm (4") per bird	Troughs: 5 cm (2 in.) per bird
Water space Fountains/cups	Up to 50 chicks/cup with drinkers progressively increased to 25 birds/cup at 20 weeks	2.5 cm (1 in.) per bird
Nipples	Up to 20 birds/nipple with drinkers progressively increased to 10 birds/nipples at 20 weeks	5-20 birds per nipple
Bell drinkers	Up to 100 birds/bell	Bell drinkers: 1 per 120 birds

Table 3: Feeder and waterer space requirement for layer birds

Layer Breeders				
Feed space			Pans: 70 birds/pan	
			Troughs: 5 linear cm (2") per bird	
Water space Fountains/cups			2.5 linear cm/bird (1")	
Nipples			5-20 birds/nipple	
Bell drinkers			Up to 120 birds/bell	
Layers - Feeder Space				
Age (weeks)	Maximum body weight (g)	Feed Trough/bird (cm)1		Birds per standard round feeder
0-6	400	1.2 - 1.4		40 - 60
6-12	950	2.0 - 2.5		30 - 40
12-18/19	1320	3.0 - 3.5		20 - 30
Light layer	1700	4.0 - 5.0		20 - 30
Medium layer	1900	4.0 - 5.0		20 - 30
Note: Open trough provides access at both sides. Feeder space available is therefore double the feed trough.				
Layers - Water Space:				
Age (weeks)	Maximum body weight (g)	Water Trough (cm)1	Birds per nipple or cup	Birds/Standard Round Waterer
0-6	400	1.5 - 2.0	15 – 20	100 – 150
6-12	950	2.0 - 4.0	10 – 15	75 – 100
12-18/19	1320	3.0 – 4.0	6 – 10	50 – 75
Light layer	1700	3.0 - 4.0	6 – 10	50 – 75
Medium layer	1900	3.0 - 4.0	6 – 10	50 – 75

(Source: Guidance for organic poultry production 2009)

Milk Derived Growth Factors and Their Use

Tanmay Hazra[1], Priti Saha[2], Yogesh Parmar[3] and Vivek Sharma[4]

[1,2]Ph.D Scholar, [3]M.Tech Scholar, [4]Principal Scientist
Division of Dairy Chemistry, NDRI, Karnal, Haryana-132001

Milk and milk products contains essential nutrients, such as proteins, lactose, minerals, vitamins, and enzymes. Additionally, despite of their low concentrations in milk, many other minor constituents present (e.g. hormones, growth factors) in milk. The full knowledge on these constituents', their physiological roles and effects on health is still lacking. Milk-derived growth factors are now a days increasingly used in health products, such as in the treatment of skin disorders and gastrointestinal diseases.

What are GROWTH FACTORS?

Growth factors are generally considered to be peptides that act via specific receptors triggering intracellular secondary messengers, ultimately resulting in cell proliferation. They stimulate the proliferation of epidermal, epithelial and embryonic cells; inhibit the secretion of gastric acid and promote wound healing.

GROWTH FACTORS IN MILK

Milk contains more than 50 growth factors and hormones. Their concentrations in milk are much lower than those of, e.g., immunoglobulins or lactoferrin. Growth factors are synthesized in the mammary gland and they can be transferred directly from mammary gland tissues to the milk in an active or modified (glycosylated, phosphorylated) form or with complex to other molecules. The concentrations of growth factors are the highest in colostrum and then decrease gradually during lactation.

Table 1: Concentration of different Growth Factors in milk and colostrum (ng-mL^{-1})

Name of Growth Factor	Milk	Colostrum
Epidermal growth factor	1-150	4-325
Betacellulin	<5	<5
Insulin-like growth factor-I	5-100	100-2000
Insulin-like growth factor-II	5-100	150–600
Transforming growth factor-β1	10-50	<5
Transforming growth factor-β2	150–1150	10-70
Fibroblast growth factor	Na	<1

The most abundant growth factors in bovine milk and colostrum are insulin-like growth factor (IGF)-I, transforming growth factor (TGF)-β2, some members of the epidermal growth factor (EGF) family and basic fibroblast growth factor (bFGF) or fibroblast growth factor (FGF)-2. The concentrations found in

colostrum are generally higher than those in milk, except for betacellulin (BTC), where it appears to be equivalent both in milk as well as colostrum. Concentration of growth factors depends on breed, milking interval stage of lactation etc.

FUNCTION OF GROWTH FACTORS IN MILK

Briefly, EGF and BTC are members of EGF family and they stimulate the proliferation of epidermal, epithelial and embryonic cells; they inhibit the secretion of gastric acid and promote wound healing. The TGF-β family plays an important role in embryogenesis, tissue repair, formation of bone and cartilage, and in the control of the immune system. TGF-β2 is the predominant from of the TGF family members found in milk products. TGF-β growth factors are recognized to stimulate proliferation of some cells, especially in connective tissue, whereas they act as a growth inhibitor of some other cells, such as lymphocytes and epithelial cells. IGF-I and IGF-II stimulate proliferation of many cell types. IGF-I stimulates cellular growth, development and differentiation. IGF-I also stimulates glucose uptake and the synthesis of glycogen. The PDGF family comprises two major proteins: PDGF and vascular endothelial growth factor. These growth factors play a role in embryonic development, proliferation of cells, migration, and angiogenesis and wound healing. Basic FGF (FGF2) stimulates proliferation, migration and differentiation of endothelial cells, fibroblasts and epithelial cells. This growth factor also promotes the synthesis of collagen. FGF2 plays an important role in proliferation, differentiation and survival of many cell types. It is involved in angiogenesis, wound healing and haematopoiesis.

STABILITY OF GROWTH FACTORS

Growth factors are very much heat resistant and able to withstand pasteurization temperature but degraded at sterilization temperature. Growth factors are also able to resist acid, alkali and urea treatments.

HEALTH EFFECT OF GROWTH FACTORS

Several health-related applications of milk growth factors have been proposed-

DISEASES	MODEL SYSTEM
Skin disorders	Rats
Leg ulcer	Human
Crohn's disease	Human
Intestinal mucositis	Rats
Osteoporosis	Human

FUTURE PERSPECTIVES

Scientific data on the potential of milk derived growth factors as health products support the view that these bioactive molecules may have a broad range of applications both as oral and topical treatments. Technological advances, innovative research approaches using metabolic engineering, systems and synthetic biology, and novel production methods will allow the production of higher amounts of such constituents, to produce them in such a way that recovery is easier and to produce differentiated compounds, thus revolutionizing the fields of personalized nutrition and functional foods.

The Neuro-Endocrine Strategies During Adaptive Process To Thermal Stress

[1*]Thulasiraman Parkunan, [1]Aasif Ahmad Sheikh, [1]Mohammad Rayees Dar, [1]Lakshmi Priyadarshini, [1]Pramod Kumar, [1]Gunjan Baghel, [2]Manju G Preedaa, [1]Dhinesh Kumar R. and [1]T. Chandrasekar

[1]PhD Scholar, National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana, INDIA
[2]PhD Scholar, Veterinary College and Research Institute (VC&RI), TANUVAS, Namakkal, Tamil Nadu
*Corresponding author Email id: drtraman@gmail.com

Stress is defined as a condition in an animal that results from the action of one or more stressors of either external or internal origin. Adjusting to stress induces a wide range of behavioral and physiological responses including endocrine changes in the *hypothalamic-pituitary-adrenal (HPA) axis* thus releasing corticosteroids and aldosterone (Von Borell., 2001). The possible stressors (Fig. 1) were UV radiation, Climate related (cold, heat, humidity, rain, ice and wind), nutrient limitation, oxidative stress, hypoxia and exposure to various drugs or toxins (Bova *et al*., 2014). Stress causes changes in neural and hormonal level in animals that cause behavioral changes and changes in reproduction, immunity and production.

COLD STRESS

Within a range of environmental temperatures called the "thermoneutral zone" (Fig 2), animals do not have to spend any extra energy to maintain their body temperature. At the lower end of this range, normal metabolic processes supply enough heat to maintain body core temperature. Within their thermoneutral zone, animals may modify their behaviour, such as seeking shelter from wind, and respond over the long term by growing a thick hair coat for winter, without affecting their nutrient requirements. However, below the lower limit of the thermoneutral zone, in the "lower critical temperature", the animal experiences cold stress. To combat cold stress, the animal must increase its metabolic rate to supply more body heat. This increases dietary requirements, particularly for energy (Tarr *et al*., 2007). The critical factors influencing cold stress of stock are wind speed and rainfall (Cleugh, 1997).

HEAT STRESS

Heat/Thermal stress is defined as a point on a *temperature-humidity index (THI)* above the thermo-neutral zone, which has adverse effects on the animal's performance (Bova *et al*., 2014). For dairy cattle, a THI of 70 is considered the upper echelon of the thermo-neutral zone (St. Pierre *et al*., 2002).

