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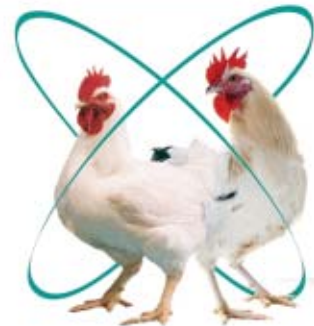
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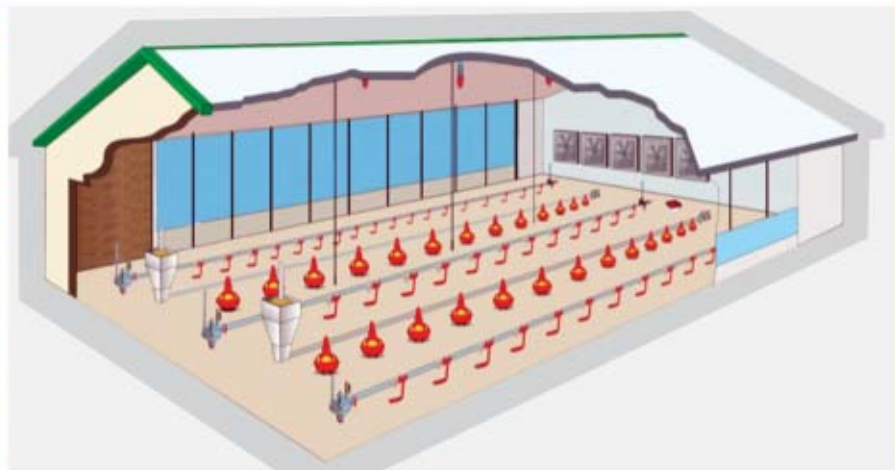
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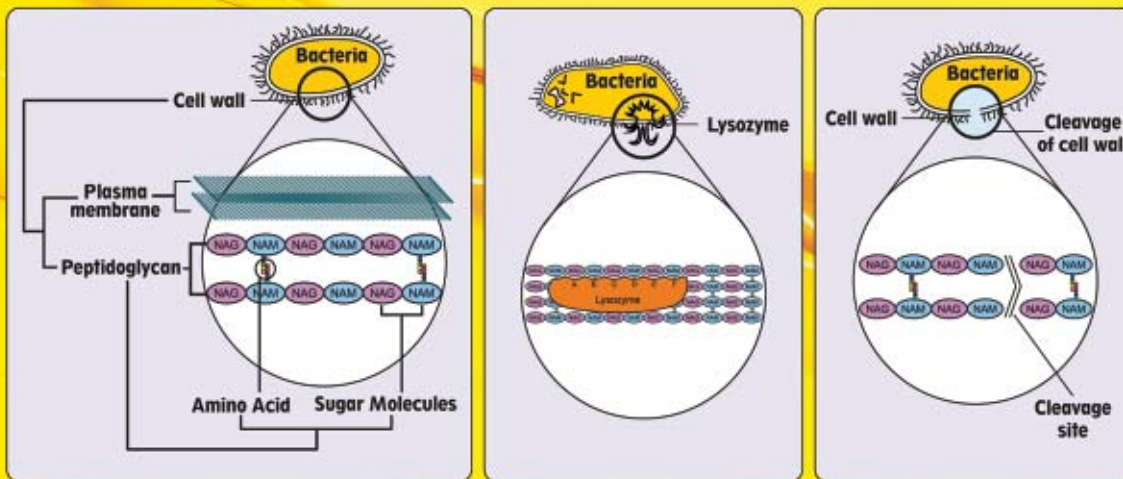


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Moving Towards “Atmanirbhar Bharat’ in Poultry Meat Production & Consumption Post COVID-19



Ministers from the Telangana government eating chicken at a public event to refute rumours that consumption of poultry products can cause Covid-19. (Image courtesy: WWW.NEWSMETER.IN)

Chicken meat can arguably be considered as “King of all meats’ owing to its availability, taste and nutritive values. In India, the chicken meat consumption is steadily rising YoY and the annual consumption in FY 2019 was considered to be around 3.8MMT with a CAGR of around 6%.

For FY 20-21, this consumption is anticipated to decrease owing to numerous factors including reduction in placements, negative social publicity, prevalence of misconception of getting Covid-19

infected through eating chicken, increase in retail cost of chicken meat and reduction in disposable income of people amid continuous lockdowns and slowdown of economy as a whole.

Nevertheless, this trend is absolutely temporary as the situation is going to turnaround soon after the Covid situation gradually improves. There is a tremendous scope of amplifying the profits amid changing environment in current scenario. It is paramount that poultry producers work on a

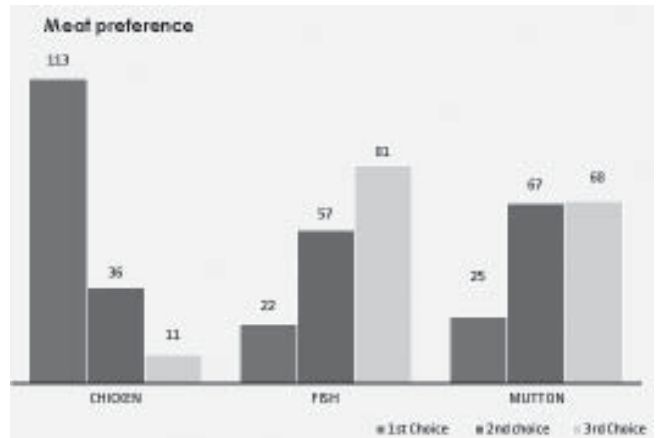
paradigm shift in their business and operational models so that they adopt to new “normal” and meet the changing expectations and needs of the customers.

To understand the changing patterns and rising expectations of the chicken meat consumers, a market survey was launched in May,2020.The survey lasted for nearly 5 weeks and covered nearly 200 non-vegetarian customers. Their responses were recorded and analysed to get the insights and changing trends of chicken meat consumption. The demography of respondents was represented by 74% male population and more than 50% of the respondents belonged to service class. 60% of the respondents belonged to North and Southern parts of India and 40% from North and Eastern region.

The outcomes of the survey are highlighted in context of the changing business scenario. More and more people are operating from home and moving out only in case of emergencies. This has led to the increase in the consumption of food among households but at the same time the demand in the restaurants and hotels has plummeted. Moreover, the due to the closure of educational institutions has also resulted in the decline in the demand of poultry meat. Thus, in order to compensate the loss in later segment, it is eminent to reach directly to customers by increasing the retail sales. Immunity has become a buzzword now and even a layman knows the importance of boosting immunity through good quality proteins. Also, there is an increased focus of government which may result in launch of new supportive policies and schemes for this sector in the time to come. It was highlighted by our honourable PM in his Independence Day message that poultry and animal husbandry can play an important role in doubling the farmer’s income.