Animals which are exposed directly to radiation can increase heat stress in stock and most will actively seek shade on hot days (Reid and Bird, 1990). Animals reared under *'comfort zone'* will not spend any energy for thermoregulation; hence maximum productivity is achieved (Etim *et al*., 2013). The range of the comfort zone depends upon the species of the animal, its size, genetic makeup, health, energy reserve and age, condition of its coat and any additional stressful conditions such as pregnancy and lactation (Gwasdauskas *et al*., 1975).

GENERAL MECHANISM

The central nervous system collects from the external (via sensory organs) and internal environment the information necessary for the maintenance of homeostasis (Fig 3). It gives significance to this information in terms of danger or threat, as related to personal expectations, past experience and opportunities for control. Finally, it initiates the adaptive responses, including behavioural adjustments and neuroendocrine changes to meet the energy requirements for the behavioural response and to maintain homeostasis (Dantzer and Mormede, 1983).

ADRENAL GLAND

In mammals, the adrenal gland (Fig 4) also known as suprarenal gland is located over the superior/anterior part of kidney. The adrenals are mainly responsible for regulating the response to stress through the synthesis of catecholamines and corticosteroid hormones. Adrenal gland contains central region (medulla) and outer area (cortex). Medulla contains specific cells called *chromaffin cells*. These cells secrete catecholamines, adrenaline (epinephrine), nor-adrenaline (nor-epinephrine) and to a lesser extent, dopamine. Adrenal cortex is divided into 3 layers *viz*., *Zono glomerulosa (aldosterone), zona fasciculata (cortisol and androgens)* and *zona reticularis (cortisol and androgens).* All 3 layers produce corticosterone.

GLUCOCORTICOIDS

Activation of the pre-optic area stimulates the hypothalamus to release *CRF (Corticotrophin-releasing factor*) that acts on the anterior pituitary to release *ACTH* (Fig 5). This stimulates the adrenal cortex to produce glucocorticoids (mainly cortisol). Activation of *hypothalamic-pituitary-adrenal axis* and the consequent increase of plasma cortisol concentration are the most prominent responses of an animal to stressful conditions (Christison and Johnson, 1972).

Plasma cortisol may increase within 20 minutes of exposure to acute heat stress, and reaches a plateau within 2 hours (Christison and Johnson, 1972). Under severe acute heat stress, the hyperglycemic action of cortisol is most likely required to provide the expected increase in glucose utilization (Collins and Weiner, 1968). Decline in plasma cortisol activity under chronic heat stress indicates adaptation to stress (Collins and weiner, 1968). Glucocorticoids have a wide range of effects in the body such as increase blood sugar levels, reduce protein synthesis, increase the activity of Na^+/ K^+

pump in cardiac cells, increase proteolysis in muscle, bones and skin (Bobic *et al*., 2011). Chronic high level of glucocorticoids can cause diabetes, low immunity, increase heart rate, slowed growth in young animals and decreased production (Bobic *et al*., 2011).

Alvarez and Johnson (1973) conducted in Non-lactating Holstein cows under short heat exposures of 40-43° C and reported that an increase in glucocorticoid level from 2.4 to 3.9 µg/100 ml (62%) by the second hour of heat exposure, reached a peak of 5.4 µg/100 ml (120%) at 4 hours, then declined gradually to the normal of 2.4 µg/100 ml at 48 hours and stayed at this level inspite of continued heat stimulus. The initial rise in plasma glucocorticoids is due to activation of the adrenocorticotropin (ACTH) releasing mechanisms in the hypothalamus by thermoeceptors of the skin, whereas the later decline to normal, inspite of continuing heat stimulus indicates a negative glucocorticoid feedback and a decrease in the glucocorticoid binding transcortin (Lindner, 1964). The glucocorticoids work as vasodilators to help heat loss and have stimulatory effect on proteolysis and lipolysis, hence provide energy to the animal to help offset the reduction of intake. Increased Cortisol concentrations have been shown to increase anxiety-related activity (Bristow and Homes, 2007; Mostl and Palme, 2002), disease susceptibility (Von Borell, 2001) as well as decreased reproductive performance (Cooke *et al*., 2012; Thun *et al*., 1998) of cows and for this reason cortisol is often used as a measure of stress.

GROWTH HORMONE

GH (Fig 6) is a calorigenic hormone produced from the anterior pituitary gland and does not function through a target gland but exerts its effects on almost all tissues of the body. The plasma GH levels decline from 18.2 ng/ml at thermo neutrality to 13.5 ng/ml in heat stressed Jersey cows (Mitra *et al*., 1972).

The decreased GH leads to less calorigenesis aimed in maintenance of heat in the body. Therefore, a reduced secretion of this hormone is all more necessary for survival of the homeotherm in high ambient temperatures.

THYROID HORMONES

The anterior lobe of the pituitary gland produces the hormone thyrotropin (Fig 7), which acts primarily on the thyroid gland to produce *thyroxin and* T_3 (Habeeb *et al*., 1992). The concentration of T_4 and T_3 in blood plasma was found to decline under heat stress conditions by upto 25% (Beede and collier, 1986). The response is slower than that described for cortisol, and it took several days for T_4 *and* T_3 levels to reach a new steady state (Kamal and Ibraim, 1969). Decreased thyroid activity is consistent with decrease in metabolic rate, feed intake and growth and milk production under heat stress (Beede and collier, 1986). This decline in thyroid hormone along with decreased plasma GH level has a synergistic effect to reduce heat production.

ALDOSTERONE

El-Nouty and coworkers (1980) demonstrated the relationship between aldosterone and urine electrolyte concentration in bovine. They found that plasma aldosterone concentration was the same during first few hours of heat exposure, however with prolonged exposure, it was 40% lower and declined rapidly during later hours of exposure. This decline is due to increased excretion of serum K^+ in sweat. There is the difference between ruminants and non-ruminants (more Na^+ will be excreted through sweat).

CATECHOLAMINES

Any stress primarily triggers CNS through sympathetic nervous system – activated adrenal gland releases *catecholamines (adrenaline and nor adrenaline)* to induce all important *flight or fight* mechanism. This increases blood pressure, heart rate, etc. This will last for few seconds. Norepinephrine and epinephrine, major neurotransmitters of the sympathetic autonomic nervous system, are both affected by stress (Lefcourt and Elsasser, 1995). Hypothalamus releases *CRH* (corticotrophin releasing hormone) which is transmitted via hypophyseal stalk to anterior pituitary causing release of *ACTH*. This acts on cortex to cause release of *glucocorticoids* (Cortisol & corticosterone). Glucocorticoids increase blood sugar levels, decrease protein synthesis, increase proteolysis of muscle, increase activity of Na^+/K^+ pump in cardiac cells. Prolonged high level can cause diabetes, low immunity, increased heart rate, slowed growth and reduced production (Squines, 2003). It is elevated during both acute and chronic thermal stress. Alvarez and Johnson (1973) have reported an average increase of 42 and 45% in norepinephrine and epinephrine, respectively at 1 hour in short heat exposed cows and 70 (norepinephrine) and 91% (epinephrine) in long heat exposures (35° C than 18° C). These regulate the sweat gland activity in cattle (Allen and Bligh, 1969).

CONCLUSION

- Any type of stress activates autonomic nervous system response and up regulates the HPA axis, which can affect not only animal welfare but also disease susceptibility, productive and reproductive performances.
- Catecholamines - mediate action for few seconds
- Glucocorticoids (Acute)-mediates their action for few minutes to hours by increased availability of glucose during stress.
- (Chronic)-Concentration will decrease due to negative feedback. They reduce growth and cause immunosuppression.
- Growth Hormone – reduced during thermal stress which leads to stunted growth, less metabolism and lesser heat production.
- Thyroid Hormone – Reduced concentration during heat stress leads to reduced BMR and hence less heat production.
- Aldosterone – Increases K^+ ion excretion through sweat in Ruminants.

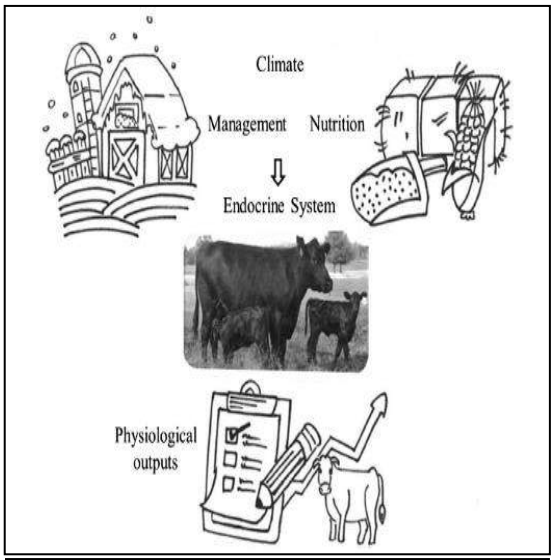


Fig 1: Various stressors and their output (Adapted from Bova et al., 2014)

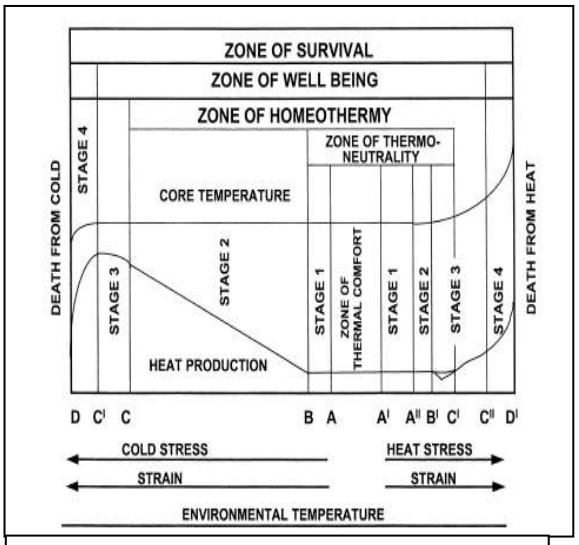


Fig 2: Various Zones with respect to environmental conditions in ruminants (Adapted from N. Silanikove, 2000)

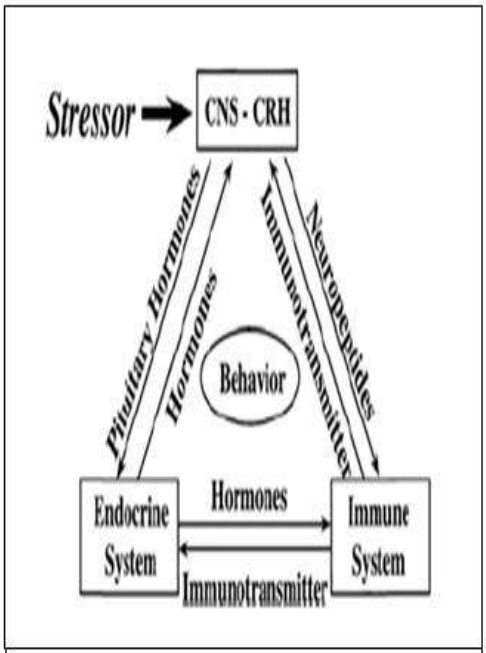


Fig 3 shows Inter-relationship between CNS, endocrine and immune system (Borell, 2001)

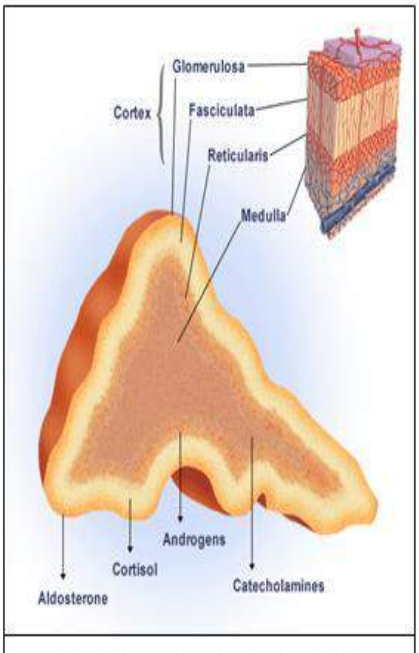


Fig 4: Adrenal gland showing different parts of Cortex and Medulla

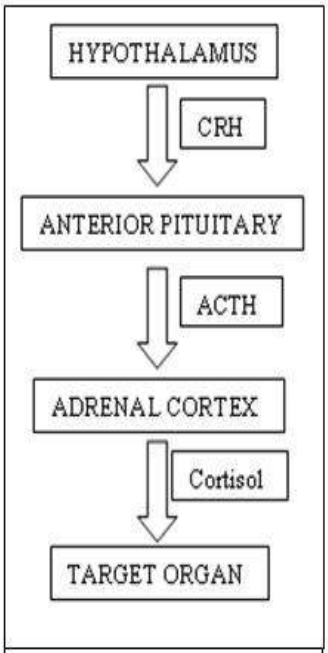


Fig 5: Hypothalamo-pituitary-adrenal axis (HPA axis)

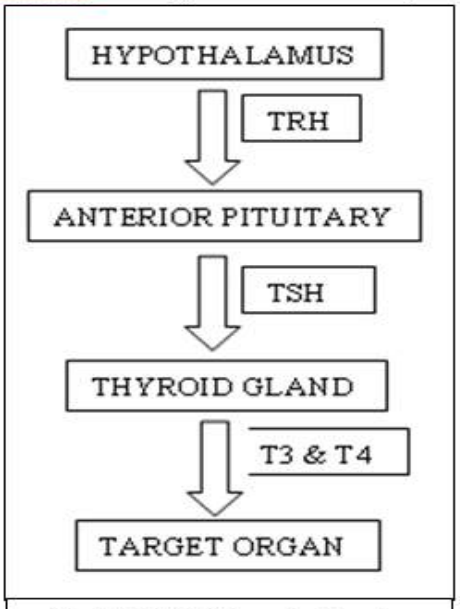


Fig 7: HPT (Hypothalamic-Pituitary-Thyroid) Axis

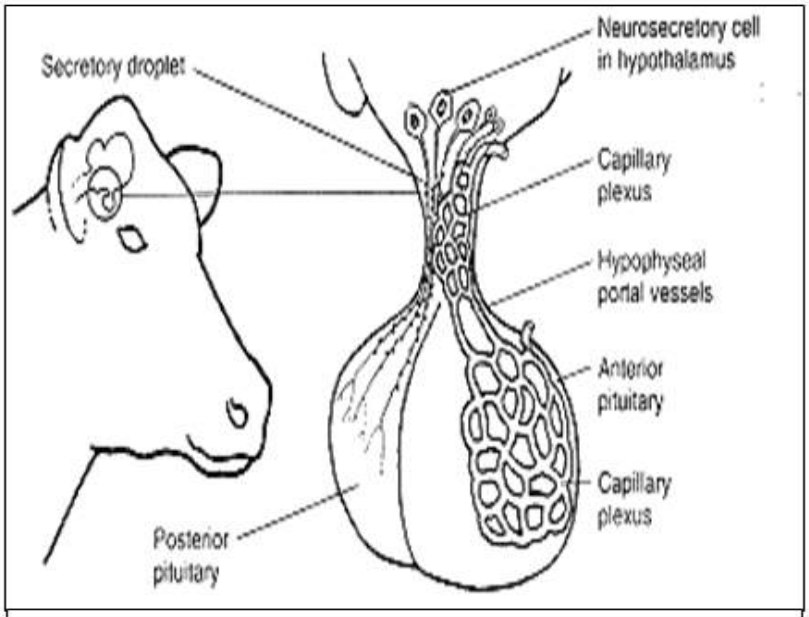
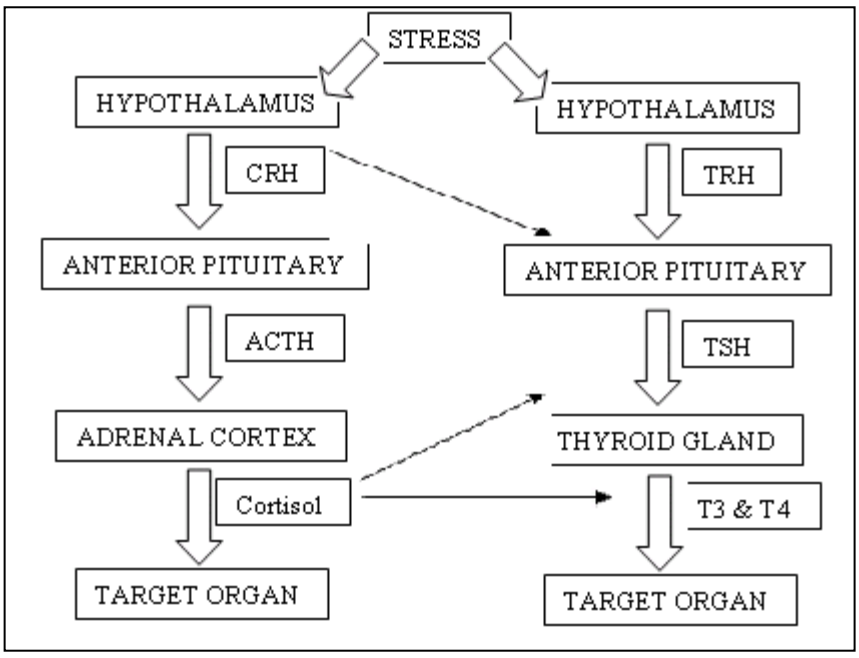


Fig 6: Pituitary gland of Cow where Growth hormones secrets



Morphological, Production and Reproduction Criteria For Judging of Murrah Buffaloes

Sandeep Kumar Sangwan*[1], Abhey Singh Yadav[2] and Patil C. S.[3]