Preference of Meat:

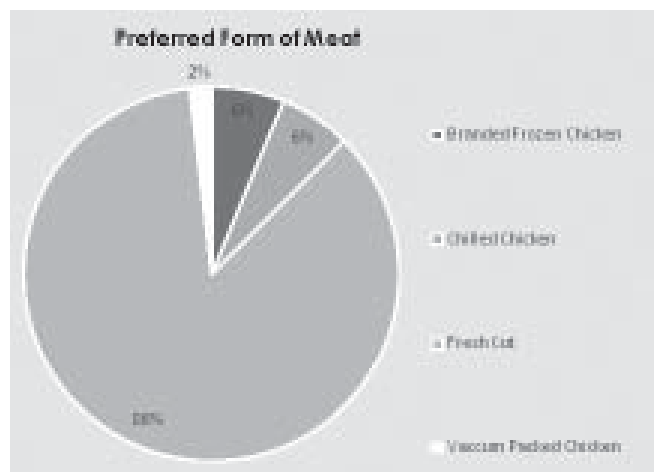
Chicken meat was considered as most preferred meat owing to its nutritive features and safety. The consumption pattern was analysed and found to be weekly once by over 50% of the population covered.



Chicken meat emerged as most preferred meat by 70% of the respondents

Chicken meat is considered as one of the healthy meats and is relatively low in fats and cholesterol among other meats. It has good amount of proteins of high biological value and is laden with n-3 polyunsaturated fatty acids. It provides selenium as antioxidant and aids in immunity building of body to fight against pathogenic bacteria and virus.

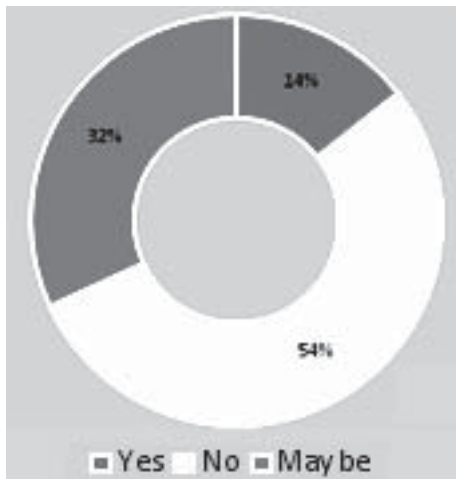
The poultry meat production is expected to rise with a CAGR of around 9% from FY 2015-16 to FY 2022-23. The meat availability per capita is also bound to rise by CAGR of 7% thus creating lot of scope and opportunities in this segment



Fresh cut chicken meat is most preferred for Indian consumers

The study reiterated the well-known fact that Indian consumers prefer the fresh cut chicken than other forms. This is the traditionally preferred form of

chicken which may shift towards the packed and branded chicken. Post covid outbreak, safety of chicken meat becomes paramount and largely people will shift towards a meat with full traceability and untouched by hands. This is reflected in the study where nearly 46% of the respondents will/ may look for anew outlet with assured quality, safety and traceability of chicken meat.



46% of the consumers will/may look for a reliable and trusted outlet for safe chicken meat

Key Challenges Amid Changing Environment

The pandemic has brought many challenges in poultry industry in terms of fluctuations of market demand, supply chain issues, labour sourcing, inconsistency in cash flow among the key highlights. This has given the opportunity to poultry producers to re-invent their approach of doing

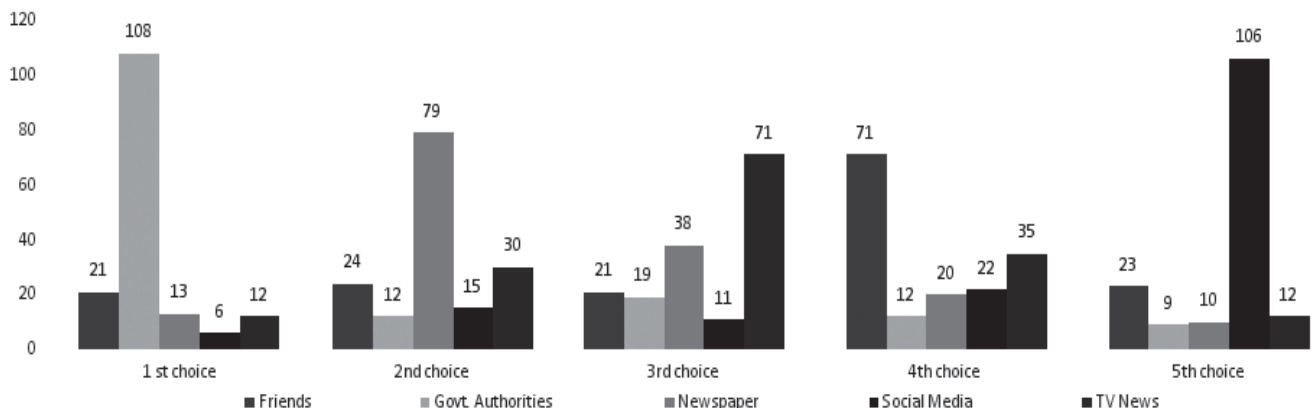
business in “new normal”. There is a dire need to reaching direct to consumers to minimize the risk of business and reduce the dependency on traders and middlemen. The key drivers in the changing business and market scenario can be projected as follows:

- Creating alternate ways of supply chain to reach consumers
- Technological advancements and innovations
- Resources optimization and enhancing business process efficiency
- Effective forecasting and agility in remodelling the business operations
- Sustainable ways of poultry production with minimized antibiotics

Communicating the Message Effectively

As the Covid-19 pandemic start emerging, spread of rumours citing the spread of virus through eating poultry meat wreaked havoc on the industry and lead to drastic fall in the chicken consumption. Largely, social media was blamed for the loss owing to its lightening speed of spread across all the sections of society.

In the study, it was observed that nearly 70% of the respondents considered government authorities as a credible source of information and social media was considered least reliable source of information.



Nearly 70% respondents trust government authorities as authentic source of information but reach and speed of false messages through social media caused damage to poultry industry

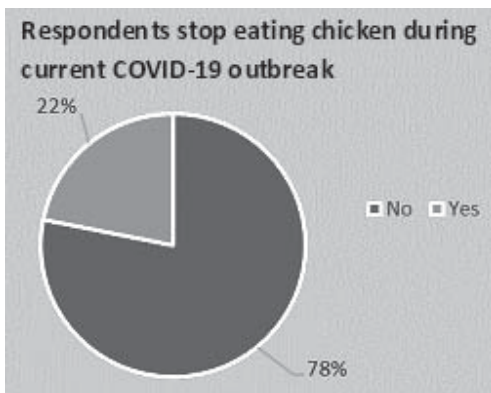
Recovering from Losses:

As per the estimates, poultry industry suffered a loss to the tune of Rs. 1.6 Billion per day. This was largely created by Fake News and irresponsible and baseless news of linkage of spread of corona virus by eating chicken meat. Various efforts were made by FSSAI, political leaders, integrators and other stakeholders of industry to curtail the loss but did not proved enough. Lot of chicken melas and awareness camps were organized to spread right information among general public.