*Corresponding author's email address "sangwan36@gmail.com"
[1]Phd Scholar, [2]Professor & [3]Poultry Manger
Department of Animal Genetics and Breeding,
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar

Among the livestock sector, cattle and buffalo play a major role in India's economy since it has about 13% of world cattle population (GOI – 2007 census) and 56.7 % of world buffalo population (FAO, 2008). The world buffalo population is estimated at 185.29 million, spreading across 42 countries, of which 179.75 million (97%) are in Asia. India has 108.70 millions Buffalo population (BAHS, 2014). Murrah is most important and renowned breed of buffaloes not only in India but also in whole world. Murrah is the pride of Haryana. Its best breeding tract for true Murrah is mainly located in southern Haryana from where it is used for the grading up of inferior buffaloes in the country. however breed is present in a much larger area particularly all over north India extending from northern & western Utter Pradesh through Delhi, Haryana (Rohtak, Karnal, Hisar, Jind & Gurgaon), Punjab (Nabha, Patiala & Ludyana) to Pakistan (Sindh). Rohtak in Haryana is well known market from where thousands of high yielders are exported. Murrah buffalo cows are most efficient and excellent milk producers. Genetic improvement for growth in Murrah buffaloes is of great importance in the large ruminant based meat industry in India, since buffaloes contribute 52.6% of

total milk and 21.2% of the total meat production (BAHS, 2012). Buffalo produces 62.35 million tonnes milk out of total Indian 121.85 million tonnes in India Its breed **Characteristics are following:-**

Colour	Jet-black with white marking on tail, face and extremities sometimes found, white marking on face and leg extremities are not generally preferred
Body	Sound, massive and wedge shape body
Head	Comparatively small
Neck	Comparatively long
Legs	Comparatively short but strongly built
Horns	Horns are short, tightly curved and somewhat flattened. Different from other breeds of buffaloes; turning backward and upward and finally spirally curving inward. As the age advances the horns get loosened slightly but spiral curves increases
Udder	Well developed and drooping
Teats	Equally distributed over the udder but hind teats are longer than fore teats
Loin	Broader and sliding forward
Hips	Broad
Tail	Long reaching to fetlock and below 6 inch white marking
Skin	Soft, smooth with scanty hairs as compared to other buffaloes
Adult Body weight	Males 550-570 & Females 450
Body height at withers	Males 1.42 m and Females 1.32 m

Murrah's production traits are followings

Age at first calving	3-4 years
Avg. Daily milk yield	7-12 kg
Avg. lactation milk yield	First lactation yield 1894±44 kg Other lactation 305 days or less yield (kg) 2183±136 Other lactation total milk yield (kg) 2226±152
Lactation length	305±60 days
peak milk yield	14 to 15 litter but up to 31.5 Kg milk production had also been recorded. The elite Murrah buffalo produces above 18-litter milk per day. A peak milk yield of 31.5 kg in a day has been recorded from a champion Murrah buffalo in the *All India Milk Yield Competition* conducted by the *Government of India*.
Calving interval	400 to 500 days
Dry days	About three months
Service period	146±27 days
Average Gestation period	310±10 days
Fat percentage	7

Murrah females are largely used to supply milk and gee in urban areas. Males are used in agriculture purposes as they are having better ability to work harder for longer periods even in hotter environments. Bulls of this breed are now also used extensively for up-gradation of inferior stock in many countries including

Thailand, Malaysia, Indonesia, Philippines, Madagascar & Brazil with aim to combine the better adaptability of their local breed with high ability in Murrah to convert fodder to high amount of milk. *Indian council of agriculture research* is maintaining herd book for Murrah. Various state governments, ICAR founded farms, agricultural universities farms and military farms are maintaining Murrah all over the country for production & dispersion of excellent germplasm throughout the country.

The *Central Institute for Research on Buffaloes, Hisar* undertook a novel exercise in conservation and propagation of such superior Murrah bulls through semen collection and cryopreservation. This semen is made available to farmers interested in improvement of their buffaloes. The Govt. Haryana had launched incentives of cash prize for farmers to expand Murrah buffaloes. In order to know more about various schemes (like prizes, incentives, trainings, subsidies, loans and subsided loans, etc.) in their locality by government the farmer should consult their nearest government veterinary hospital.

Pattern Recognition Receptors: Role in Disease Resistance in Domestic Animals

Vikas Kumar Singh[1], Rakesh Kumar[2] and G.Elaiyaraja[1]

[1] Immunology Section, Indian Veterinary Research Institute Izatnagar, U.P.
[2] Dairy Cattle Breeding Division, National Dairy Research Institute, Karnal, Haryana.

Innate immunity is the first line of defense against infections and come in action earlier than the adaptive immune responses. The cells and soluble molecules of innate immunity either exist in a fully functional state before encounter with microbes or are rapidly activated by microbes. A family of receptors, called Pattern Recognition receptors (PRRs), is proteins that recognize and respond to molecular patterns associated with pathogen by activating antimicrobial defense mechanisms in the cells in which they are expressed. These receptors are evolutionary conserved and found in every form life from insects up to mammals. In fact, most of the mechanisms of innate immune defense developed very early in evolution, about 750million years ago. In contrast, adaptive immune defense is present only in vertebrates and appeared about 500 million years ago.

How do Pattern Recognition receptors recognize microbes?

The microbial substances that stimulate innate immunity are called pathogen-associated molecular patterns (PAMPs).Different classes of microbes (e.g., viruses, gram-negative bacteria, gram positive bacteria, fungi) express different PAMPs like double-stranded RNA, unmethylated CpG DNA sequences , lipopolysaccharide (LPS) in gram-negative bacteria, lipoteichoic acid in gram positive bacteria, and mannose-rich oligosaccharides found in microbial but not in mammalian glycoproteins. These PAMPs are recognized by the host cellular receptors called pattern recognition receptors (PRRs). They are expressed on the plasma membrane or endosomal membranes and sometimes in cytoplasm of various cell types like macrophages, neutrophils, dendritic cells, epithelial cells etc. When these cells associated PRRs bind to PAMPs then, they activate signal transduction through various transcription factors that enhance the antimicrobial activity and pro inflammatory functions of the cells in which they are expressed.

Classification of PRRs.

Broadly, it can be divided into two classes

A. Cell associated PRRs: expressed on membranes or in the cytoplasm of cells (Table 1)

B. Soluble PRRs: found in the blood and extracellular fluids (Table 2)

Importance of PRRs in disease resistance in animals

Following activation by ligands of microbial origin, immune cells expressing PRRs can produce cell signalling factors called cytokines and chemokines which induce inflammation. In the case of a bacterial pathogen, the microbe might be phagositosed and digested, and

its antigenic peptides presented to $CD4^+$T cells by the antigen presenting cells. Whereas, in viral diseases, immune cells that have detected a virus mayrelease interferon that activate the neighbouring healthy cells for the synthesis of anti-viral proteins.Toll-like receptors have also been shown to be an important link between innate and adaptive immunity and also augment the adaptive immune response by releasing cytokines. The generation of cell mediated immunity or humoral immunity also regulated by these innate receptors. The soluble receptors like complement recognizes the microbial pattern and triggers the chemotaxis, inflammation, opsonisation and phagocytosis of microbes while the collectins disrupt the cell membrane of microbes by binding with the terminal mannose of pathogen. It has been seen the increased expression of these receptors in the microbial infections like TLR4 expression higher in the gram negative bacterial infections and TLR3,7 more in viral infections.Likewise,in fungal infection more expression CLRs has been reported.

Due to greater role of these receptors in disease resistance the researcher are trying to explore these in the treatment and prevention of diseases. The TLR7 agonist has been used as adjuvant in the Rota virus vaccine in animals while the TLR9 agonist has tried in brucellosis vaccine.

CONCLUSION

The identification of mammalian PRRs has widely revolutionized the field of microbial pathogenesis and mammalian immunology. We are at initial stage to understand the complexities of this evolutionarily conserved innate receptors and the important role it plays in innate immunity. These receptors have been shown to interact with each other, thereby giving rise to a network of multimolecular complexes that add an extra level of complexity to pathogen recognition. Explaining the precise mechanisms regarding the exact function of these receptor networks are the biggest challenge and this even bigger with the discovery of intracellular PRRs, the NOD-like and RIG-1-like receptors.

Understanding of the functions of these receptors, their ligands, and subsequent gene-activation after receptor–ligand interaction may lead to the development of new therapeutic approaches like modulation of PRR activity can be achieved by the addition of soluble forms of PRRs or PRR-blocking molecules. Such knowledge could then be applied to improve established and new therapies.

Table 1. Cell associated PRRs.