It generated lot of interest and attracted crowd who attended and participated in the mela consuming chicken and busting the myth.

In the study conducted, it was found that around 22% of the respondent stopped eating chicken amid corona pandemic. It may be due to the lack of right information or due to precautionary approach as meat is considered as luxury food item and not a necessity.



22% of the respondents stopped eating chicken during covid-19 outbreak

Paradigm Shift for Quality:

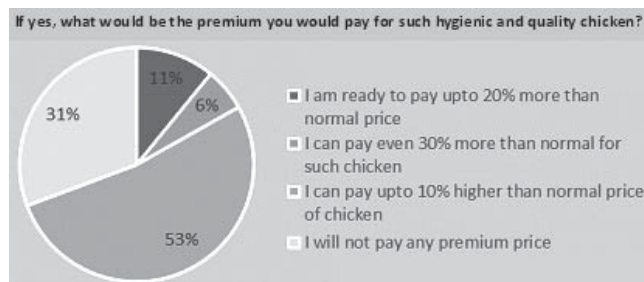
Most of the respondents were in agreement to receive a nicely packed branded chicken with guarantee of quality and traceability directly delivered to their home



Nearly 70% of respondents were ready to pay premium price for a good quality branded chicken

What's in it for Me?

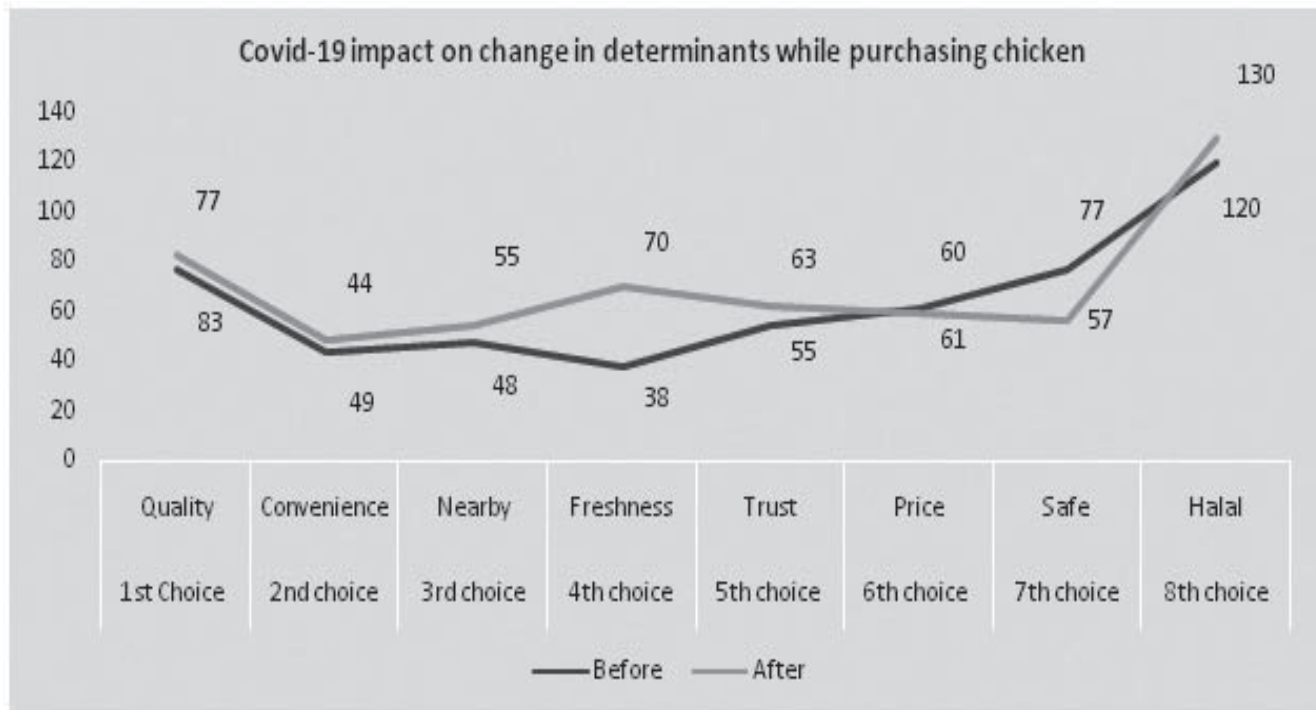
It is paramount that the business process to be again looked from new angle and perspective and then backed with required technological and operational innovations, poultry producers should carve a new way which leads to the profitable future. Today's consumer is technologically well connected and understands the importance of value additions in food delivery systems. They are willing to pay premium towards a good quality and hygienic chicken meat. The same was reflected during the survey where a whopping 70% of the respondents were ready to pay premium to the tune of up to 30% of the normal cost of chicken.



74% respondents vouched for home delivery of nicely packed branded chicken with guarantee of quality & traceability

Need of the Hour- Good Quality Chicken Meat with Complete Traceability

In the current study, it was estimated that people are focused on quality post covid and will prefer a branded chicken which represents quality and trust.



Quality, freshness and customer closeness are important parameters customers evaluating post Covid

Conclusion:

The growing pandemic has created a need for the safe and hygienic food. The chicken meat in India is largely based on wet markets and individual meat sellers. There exists a huge opportunity for safe, hygienic and branded product as the segment is growing by double digits which has got a huge thrust from the pandemic outbreak.

The current study delved into the mind of new age consumers with a changing mindset. Due to the change of consumer mindset following the Covid-19, this study revealed that the future surely lies in branding, processing and adding value to the produce. Today's consumer is well connected and aware about the latest advancements and willing to try new products and services which satisfies

the quality parameters. The need of a good quality protein is clearly established to improve the immunity and stay healthy. Thus, it becomes vital that poultry producers innovate and bring technological advancements and innovations in supply chain and production processes to connect with the consumers directly. For this, the integrators can directly get benefit from the organizations working on "Partners in Progress" model and has the expertise in planning and executing specified programs including antibiotic reduction.

(Disclaimer: The views expressed by author are personal and does not endorse the view of company. Currently the author is working as Managing Director of EW Nutrition South Asia)

NATIONAL EGG CO-ORDINATION COMMITTEE

DAILY / MONTHLY EGG PRICES DECLARED BY NECC AND PREVAILING PRICES AT VARIOUS PRODUCTION CENTRES (PC) AND CONSUMPTION CENTERS (CC) AUGUST 2020

Name Of Zone / Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average					
NECC Prices																																					
Ahmedabad	360	372	375	382	387	387	387	387	360	360	360	360	362	367	372	377	382	387	392	397	402	404	425	425	420	410	415	420	425	435	445	455	393.77				
Ajmer	375	378	380	383	383	380	350	353	347	347	347	347	360	365	367	367	388	388	388	390	390	390	380	380	388	399	404	406	425	425	435	442	383.75				
Asansole	425	395	430	430	430	430	430	430	420	420	420	420	420	370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	419.23				
Barwala	370	373	376	383	383	380	350	353	347	347	347	354	371	367	380	380	380	383	386	386	386	400	395	388	393	396	401	421	424	440	436	383.1					
Bengaluru (CC)	350	355	365	370	375	375	375	360	345	345	345	350	350	355	360	360	365	370	375	380	380	380	380	380	380	380	380	385	395	405	415	425	371.94				
Brahmapur (OD)	391	399	404	409	409	409	389	389	378	378	378	378	378	378	385	392	394	399	404	404	408	408	409	409	405	405	409	422	430	438	445	402.06					
Burdwan (CC)	450	410	450	450	450	450	420	420	420	420	420	420	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	434.17					
Chennai (CC)	375	380	380	395	395	395	395	395	365	365	365	365	365	365	365	365	365	365	375	375	375	375	375	375	375	375	375	375	390	390	410	420	379.19				
Chittoor	368	373	373	388	388	388	388	388	358	358	358	358	358	358	358	358	358	368	368	368	368	368	368	368	368	368	368	368	383	383	403	413	372.19				
Delhi (CC)	385	385	385	388	388	388	388	388	388	388	388	370	370	370	380	380	380	395	400	395	400	400	400	400	400	400	411	411	415	438	440	443	398.16				
E.Godavari	387	394	399	403	405	405	405	405	375	375	375	375	375	375	380	387	390	393	398	401	404	407	407	407	407	407	407	412	417	422	429	436	443	399.03			
Hyderabad	335	345	355	365	365	365	365	345	345	345	345	350	355	360	360	360	365	370	375	375	375	375	375	375	378	380	382	384	386	390	401	408	367.06				
Ludhiana	363	369	373	375	375	379	371	361	356	351	351	351	358	367	367	367	367	383	383	388	388	388	388	386	377	386	396	407	423	423	436	379.9					
Midnapur (KOL)	450	410	450	450	450	450	420	420	420	420	420	420	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	433.08					
Mumbai (CC)	378	385	390	395	405	405	405	405	385	385	385	385	385	388	388	388	388	392	395	400	405	410	410	410	410	410	415	425	430	435	445	455	404.35				
Muzaffarpur (CC)	400	419	419	424	429	428	423	401	409	410	410	414	414	414	419	419	429	433	438	438	438	438	438	438	442	448	448	462	467	471	486	431.09					
Mysuru	357	363	373	378	378	380	380	380	350	350	350	355	355	360	365	365	370	375	380	385	385	385	385	385	385	385	385	390	395	405	415	427	377.13				
Nagpur	323	340	345	355	350	340	325	330	330	310	315	320	335	355	355	355	360	365	365	365	360	360	360	360	360	365	380	390	400	410	415	420	355.9				
Namakkal	365	365	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	385	385	385	385	385	385	385	385	385	385	390	390	410	410	369.68				
Patna	409	414	419	419	419	409	409	405	405	405	405	410	414	414	414	414	414	429	429	429	429	429	433	433	433	438	442	442	457	467	476	426.45					
Pune	380	385	385	390	400	400	400	400	380	380	380	380	380	380	385	385	395	400	405	410	410	410	410	410	410	410	412	415	425	430	435	445	460	399.39			
Ranchi (CC)	409	414	419	428	428	428	428	428	419	419	419	429	429	429	429	429	438	438	442	442	442	442	442	442	442	448	452	452	462	467	476	490	437.39				
Vijayawada	392	399	401	403	405	405	405	405	375	375	375	375	375	375	380	387	390	393	398	401	404	407	407	407	407	407	407	412	417	422	429	436	443	400.23			
Vizag	400	400	405	405	405	405	405	405	375	375	375	375	375	375	380	390	400	405	410	410	415	425	425	425	425	425	435	450	450	452	454	410.19					
W.Godavari	387	394	399	403	405	405	405	405	375	375	375	375	375	375	380	387	390	393	398	401	404	407	407	407	407	407	407	412	417	422	429	436	443	399.84			
Warangal	328	338	348	358	368	368	368	368	348	348	348	348	348	358	363	363	363	368	373	378	378	378	378	378	381	383	385	387	389	393	404	411	369.26				
Prevailing Prices																																					
Allahabad (CC)	371	390	405	405	405	390	380	380	380	381	381	390	414	414	414	414	428	429	429	419	414	409	405	405	429	452	452	462	467	476	414.45						
Bhopal	380	380	380	390	400	400	400	380	370	370	370	370	375	375	385	400	400	410	410	410	412	412	400	380	380	380	390	400	415	425	435	445	393.18				
Hospet	315	320	330	335	340	340	340	325	310	310	310	315	320	325	325	330	335	340	345	345	345	345	345	345	350	360	370	380	390	390	390	390	390	390	390	390	390
Indore (CC)	390	390	380	380	410	410	400	370	355	355	355	360	370	380	380	380	385	400	405	407	407	407	407	407	395	398	398	407	425	430	440	450	392.74				
Jabalpur	372	372	380	381	387	387	377	370	370	370	370	370	365	385	385	385	392	395	400	405	407	407	407	407	407	395	398	398	407	425	430	440	450	394.16			
Kanpur (CC)	390	395	395	414	414	405	395	386	386	386	386	390	400	400	400	400	410	410	419	419	419	419	419	419	419	419	419	419	419	419	419	419	419	419	419	419	
Kolkata (WB)	410	412	418	450	418	418	418	418	418	418	418	418	418	418	418	418	418	423	428	428	428	448	448	448	448	453	468	468	475	485	492	500	434.97				
Luknow (CC)	390	390	390	410	416	416	416	416	416	416	417	417	417	417	417	417	420	427	443	443	443	443	443	443	443	443	443	443	443	443	443	443	443	443	443	443	
Raipur	390	390	370	370	400	400	400	400	370	365	365	365	375	380	400	400	405	405	415	420	430	430	430	430	430	430	430	430	430	430	430	430	430	430	430	430	
Surat	370	375	380	385	385	390	390	370	370	370	370	372	377	382	387	392	397	410	415	420	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	
Varanasi (CC)	405	420	420	423	423	424	416	417	417	417	407	417	417	417	420	423	423	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	433	