S. No.	Name of PRRs	Ligands/PAMPs	Example	Location
1.	Toll-like Receptors (TLRs)	LPS,HSP,ds-RNA, flagellin,CpGDNA,Peptidoglycan etc.	TLRs 1-13	Cell membrane and endosome of dendritic cells, B cells, phagocytes, endothelial cells etc.
2.	C-type lectin like receptors (CLRs)	Microbial terminal mannose&fructose, Glucans of fungal cell walls.	Mannose receptor, Dectin	Plasma membranes of phagocytes
3.	NOD-like receptors (NLRs)	peptidoglycans Flagellin, muramyl dipeptide,	NOD1and NOD2,	Cytoplasm of phagocytes epithelial Cells.
4.	RIG-like receptors (RLRs)	Viral RNA	RIG-1, MDA-5	Cytoplasm of phagocytes
5.	Scavenger receptors	Microbial diacylglycerides	CD36	Plasma membranes of phagocytes

Table 2: Soluble PRRs

S.No.	Name of PRRs	Ligands/PAMPs	Example	Location
1.	Natural antibodies	Microbial phosphorylcholine	IgM	Plasma
2.	Complement	Microbial surfaces	C3,C5,C1	Plasma
3.	Pentraxins	Microbial phosphorylcholine	C-reactive protein	Plasma
4.	Collectins	Carbohydrates with terminalmannose and fructose	Mannose-binding lectin, Surfactant proteins A and D	Plasma,Alveoli
5.	Ficolins	*N*-Acetylglucosamine and lipoteichoic acid	Ficolin	Plasma

Advances In Sperm Sexing Technologies And Their Uses

S. K. Sheetal*[1], Shiv Prasad[2] and H. P. Gupta[3]
[2]Professor, [3]Professor & Head
Department of Veterinary Gynaecology and Obstetrics,
College of Veterinary and Animal Sciences
Govind Ballabh Pant University of Agriculture and Technology,
Pantnagar-263145, (Uttarakhand)
*[1]Corresponding Author Ph.D. Scholar, E-mail - sksheetalmuz@gmail.com

Artificial insemination (AI) has been accepted as most important technology worldwide for the animal improvement programmes and being widely used for breeding dairy cattle and buffalo in India. Theoretically, Semen contains approximately equal numbers of sperm containing X or Y chromosomes, resulting in female or male offspring, respectively. However to increase milk production to fulfil the per capita requirement, more female births are needed, and that can only be achieved by the sexed semen. Thus, Female dairy offspring are more desirable than male offspring. In normal condition, male progeny producing sperm bears Y chromosome whereas female producing sperm bears X chromosomes. The quest to identify or separate male and female producing sperms created great interest among research communities for many years and various methods were adopted in the past. Scientists worldwide tried to sex the sperms by size, weight and density (Bhattacharya *et al.,* 1996); swimming capabilities/speed (Erricsson *et al.,* 1976); electrical surface charges (Shirai *et al.,* 1974), sedimentation, electrophoresis, centrifugation, sephadex filtration etc. However none of these methods was able to significantly separate the viable sperms capable to fertilize. A major breakthrough in the development of sexed semen came when it was observed that sperm containing X-chromosomes contain more DNA (4.2 %) than sperm containing Y-chromosomes (Moruzzi, 1979). This most advanced very effective viable sexed sperms producing method is named as flow cytometry. It is now possible to predetermine the sex of offspring in number of species with the accuracy of 85-95% (Shidel *et al.,* 1999; Johnson, 2000). In India the first predetermined sexed male calf named Shreyas born on 1st January 2011 in West Bengal. Thousands of calves have been produced now by using AI with sexed semen (Seidel and Garner, 2002).

FLOW CYTOMETRY AND SEMEN SEXING

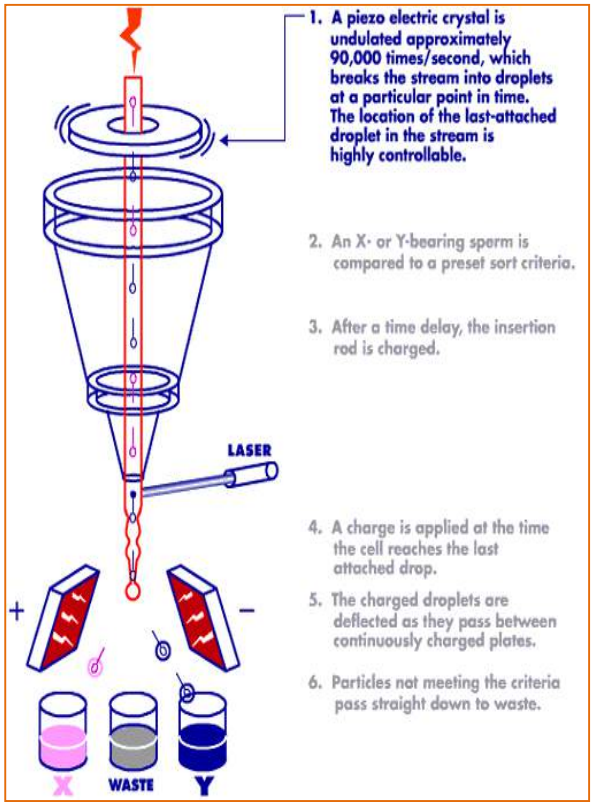
The sorting of the sperm by flow cytometry is based on the DNA content differences of the X and Y chromosome bearing sperm of that species/breeds. Sperms (male gametes) are haploid cells that can be accurately analyzed for their DNA contents. In this method, sperms are prepared with a DNA-specific stain (Hoechst 33342) which binds to the sperms according to their DNA content.

Flow cytometer sends these sperms under high pressure (about 50 psi) in a stream of droplets through a chamber, one-by-one, at a high speed (50 mph) Subsequently the UV laser is used to excite the Hoechst 33342 stain of sperm cells. The stained X sperm shows more fluorescence than Y sperm because of their higher DNA content and a detector senses the fluorescence. A charge is placed on the droplets, depending on the fluorescence and then charged plates deflect the droplets containing a sperm into pools.

Pool 1: Less DNA -- Y sperm --- male
Pool 2: More DNA – X sperm --- female
Pool 3: Not sorted -- discarded

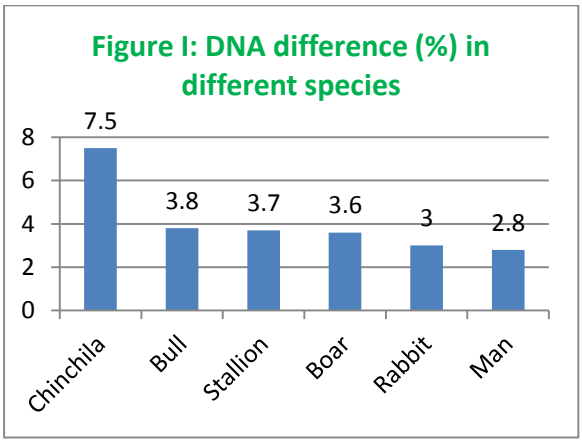
Sorting purity of the X and Y sperm pool is determined by PCR by amplifying both Bovine X chromosome specific (PLP) and Y chromosome specific (SRY) gene.

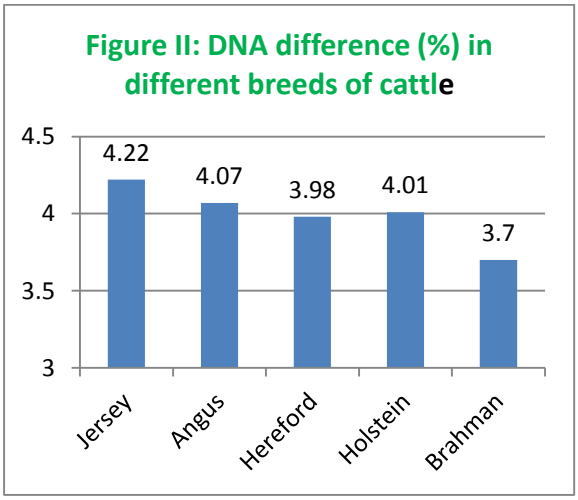
Diagramatic representation of Flow cytometry



DNA content differences in species/ breeds

The initial DNA content difference (2.8%) was documented for human sperms with a Phywe or ICP 22 flow cytometer (Otto et al., 1979). This innovative measurement was also applied in semen samples of domestic livestock, including bulls, boars, rams and rabbits. Although The DNA content for all cells for each mammalian species is highly conserved, but some DNA content differences also found among different breeds of cattle. (Garner et al., 1983). In bovine, sperms from Jersey bulls exhibited a greater X-Y DNA content difference than those from Holsein or Hereford bulls. In addition, wildlife species X and Y sperms also differs in their DNA contents measured by flow cytometry recently.





SIZE AND SHAPE (HEAD)DIFFERENCES

Shape of the head and size in sperms of different species are also important contributors for their separation by flow cytometry. Most domesticated mammals have a flattened, oval shaped heads with the exception of rodents and monotremes (Austin, 1965). The effectiveness of utilizing DNA content differences between the X- and Y-chromosome carrying sperm depends not only on relative DNA differences, but also on the ability to precisely orient these gametes at the time of measurement in the flow cytometer. This attribute can be expressed using actual species differences in DNA content as reflected by the presence of the X- or Y-chromosome and the area making up more flattened side or profile of the sperm head. A comparison of this particular attribute is shown for a few mammalian species (Table I).

Table I: Sperm head size differences and sorting indices (Flow cytometry sorting index = head profile area of sperm in µm² X sperm DNA difference in %).

Species	Bull	Boar	Rabbit	Dog	Man
Area (µm²)	34.5	37.5	28.0	20.9	10.8
X-Y difference (%)	3.8	3.6	3.0	3.9	2.8
Sorting Index	131	115	84	82	31

This approximation suggests that the easiest sperm to separate in flow cytometer would be from the bull because the area of the head profile is 34.5 mm2 with an X–Y difference in DNA content of 3.8% resulting in the highest sorting index of 131. This makes sex-sorting of sperm not only different for each mammalian species, but differences in sorting efficiency also exist for the sperm of individual males within a species.

SEX-SHORTING OF SPERM AND THEIR DAMAGES

The primary goal of the sex-shorting of semen is that only living sperm is shorted. So identification of dead and living sperm is important for this process. Damaged or dead sperm were first identified in Hoechst 33342 stained population by their uptake of a membrane impermeant dye, propidium iodide (PI).

Sperm DNA damage during shorting process is expressed as a DNA fragmentation index (% DFI). It is decreased by the use of stain, laser and their combined use. Sperm viability tests with SYBR-14 and PI determines the damage of the sperm during shorting.

CHALLENGES AND LIMITATIONS OF FLOW CYTOMETRY

The primary limitations of using flow cytometry to sort semen are: (i) the slow speed of the process relative to the number of viable sperm required for AI in cattle; and (ii) the high proportion of sperm cells that are lost, cannot be oriented for sorting, or cannot be accurately identified as bearing an X or Y chromosome and pass through without being sorted (combined >75% loss). Of the remainder that is successfully sorted, only half is the desired gender. Consequently, only 10-15% of the original sperm population entering the flow cytometer are recovered as marketable, sexed semen (Seidel Jr and Garner, 2002). Conventional semen straws contain ~20 million sperm.

Sorting speeds are currently inadequate for commercially viable production of semen straws containing 20 million sperm, and consequently sexed semen straws generally contain approximately 2 million sperm (Sharpe and Evans, 2009). As a result of both sperm damage during the sorting process and lower sperm numbers included in each straw, use of sexed semen generally results in poorer conception rates compared with conventional semen. The conception rates achieved with frozen-thawed sexed semen in maiden heifers are approximately 80% of those achieved with conventional semen (e.g. 70 vs. 56%). The reduction in fertility observed when using sexed semen has, to date, restricted its use to inseminations on maiden heifers.

BENEFITS OF SEXED SEMEN USE

- Using sexed semen is increased numbers of heifer calves born, with approximately 90% of successful pregnancies resulting in a heifer calf.
- To expand herd size and production.
- To reduce the incidence of difficult calvings (heifer calves are lighter than male calves).
- Improve biosecurity by increasing herd size.
- Also control the sex of offspring of endangered and exotic species.

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Sustainability of White Revolution in India by Exporting Meat of Culled Buffaloes

Muzamil Abdullah*, Utkarsh Kumar Tripathi, Susavi Kumari, Suman Kumari Joshi and Shilpi Kerketta

PhD Scholar, Livestock Production Management, ICAR-NDRI-Karnal, Haryana

**Corresponding author: mabhatndri@gmail.com*

Livestock sector recorded a growth in value of output about 4.8 percent per annum in Eleventh Five Year Plan has excellent potential for higher growth in twelfth five year plan. The increased demand for protein foods in the country is the main driver for such growth, which is also more inclusive. Buffalo with more than 111 million population contributes more than 50% of total milk production in India. In dairy sector culled animals and male calves are usually burden. If these culled animals are properly managed, there is lot of potential to produce and export quality buffalo meat from India. Sustainability of white revolution in India is only through meat exports by culling process. Buffalo meat production in 2013 was 3.7 Million tons while as Indian Buffalo meat exports in 2013 was 1.55 million tons which amounted 2.8 billion USD (APEDA, 2013). Annual buffalo meat export growth 15%. Buffalo Meat contributes 86% of total meat exports livestock sector valued 74 Billion USD and is 25 % of total agricultural production. India is largest exporter of buffalo meat and third largest exporter of meat after Brazil and Australia. Indian buffalo meat export in 2014/15 was 4.15 tons (Business Today, 2015). Over 74000 people are directly employed and few lacs indirectly employed. Policies and proactive role of government of India and state governments contributed to the success of four decades for meat exports growth.

Currently buffalo provides more than 20% of the meat production in India. In India culled buffaloes (unwanted males and dry buffaloes) are used for meat production. Buffaloes are sent to the abattoir when they grow old and stop yielding milk. Buffalo meat consumption in India was estimated about 2.3 million tons in 2014). Indian meat is exported to 65 countries, the biggest markets being Vietnam (40 %), Malaysia (9%), Thailand (7%) and Saudi Arabia (6%) (Business Today, 2015). About 7 million male calves are produced every year. However quality of beef due to their stunted growth rate and poor carcass yield is not satisfactory. Farmers prefer to feed to female calves for replacement of herd. Male calves become neglected due to malnutrition, emaciation and diseases leading to low weight at marketing age and less carcass yield when slaughter. Growth rate and quality of beef and economic return from calves can be improved by fattening. This precious germ

plasm could form a basis for strong meat industry along with raised buffalo broilers if proper infrastructure is created for fattening them.

Meat of buffalo calves, having no religious taboo and buffalo meat is preferred and relished by most of the sections of our population because it is naturally reared, Lean meat, it is low in fat and cholesterol besides there is no practice of using hormones, antibiotics, growth promoters for buffaloes and usually these are disease-free animals.

Popularity of Indian meat at international level

The first reason for popularity of Indian buffalo meat is that it is almost 20 per cent cheaper than Brazil cattle beef. A secondary reason for Indian meat's popularity in the Persian Gulf countries and others with large Muslim populations is that buyers are assured of halal meat (Business Today 2015).

Feeding of male buffalo calves from birth to weaning

To achieve maximum benefits the calves should be reared on milk replacers, feeding should be given in restrict amounts. The meals should be divided into two meals. Milk or milk replacer feeding should be fed at the rate of ½ kg less than $1/10^{th}$ of body weight of calf for first month. Fresh water should be available. The mash starter (TDN 75% and DCP 20%) should be given from two weeks. Good quality berseem hay ad libitum should be provided to develop rumen at early.

Feeding buffalo males for growth

From weaning to about 150 kg body weight, male calves require special attention in formulating rations to promote maximum tissue growth. A highly digestible pelleted starter (70 to 75 % TDN and 15 to 17% DP) is essentially required to achieve about 0.7–0.8 kg. The ration concentrate to roughage ranges between 50:60 or 60:40 on a DM basis, with good quality berseem hay making up at least half of the roughage. Feeding for fattening of buffalo males can be done:

1. Fattening from 200 to 350 kg, over a short fattening period of about 4 months.
2. Fattening from 250 to about 500 kg over a relatively longer period of 10 to 18 months.

The first practice produces relatively juicier meat but the second practice is preferred by slaughter houses as it produce high dressing yields. Tethering can be done to fattening calves for individual feeding. Minerals and vitamins should be supplemented properly.

Regular Weighing

Measuring live weight on weekly basis or at least monthly basis is very important for growth evaluation. The overall average daily gain during fattening should be 800 to 900 g/day depending on the level of concentrates

Housing

At young age during winter calves should be kept in sheds to prevent from hypothermia and always use a dry bed of rice straw. During summer proper ventilation should be provided. The roof should be made of good insulating material like paddy grass, asbestos sheet etc. Water showers wallowing should be provided during summer

Health care

Above all, it would be pertinent to develop animal healthcare plan for complete freedom of certain diseases especially foot and mouth disease, and all important diseases indicated by OIE. Important diseases are Foot and mouth disease, sarcocystosis, brucellosis, tuberculosis and food pathogens like *Campylobacter jejuni*, *Salmonella typhi*, *Shigella dysentariae*, staphylococcus aureus, E.*coli*, *Listeria monocytogenes* and *Yersinia enterocolitica*. So regular (weekly) veterinary checks and assistance of the veterinarian is needed as international standard meat processing plants for processing is a must for quality product export.

CONCLUSION

The proper utilization of culled buffaloes for quality meat production is a ray of hope for sustainability of dairy sector in India as farmers get benefited both from milk as well as from meat of culled animals.