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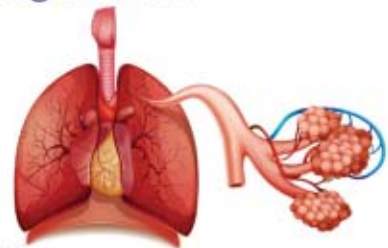
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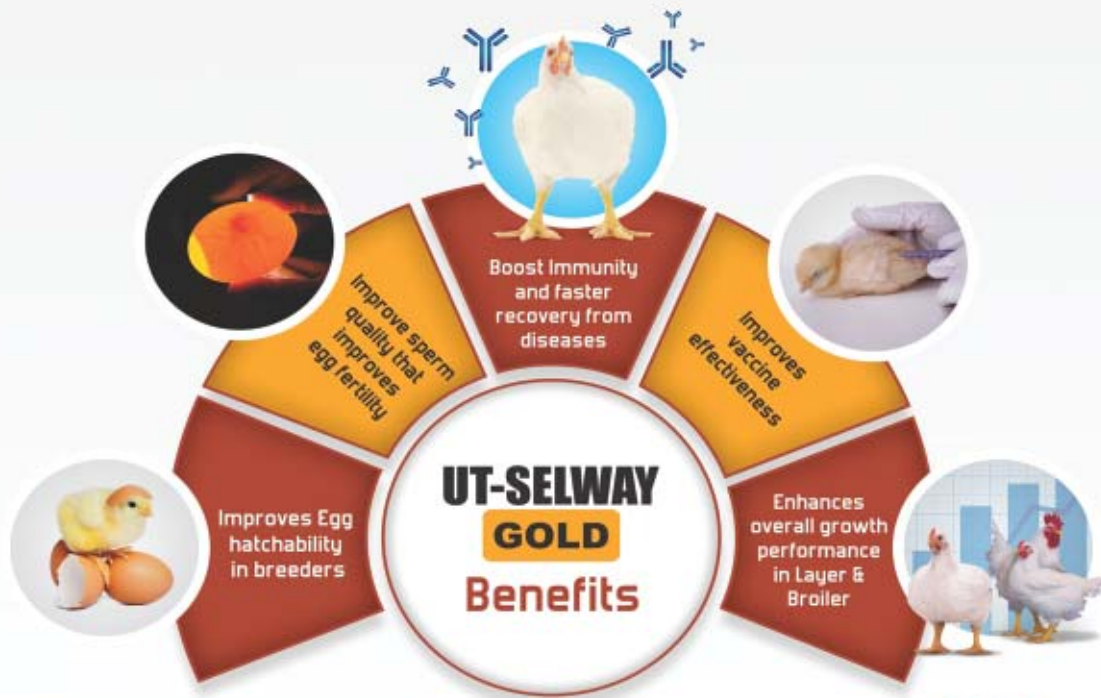
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Plastination: A unique technique of fish preservation

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1. Introduction

Plastination is the method of long term preservation of the biological tissues with completely visible surface and high durability. It is a process designed to preserve the body for educational and instructional purposes in a more detailed way than ever before. Plastinates are dry, odorless, durable and are particularly valuable educational tools not only for medical professionals but also for a broader public.

Anatomists have long sought a technique for the preservation of soft tissue, producing durable, dry and handable specimens. Both, Deegener and Berndt (1914) and Hochstetter and Schmeidel (1924) came close to this goal with their paraffinization technique. Their patent specification extols the dry texture, natural appearance, and great resistance to mechanical influences of paraffinized specimens. However, the claim of an unlimited durability was exaggerated, as paraffinized specimens turned out to be delicate, heat-sensitive and flammable.

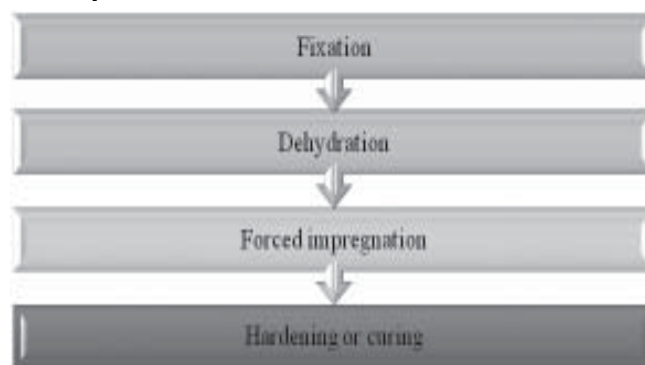
Plastination technique was developed by Dr. Gunther von Hagens in 1979 at the Heidelberg University in Germany (von Hagens, 1979). The improved properties of plastinated specimens are mainly accounted for by the superior qualities of curable polymers. The class of polymer used determines the mechanical (flexible or firm) and optical (opaque or transparent) properties of the specimen.

2. Principle behind Plastination

In a living organism, the body fluids play a very important role in maintaining the shape and weight

of the organism. However, decomposition begins immediately once after the organism dies. The process of decomposition is aided by the body fluids which provide a good medium for the body's own chemicals and enzymes to autolyse the body tissues, and for bacteria to breakdown the tissues by putrefaction (Ameko et al., 2014). During plastination, the decomposition of the organism is terminated through fixation. The water and fats in the tissues are then totally replaced by dehydration with acetone. The acetone is completely evaporated from the tissues and replaced with a low viscosity and reactive polymer such as silicon or polyester through forced vacuum impregnation (Suganthi and Deepak, 2012). The polymer is then hardened by curing with light, heat or certain gases (Weiglein, 2005). The preserved specimens are known as Plastinates (Priya et al., 2007).

3. Steps involved in Plastination



3.1. Fixation: This is the first step of plastination in which fish is kept in 10% formaldehyde solution at room temperature in order to arrest the decomposition of the body. Lower percentage of formaldehyde solution may produce less bleaching of the fish. Minimal fixation with low % of

formaldehyde and short time duration (1-2 days) will yield a flexible and more natural looking fish.

3.2. Dehydration: This is the second step in which fishes are removed from the fixative, drained and then immersed in acetone solution. Under freezing conditions, the acetone will remove all the water and soluble fats and replace it inside the cells. Fishes are subjected to at least three changes of acetone bath at one-week interval in every change and agitated at least once in a day to ensure maximum action of the acetone on the fishes.

3.3. Forced impregnation: This is the central phase of the plastination process. Dehydrated fishes are removed the acetone solution, drained off excess acetone and then placed in bath of curable liquid polymer such as silicone rubber, polyester or epoxy resin. By creating a vacuum, the acetone boils at a low temperature. As the acetone vaporizes and leaves the cells, it draws the liquid polymer in so that the polymer can penetrate in each and every cell. This process lasts 2-5 weeks.

3.4. Hardening or curing: This is the final step of plastination in which impregnated fishes is exposed to a hardener which can be liquid (S3) or gaseous (S6) in nature. Impregnated fishes and a bowl filled with curing agent is placed in a tightly closed chamber for several weeks. The hardener commences end to end linkage and hence elongation of the silicone molecules, which produces increased viscosity of the reaction mixture. This linkage is reported to enhance flexibility of the impregnated fishes. For complete curing, the fishes should be kept in a plastic bag for several weeks. Once the fishes are hardened, they are ready to use.

4. Advantages of Plastination

- Plastinated fishes are dry, odorless, durable and non-toxic.
- Fishes can be easily transported without any preservation input.

- Plastinated fishes are long lasting.
- Fishes are devoid of harmful effects of formalin exposure because there will not be formalin fume irritation on the dry fishes.
- Plastination technique can be used for preservation of all kinds of animals from gross specimens to cross sections which includes human beings, livestock's and fishes of different morphometric.
- Alternative method of fish preservation for teaching and research purposes.

5. Disadvantages of Plastination

- Plastination technique is a costly procedure as it involves costly chemicals and instruments.
- It includes sequential steps thus it is a time consuming process.
- It requires skilled and technical persons to carry out and handling of the equipment.
- Shrinkage and inability to manipulate the superficial structures to study deep structures.

6. Historical studies on Plastination of fish

Asadi (1998) carried out the plastination of three species of Sturgeons (*Huso huso*, *Acipenser persicus* and *Acipenser stellatus*) using standard S10 technique.

Ameko et al., 2013 preserved the fresh samples of Tilapia, African Catfish and African Bonytongue using a modified adapted protocol of standard S10 Plastination method.

7. Conclusion

Plastination is a unique method of preserving fishes in a dry and odorless state invented by Dr. Gunther von Hagens. Plastinated fishes serve as an excellent models for teaching and extension purposes because of easy handling without any noxious odor. It also serve as excellent museum specimens which can be kept in departments for

the aesthetic value. Thus Plastination is a game changing invention for macroscopic fishes and anatomical preparation.

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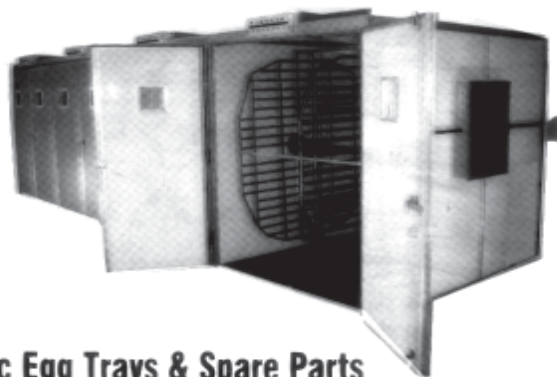


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Optimizing utilization of Fats & Oils in Poultry Nutrition

By Dr. Sandeep Gavali, Dr. K.P. Kale, Dr. Sunil Nadgauda,
Dr. Parag Mahadik and Dr. Sudhir Kale from Venky's India Limited, Pune

As per current scenario, oil is one of the major source of energy in poultry feed for fulfillment of required energy levels.

According to Baião NC and Lara LJC (2005) the term fat (animal or vegetal) is used as a synonym for lipid in the human food as well as in the ingredients for animal nutrition. The addition of fat to diets, besides supplying energy, improves the absorption of fat-soluble vitamins, diminishes the pulverulence, increases the palatability of the rations, and increases the efficiency of the consumed energy (lower caloric increment). Furthermore, it reduces the passage rate of the digesta in the gastrointestinal tract, which allows a better absorption of all nutrients present in the diet.

Considering importance of fats and oils in poultry feed, we want to discuss following important points:

- Use of Fats and Oils in poultry diet
- Emulsifier and their usage in poultry feed
- Field trial reports of the emulsifier (Emulso-V)

Fats and Oils in poultry feed:

According to Murugesan G. R., historically, starch (specifically maize/corn starch) has been the primary energy source for poultry feed. As maize is now being increasingly utilized in ethanol production, the cost and availability of starch as a low-cost energy source is being adversely affected. This makes dietary energy the costliest component in poultry feed. Energy costs will continue to drive grain prices, as more grain is diverted towards bio-fuel production, impelled by high crude oil prices. While continual usage of maize increases dietary costs and reduces margins, reduction of dietary

energy might result in either slowed growth rates and/or reduced feed efficiency. Another option, however, is to use supplemental fats and oils to increase dietary energy content. This would allow for continued performance and give the flexibility to poultry producers when pricing ingredients. Fats and oils have been used by the growing poultry industry around the globe as a supplemental dietary energy source in poultry feed to yield higher levels of metabolizable energy at an economically justifiable price. Hence, understanding fats and their metabolism is a critical factor when it comes to efficient utilization of the dietary energy contributed by fat/oil supplementation.

For understanding better usage of fats and oils and to increase its utilization, knowledge of the following points is essential:

1. Selection of fats and oils
2. Quality of Fats and Oils
3. Broiler's Diet
4. Digestion and Absorption of fats and oils

1. Selection of fats and oils:

Introduction of fats and oils:-

The term "fat" is used as a synonym for lipid and refers to triglycerides or triacylglycerols of several profiles of fatty acids. Oils are esters of glycerol as with fats; however, oils are liquid unlike fats which are solid at room temperature (Lehninger *et al.*, 2008).

Fats and oils both are composed of triglycerides (having three fatty acids with one glycerol backbone).

Fatty Acids –

- a) Short Chain Fatty Acids – Having 2 to 5 numbers of carbon atoms in their structure. For e.g. Propionic acid, Butyric acid.
- b) Medium Chain Fatty Acids – Having 6 to 12 numbers of carbon atoms in their structure. For e.g. Capric acid, Caprylic acid.
- c) Long Chain Fatty Acids – Having 13 to 21 numbers of carbon atoms in their structure. For e.g. Palmitic acid.
- d) Very Long Chain Fatty Acids – Having above 21 numbers of carbon atoms in their structure.

Saturated and Unsaturated Fatty Acids –

- a) Saturated Fatty Acids – Having no double bond in their carbonic chain structure, high melting point than unsaturated fatty acids, less polar and available in animals fats in large quantity.
- b) Unsaturated Fatty Acids – Having one or more numbers of double bonds in their carbonic chain structure, less melting point than saturated fatty acids, more polar, cis as well as trans type of fatty acids, available in vegetable oils in large quantity.

Triglycerides –

A)

- a) Simple Triglycerides – Having same types of fatty acids attached to their glycerol backbone.
- b) Mixed Triglycerides – Having different types of fatty acids attached to their glycerol backbone.

B)

- a) Triglycerides with Saturated Fatty Acids – Having all three saturated fatty acids in their structure.
- b) Triglycerides with Monounsaturated Fatty Acids – Having one double bond in their unsaturated fatty acids structure.
- c) Triglycerides with Polyunsaturated Fatty Acids – Having two or more number of double bonds in their unsaturated fatty acids structure.

Fats –

Fats are having more number of saturated fatty acids (no double bond in their carbonic chain structure), fats are less polar than oils and having high melting point, hence they are solid at room temperature. They are made up of simple or mixed types of triglycerides with more number of saturated fatty acids.