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Prevention and Control of Salmonella Transmission from Poultry to Human

Raj Narayan Trivedi[1], Parvathy Rajan[2], Manoj Kumawat[2], Sujoy Dhara[3], Sanjeev Kumar Bhure[2], Tapas Kumar Goswami[1] and Manish Mahawar[2]

[1]*Division of Immunology,* [2]*Biochemistry Division and* [3]*Animal Biotechnology*
Indian Veterinary Research Institute Izatnagar, Bareilly - U. P. 243 122 India
Correspondence email: dr.rntrivedi@gmail.com

Non-typhoidal *Salmonella* are the major cause of foodborne gastroenteritis in human. Going back in history, the name *Salmonella* was coined in honour of the American scientist, Daniel Elmer Salmon. About 2500 serotypes (serovars) of *Salmonella* have been discovered till date. However major *Salmonella* serovars involved with foodborne infections are *Salmonella* Enteritidis and *Salmonella* Typhimurium. Although these serovars can infect a variety of animals and transmits to human following consumption of the animal products, but poultry and its products are the major sources of infection. *Salmonella* infection is having more prevalence due to its clinically inapparent infection (act as a carrier) in poultry for variable duration. The products from these poultry birds enter the food chain of humans via meat and eggs and their value added products and in turn contaminate the human food. The prevalence of *Salmonella* serotypes may vary considerably between different areas like localities, districts, regions and countries and therefore, surveillance and identification of the prevalent *Salmonella* serovars in poultry should be carried out in order to develop a control programme for the area.

INFECTION TO HUMAN

Salmonella Enteritidis and *Salmonella* Typhimurium colonizes in the intestine of poultry asymptomatically and are transmitted to human by consumption of contaminated food (eggs and other poultry products). Perfectly normal-looking eggs may also carry *Salmonella* infection. Eggs are usually contaminated with chicken faeces. It is an important source of infection if infected eggs and egg products, are not prepared, handled, or refrigerated properly.

Sign and symptoms of *Salmonella* infection

The symptoms of *Salmonella* infection usually appear 12–72 hours after infection. The disease is characterized by acute onset of high fever, abdominal pain, diarrhoea, nausea etc. and usually lasts for 4–7 days, and most people recover without treatment. In some immunocompromised patients, the diarrhoea could be so severe and patient needs to be hospitalized. The elderly, infants, and those with impaired immune systems are more likely to develop severe illness. In cases where bacteria enter the bloodstream, antibiotic therapy

is needed. Some people afflicted with Salmonellosis later experience reactive arthritis, which can be chronic and have long-lasting disabling effects like pain in their joints, irritation of the eyes, and painful urination. This is called reactive arthritis, which is difficult to treat.

Prevention methods

There are many ways to prevent *Salmonella* infection in poultry and human. As poultry is the main source for human infection, if we prevent the infection in poultry then we can easily control the food borne *Salmonella* infection in human. Prevention requires control measures at all stages of the food chain, from agricultural production, to processing, manufacturing and preparation of food. National/regional surveillance systems are important means to detect and respond to Salmonellosis and other enteric infections in early stages, and thus to prevent them from further spreading. Transmission of *Salmonella* from poultry to human can be prevented by two major ways:

A-Control of infection in the chicken themselves

B-Improvements in poultry product processing technology

A-Control of infection in the chicken themselves

A.1- Hatchery and chicks

Salmonella control in the hatchery is based on good management and vaccination of breeder flocks to provide maternal immunity against *Salmonella* infection in the day old chicks. An effective hatchery code of practice should include 1) -separate housing for high and low risk flocks. 2) -Flow of eggs, chicks, trolleys and tray should be in single direction, reverse direction should not be allowed. 3) -Airflow should be from clean to dirty areas. Efficient handling and proper disposal of waste should be done. The flocks should be monitored for *Salmonella* infection periodically. If *Salmonella* outbreaks occur then take appropriate control measures. Effective bio-security measures should also be followed. Individual bird-vaccination should be done periodically to maximize the protective mechanism and optimization of intestinal flora**.**

A.2 Feed and drinking water

Poultry feed and drinking water can be contaminated by *Salmonella* from the origin source thus feed and water are the potential source of infection. Protein in poultry feed can be a potential source of infection. Animal protein may be contaminated from salmonella from origin itself while vegetable protein can be contaminated during processing of feed. Testing of raw materials, which are a part of poultry, feed is important. Risk of feed being contaminated is relatively small. However, the potential for spread of *Salmonella* infection from contaminated feed is huge. *Salmonella* contamination may be intermittent and therefore may not always be present in the finished products. Feed sample for *Salmonella* testing should be taken from inside the equipment and from related spillage. Air supply and control of temperature and humidity near the cooler are very important to avoid recontamination. Heat and chemical treatment of feed may be necessary. Water stored in tanks should be monitored for the presence of *Salmonella*. Nipple drinkers' are less

likely to transmit *Salmonella* than bell or cup drinkers. Adequate rodent control measures should be followed at all stages of poultry production and feed manufacture. Feed stores and houses should be proofed against wild birds and rodents.

A.3 Farm management

Control of salmonellosis at farm is based on preventing the introduction of *Salmonella* on to a farm and preventing its spread in farm horizontally from bird to bird. On arrival at the farm, chick should be *Salmonella* free so there must be adequate *Salmonella* monitoring and control at the hatchery as above described. When chicks arrive at the farm, samples can be taken from-chick box liner, swabs from bases of boxes and dead chicks. Culture of these samples will confirm the *Salmonella* status of the new birds. Positive samples should be traced back to the suppliers. Monitoring and health checkup of personnel (who attend the birds) for the diagnosis of *Salmonella* carriers may be necessary. Strict biosecurity measures should be followed in the farm shower and changing room facility and restrict the number of people allowed to enter poultry houses. Staff attending poultry should not be allowed to attend other animals. Education and awareness programmes of personnel should be done at the farm. Vaccinating the chicken against *Salmonella* can prevent infection. Farm building surfaces and equipments should be easily cleanable with disinfectant and disinfection swabs should be taken after cleaning and disinfection to check for the persistence of *Salmonella*. Adequate time interval should be allowed between subsequent flocks if previous flocks were *Salmonella* positive.

A. 3. 1 following points should be considered with extra attention

a. Monitoring

Flocks should be monitored frequently for possible *Salmonella* infection. Samples for cultures can be taken from-litter, fecal samples, and boot, or drag swabs, dust samples on broiler farms. A combination of boot swab and dust taken at 21 to 28 days is better than sampling litter. For breeder flocks in lay or commercial laying flocks, samples can also be taken from nest box floor swabs, nest box litter, swabs from egg sorting tables and corridors and spilled debris from egg collection belt. In cases of positive samples, appropriate action must be taken, which could be: treatment with anti microbial or culling of infected flocks.

b. Vaccination

Vaccination as part of *Salmonella* control programme contributes to the achievement of *Salmonella* free poultry meat and eggs. Live and inactivated *Salmonella* vaccines are available. When the parent birds are vaccinated against *Salmonella*, the chicks are protected by maternal antibodies in the hatchery. This will limit the spread of *Salmonella* infection in the hatchery. Vaccination against *Salmonella* protects chicken from Infection or re-infection through vermin and the environment, infection from contaminated feed and spread of an undetected infection. Chances of infection are more in flocks where a few chicken are not protected by vaccination. Breeders, broilers, and layers can all be vaccinated against *Salmonella* according to the standard vaccination schedule.

c- Gut flora enhancement

The inclusion of some inhibitory products in the diets of broilers on the farm results in extra protection against *Salmonella* infection as the maternal antibody decline. These products support the natural intestinal micro flora resulting on a negative impact on pathogenic bacteria such as *Salmonella*.

d- Cleaning and disinfection

Houses and buildings should be designed to facilitate cleaning and disinfection. After cleaning, swabs should be taken to check for the persistence of *Salmonella*. Farms that have persistent problem with re-infection should be left vacant for some time. Problem farms (farms with previous *Salmonella* positive flocks) should be allowed more time for cleaning and disinfection. Drying is very important in the complete elimination of *Salmonella*. After cleaning and disinfection, fresh litter should be supplied for the new flocks.

e- Hatching egg hygiene

This is another important aspect of on farm *Salmonella* control. Chicks may be infected with *Salmonella* via contaminated egg shells .This could cause spread of salmonellosis in the hatchery. Faeces usually contaminate egg shells. Egg should be collected thrice daily. Dirty eggs and eggs taken from the floor should be separated and not used for hatching. Lightly soiled eggs may be cleaned gently with potassium parmagnate solution. In the hatchery these eggs should be placed at the bottom of the hatching tray.

B-Improvements in poultry product processing technology

It is important to minimize microbial contamination of poultry meat products, especially in relation to any food borne pathogen, such as *Salmonella*. The *Salmonella* status of broiler flock should be monitored during rearing at farm. *Salmonella* positive flocks should be processed separately, usually at the end of the processing shift. The equipment and the processing environment should be cleaned and suitably sanitized before the next flock is processed.

SUMMARY

Salmonella is one of the major foodborne pathogen to human which mainly spread through contaminated food from poultry origin. For prevention of Salmonellosis in human, adequate hygienic measures should be followed in poultry farming and poultry product processing.