Oils –

Fats are having more number of unsaturated fatty acids (one or more numbers of double bond in their carbonic chain structure), high polar than fats and having less melting point than fats, hence they are liquid at room temperature. They are made up of simple or mixed types of triglycerides with more number of unsaturated fatty acids.

With considering above classification of Fatty Acids, Saturated and Unsaturated Fatty Acids, Triglycerides and Fats and Oils, selection of best fats and oils are as per below:

- I. Oils are preferred than fats as they are having more numbers of unsaturated fatty acids.
- II. The increase in the length of the carbonic chain of saturated fatty acids increases the melting point of the fat and the presence of the double bond decreases the melting point. The longer is the chain, the smaller is the number of double bonds, and less soluble it will be in water. The geometry of the double bond also influences the melting point.
- III. Trans fatty acids have higher melting point than their cis isomers.
- IV. All types of unsaturated fatty acids are more preferable than all types of saturated fatty acids.
- V. Long chain unsaturated fatty acids can provide more metabolizable energy to the birds than all other fatty acids and also helps to form more micro micelle for better absorption of oils.
- VI. Triglycerides with Polyunsaturated Fatty acids (Cis type of long chain unsaturated fatty acids) can provide more metabolizable energy to birds

than Triglycerides with Monounsaturated Fatty acids and Saturated Fatty Acids.

VII. U/S ratio (Unsaturated/Saturated) of fats/oils inclusion in poultry diet should be at least 4:1 for better utilization and absorption of fats/oils.

Additionally, there are some points need to consider during selection of fats/oils for poultry diet inclusion rather than above mentioned criteria for better utilization and prolong life of fats/oils.

2. Quality of Fats and Oils –

The quality of fats/oils is most essential part of selection of oils/fats for poultry diet and to maintain the good quality of selected oil/fat is also important for it's prolong life and it is depends on following points –

I. **Oxidative Rancidity** - Polyunsaturated fatty acids are more prone to oxidative reactions or to form oxidative rancidity as they are having more number of double bonds. Hence for avoiding the same we need to use some antioxidants. e.g. natural antioxidants (vitamins A and E), the synthetic α -tocopherol and other phenolic antioxidants (BHA Butyl hydroxyanisole, BHT - Butyl hydroxytoluene, TBHQ tert-butyl-hydroxyquinone, PG 3,4,5-Trihydroxybenzoic acid propyl ester) and the non-phenolic antioxidants (Ethoxyquin Ethox, 6 ethoxy-1,2 dihydro-2,2,4 trimethyl quinoline) are effective in inhibiting oxidation. BHA and BHT are effective in stabilizing animal fats. TBHQ is effective in stabilizing both animal and vegetal

fats. The mixture of TBHQ with BHT and/or BHA is widely used in the control of oil and fat oxidation. PG is the most adequate to stabilize animal fats (Butolo, 2001; Papas, 1993 cited by Gómez 2003).

II. **MIU (Moisture, Impurities and Unsaponifiable)** – Max level should be 1%.

III. **Acidity (Free Fatty Acids)** – It has been suggested that for each 1% of increase in acidity, 10 kcal of metabolizable energy is lost per kg of diet/ ingredient (Barbi & Lucio, 2003).

IV. **Saponification value** – It is always higher when triglyceride chains are shorter.

V. **Peroxide value** – Max. 20 meq is accepted per kg of oil/fat (or depends on the nature of fatty acids available in oil/fat).

VI. **Iodine value** – It is considered better for stability of fats/oils. Iodine value between 70 and 120 or above (or depends on oil/fat).

3. Broiler's Diet –

Total requirement of energy is high in broiler birds. For fulfillment of their energy requirement oil/fat is the best source than other carbohydrate and protein rich sources as heat increment during fatty acids conversion from oil/fat is lesser than carbohydrate and protein.

Generally following broiler diet specifications are followed in the poultry industry for better broiler performance.

Table 1. Broiler's Diet

	Pre Starter Feed	Starter Feed	Finisher Feed
Feed Required (In Grams)	400	1200	Balance
Total ME (Kcal) requirements	3000	3150	3250
Ether Extract %	3.00 to 4.00	4.00 to 5.50	6.00
Oil %	1.50 to 2.00	2.00 to 2.50	2.50 to 3.50

As per physiology of birds they are having capacity to utilize or digest limited quantity of oils/fats when we are offering energy in the form of oils/fats. Endogenous emulsifiers are not much efficient in the digestion of fat (Dr. Rajesh Singh, 2019).

4. Digestion and Absorption of fats and oils

Fat digestion

The digestion and absorption of fat in the chicken occurs mainly in the small intestine (Scott *et al.*, 1982). The presence of digesta, with intact dietary fat in the duodenum, stimulates cholecystokinin secretion, which in turn induces the secretion of pancreatic enzymes and bile (Friedman and Nylund, 1980). While bile salts emulsify fat along with co-lipase providing more surface area for the enzymes to act upon, lipase hydrolyses the emulsified triglycerides on sn-1 and sn-3 positions to release Monoglycerides and free fatty acids (Mu and Hoy, 2004). Cholesterol esterase hydrolyses cholesterol-fatty acid esters into cholesterol and free fatty acids (Mu and Hoy, 2004). Also large amounts of endogenous phospholipids enter through bile, predominantly Phosphatidylcholine in addition to dietary phospholipids. Phospholipase A2 cleaves phospholipids at the sn-2 position to release lysolecithins and free fatty acids (Scott *et al.*, 1982).

Fat absorption

Bile salts are biological surfactants as well as detergents, which are amphipathic i.e., they have both hydrophobic and hydrophilic ends (Mu and Hoy, 2004). When the concentration of bile salts in the lumen is at or above “critical micellar concentration,” they arrange themselves on the surface of lipid digestion products, with their hydrophobic ends turned inward and hydrophilic ends turned outward (Free Fatty Acids, Monoglycerides, Cholesterol and Lysolecithin), forming “Mixed Micelles” (Garrett and Young, 1975).

Long-chain unsaturated fatty acids have greater ability to form micelles, they may act synergistically in the absorption of saturated fatty acids when mixed with them (Ferreira,

1999). To get their lipid content absorbed actively by enterocytes, these mixed micelles can pass across the unstirred water layer, which bathes the enterocytes (Iqbal and Hussain, 2009). Inside the enterocytes, the MG, free fatty acids are re-esterified to form triglycerides and together with cholesterol, lipoproteins and lysolecithins, are assembled into portomicrons (Stevens, 2004). Around 15% of fatty acids present in the lumen are catabolized in the mucosal epithelium towards the maintenance energy requirement (Noy and Sklan, 1996). Short chain fatty acids and free glycerol are absorbed directly through passive uptake (Gropper *et al.*, 2008). The portomicrons, short chain fatty acids and free glycerol are transported through the portal venous system to the liver, since unlike mammals the lymphatic system of the birds is not well developed (Bensadoun and Rothfeld, 1972).