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Functional Food: Innovative Trends in the Food Industry

Swati Shivani[1], Subodh Sinha[2] and Raj Narayan Trivedi[3]

[1]Ph.D Scholar Division of Dairy Cattle Nutrition N.D.R.I, Karnal, [2]Ph.D Scholar, Department of Animal nutrition IVRI Izatnagar Bareilly [3]Ph.D Scholar, Department of Veterinary Microbiology G.B.P.U.A & T, Pantnager

Correspondence email: dr.rntrivedi@gmail.com

Phone No- 09456092715

In the last decades consumer demands in the field of food production has changed considerably. Consumers more and more believe that foods contribute directly to their health (Mollet and Rowland, 2002). Today foods are not intended to only satisfy hunger and to provide necessary nutrients for humans but also to prevent nutrition-related diseases and improve physical and mental well being of the consumers (Menrad, 2003; Roberfroid, 2000). The development of functional foods is currently one of the most intensive areas of food product development world wide. In this regard, functional foods play an outstanding role. The increasing demand on such foods can be explained by the increasing cost of healthcare, the steady increase in life expectancy, and the desire of older people for improved quality of their later years (Kotilainen *et al*., 2006; Roberfroid, 2000a). Food products with health claims attesting to functional capacity to promote health which extends beyond provision of essential nutrients are eagerly accepted by consumers and likely results in decreased morbidity and mortality, and increased quality of life in the general population.

The term ‘‘functional food’’ itself was first used in Japan, in the 1980s, for food products fortified with special constituents that possess advantageous physiological effects (Hardy, 2000; Stanton *et al*., 2005). Functional foods may improve the general conditions of the body (e.g. pre and probiotics), decrease the risk of some diseases (e.g. cholesterol-lowering products), and could even be used for curing some illnesses. Functional foods have been broadly defined as ‘foods similar in appearance to conventional foods that are consumed as part of a normal diet but have been modified to subserve physiological roles beyond the provision of simple nutrient requirements and/or reduce the risk of chronic disease. (Bech-Larsen & Grunert, 2003). International Life Science Institute (ILSI) Europe defined functional food as follows ‘‘a food product can only be considered functional if together with the basic nutritional impact it has beneficial effects on one or more functions of the human organism thus either improving the general and physical conditions or/and decreasing the risk of the evolution of diseases.

Classification of functional foods & Health benefits

A growing number of consumers are becoming aware of functional foods with

hopes of reaping additional health benefits that may reduce certain disease risks or promote optimal wellness. A number of health benefits are related to functional food. Health benefits may be grouped in three main classes: direct health benefits, reduction of risk diseases and better life conditions. The extant literature proposes different classification of functional foods. From a product point of view (Kotilainen, 2006; Sloan, 2000; Spence, 2006) have proposed the following classification:

1. Fortified product: A food fortified with additional nutrients (labelled fortified products), such as fruit juices fortified with vitamin C, vitamin E, folic acid, zinc and calcium.

2. Enriched products: A food with additional new nutrients or components not normally found in a particular food (labelled enriched products), like probiotics and prebiotics.

3. Altered products: A food from which a deleterious component has been removed, reduced or replaced By other components with beneficial effects (labelled altered products), for example: ice cream and fibre fat releasers.

4. Enhanced commoditie: A food in which one of the components have been naturally enhanced (labelled enhanced commodities), e.g., eggs with increased omega-3 content.

An alternative classification based on the aim of functional foods, they can be classified as follows (Makinen-Aakula, 2006).

- Functional foods that add well to life or improve children's life, like prebiotics and probiotics.
- Functional foods that reduce an existing health risk problem such as high cholesterol or high blood pressure.
- Functional foods which makes life easier, such as lactose-free or gluten-free products.

Main types of functional foods available on the market

Most early developments of functional foods were those of fortified with vitamins and/or minerals such as vitamin C, vitamin E, folic acid, zinc, iron, and calcium (Sloan, 2000). Subsequently, the focus shifted to foods fortified with various micronutrients such as omega-3 fatty acid, phytosterol, and soluble fibre to promote good health or to prevent diseases such as cancers (Sloan, 2002). Alternative classification of some functional products are (1) ''add good to your life'', e.g. improve the regular stomach and colon functions (pre and probiotics) or ''improve children's life'' by supporting their learning capability and behaviour. It is difficult, however to find good biomarkers for cognitive, behavioural and psychological functions. Other group (2) of functional food is designed for reducing an existing health risk problem such as high cholesterol or high blood pressure. A third group (3) consists of those products, which ''makes your life easier'' (e.g. lactose-free, gluten-free products) (Makinen-Aakula, 2006).

Functional food products are not homogeneously scattered over all segments of the food and drink market and consumer health concerns and product preferences may vary between markets. The most prominent types of functional products are presented briefly in the followings.

PROBIOTICS

Probiotics are defined as "live microorganisms, as they are consumed in adequate numbers confer a health benefit on the host", with ongoing controversy as to whether cultures must be viable for efficacy in all cases. (Charalampopoulos, Pandiella, and Webb 2003). It produces Influence on human health, including influence on gastrointestinal health, immune function and cancer (Jones and Jew, 2007). Example - Lactic acid bacteria (LAB) and bifidobacteria.

PREBIOTICS

Prebiotics are non-digestible food ingredients that beneficially affect the host by stimulating the growth and/or activity of one or a limited number of bacteria in the colon, thus improving host health. Ex- Fructooligosaccharide (FOS), inulin, isomalto oligosaccharides (IMO), polydextrose, lactulose and resistant starch.

Functional drinks

It is non-alcoholic beverages fortified with vitamins A, C and E or other functional ingredients (Menrad, 2003 and Side, 2006) Used to reduce the cholesterol level, to stimulate the antioxidant function and to avoid the inhibition of growth and the deformation of the bones (Tammsaar, 2007). Ex- ACE drinks, cholesterol-lowering drinks, "eye health" drinks or "bone health" drinks.

Functional cereals

Cereals, is also used for the production of functional foods as oat and barley. Cereals can be used as fermentable substrates for the growth of probiotic microorganisms. Additionally, cereals can be applied as sources of non-digestible carbohydrates that besides promoting several beneficial physiological effects can also selectively stimulate the growth of lactobacilli and bifido bacteria present in the colon and act as prebiotics. Cereals contain water soluble fiber, such as beta-glucan and arabinoxylan, oligosaccharides and resistant starch, which have been suggested to fulfill the prebiotic concept. Cereal constituents, such as starch, can be used as encapsulation materials for probiotics in order to improve their stability during storage and enhance their viability during their passage through the adverse conditions of the gastrointestinal tract (Brennan & Cleary, 2005; Charalampopoulos *et al*., 2002).

Functional meat

Meat modified by adding ingredients considered beneficial for health or by eliminating or reducing components that are considered harmful **(**Bhat and Bhat, 2011). To reformulate the fatty acid profiles or inclusion of antioxidants, dietary fiber or probiotics (Siro, 2008). Meat with the control of the composition of raw and processed materials.

Functional eggs

Eggs with increased omega-3 fatty acid content **(**Siro, 2008). Egg enriched with omega-3 fatty acids simultaneously with antioxidants and other vitamins helps in to reduce the possible formation of blood clots and for blood pressure control.

Development of functional food: some considerations

Several mid and long-term developments in society, as well as socio-demographic trends are in favour of functional food, so that it can be assumed that functional food represents a sustainable category in the food market. Moreover, it is beyond doubt that persuading people to make healthier food choices would provide

substantial (public) health effects (e.g. decreased mortality, and increased quality of life), therefore it is a common economic and public interest (Jones and Jew, 2007; Van Kleef, Van Trijp & Luning, 2005). This increasing consumer awareness in combination with advances in various scientific domains, provides companies with unique opportunities to develop an almost infinite array of new functional food concepts (Bistrom & Nordstrom, 2002; Van Kleef *et al.*, 2002). This development of functional food involves identifying functional compounds and assessing their physiological effects; developing a suitable food matrix, taking into account bio-availability and potential changes during processing and food preparation. These foods are not intended merely to satisfy hunger and provide humans with necessary nutrients, but also to prevent nutrition related diseases and increase physical and mental wellbeing of consumers (Menrad, 2003). Therefore, as one of the first steps of product development, it is necessary to explore which diseases consumers are concerned (Van Kleef *et al.*, 2005). It is not a neglectable aspect that functional food products help to ensure an overall good health and/or to prevent/manage specific conditions in a convenient way (i.e. through daily diet) (Benkoui-der, 2005a; Poulsen, 1999; Sloan, 2000).

CONCLUSIONS

The goal of functional foods is to translate scientific advances in understanding the role of diet in health into effective foods, and to maintain the quality and safety of the modern food supply. It will be necessary to understand the mechanisms by which health performance and disease prevention are supported by diet. Ingredients (whether specific molecules or mixtures of complementary molecules) that have beneficial effects on these mechanisms must continue to be discovered and their activity, stability and delivery within foods assured. functional Food are often effective in promoting health and leading to disease risk reduction.

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