Role of Lipoproteins:

Very low density lipoproteins (VLDL) – carry triglycerides from the liver to the extra hepatic tissues like the ovary (for egg yolk synthesis) or muscle (for energy) (Phan and Tso, 2001).

High-density lipoprotein cholesterol (HDL-C) – “Good cholesterol” because HDL-C takes up excess cholesterol and carries it to the liver for removal.

Low-density lipoprotein cholesterol (LDL-C) – “Bad cholesterol” because it deposits excess cholesterol in walls of blood vessels.

Difficulties in first few days of life:

Secretion of bile acids/salts and pancreatic lipase enzyme are less in first 14 to 21 days of life. Hence, external supplementation of emulsifier is essential for better digestion and absorption of fats / oils.

According to Carew *et al.* (1972) the capability to absorb corn oil increased from 84% to 95% from the first to the second week of age and absorption of tallow has increased from 40% to 79%.

We have done one trial on broiler’s based on above hypothesis using Emulso-V (PEGR based emulsifier from Venky’s) and following are our findings:

Table 2. Trial of Emulso-V on broiler birds

Parameter	Control (Normal Diet - 32.80 Kcal ME per kg of feed)	Treatment – 1 (Control diet + Emulso-V @ 250 g /MT Feed)	Treatment – 2 (Control diet + Emulso-V @ 300 g /MT Feed)
Avg. BW (Kg)	0.380	0.397	0.402
FCR	1.289	1.266	1.225
CFCR	1.694	1.666	1.625
Cum. Mort %	1.233	1.100	1.467
Mean Age (Days)	14	14	14

* Note - Energy level is reduced by reducing 6 kg soya oil per ton of feed.

Addition of emulsifier showed better weight gain as compared to control diet. Exogenous or external supplementation of emulsifiers is most important in broilers for better digestion and absorption of fats/oils during early life.

Emulsifier:

Emulsifier - A substance that stabilizes an emulsion and having water loving head (Hydrophilic) and an oil loving tail (Hydrophobic).

Emulsion – It is a mixture of two or more immiscible liquids. They are having two types oil in water emulsion and water in oil emulsion.

HLB Value (Hydrophilic-Lipophilic Balance) – HLB is the tool or scale which is used for the evaluation of the type of emulsifiers. HLB value ranges between “0 to 20” for different emulsifiers.

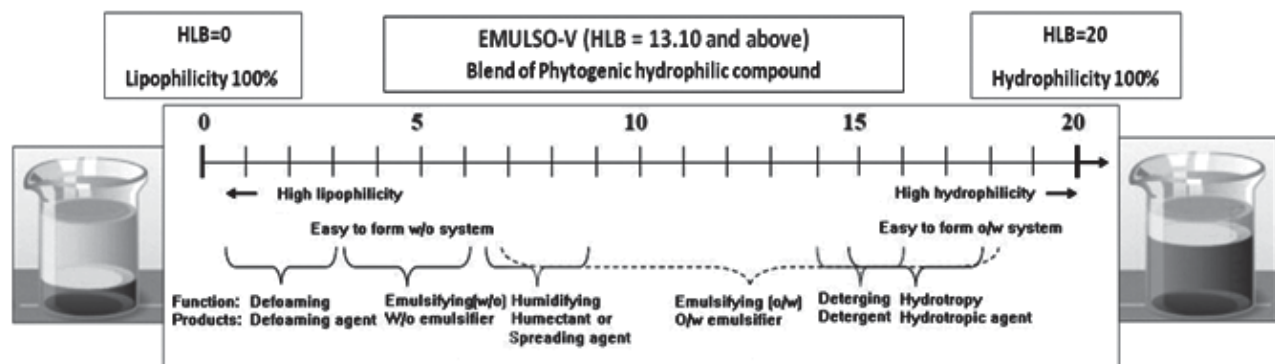
HLB – 4 to 6 are using as water in oil emulsifiers, HLB – 7 to 9 are using as wetting agents, HLB - 8 to 18 are using as oil in water emulsifiers, HLB –

13 to 15 are using as Detergents and HLB – 10 to 18 are using as Solubilizers.

Bile salts are acting as natural emulsifier which is having HLB (Hydrophilic-Lipophilic Balance) value around 18. i. e. more hydrophilic, also there are various commercial emulsifiers available in the market.

Birds are consuming 2.5 to 3 times more water than the feed consumption, and total fat in feed is around 6 % or slightly more (depends on the feed ingredients), hence water consumption is approx. 30 – 40 times more than total fat intake, Hence birds require emulsifier which dissolve oil in water and should have more Hydrophilicity or HLB value (min. 8 and max. 18).

Fig. 1. HLB Scale



Commercial emulsifiers –

1. **Lecithin (Phospholipids)** – More lipophilic emulsifier with low HLB value hence not suitable for poultry. Its structure is having two lipophilic tails and one hydrophilic head.
2. **Lysolecithin (Lysophospholipid)** – Hydrophilic emulsifier with O/W emulsifier property but HLB is below 13. It is derived from lecithin and having one lipophilic tail and one hydrophilic head.
3. **GPEGR (Glyceryl Polyethylene Glycol Ricinoleate) /PEGR (Polyethylene Glycol Ricinoleate) / Emulso – V (Venky's)** – Hydrophilic emulsifier with **O/W emulsifier** property and HLB value is around **13.10 and above**. It is derived from castor oil and its structure is having more hydrophilic portion. Castor oil is rich in long chain unsaturated fatty acids which acts as a potent emulsifier itself. Toxicity of enzyme ricin is removed after heat treatment.

About GPEGR/PEGR (Emulso – V) – Properties

Properties and Uses –

- I. PEGR is non toxic and naturally biodegrades and is recognized as Generally Recognized as Safe (GRAS).
- II. PEGR is non-ionic and stable in broad range of pH and high temperatures and is suitable for pelleted feeds.
- III. “Nutritional Emulsifier” as it consumes little energy than other emulsifiers like soy lecithin and dissolved in gut by mechanical stirring.
- IV. It can increase digestibility of long chain saturated fatty acids (C16 and C18) hence; it is economical as animal fats and some vegetable fats (Like Palm oil) contains LCFA (Max. saturated).
- V. It reduces liver fat / abdominal fat pad and circulatory lipids as well as dietary lipids are utilized in better way.

- VI. PEGR utilize more fat and can be used in least cost feed formulation for energy equivalence.
- VII. PEGR act as a bio surfactant.
- VIII. PEGR is compatible with NSPs because PEGR reduces viscosity (NSPs having property to increase the viscosity in GIT and increased viscosity leads to inadequate absorption of nutrients and impaired peristaltic progress of chyme through intestine which may leads bacterial overgrowth and micro flora reduces binding of bile salts to fat in upper intestinal tract, hence wash out the fats with reduces its utilization).
- IX. PEGR is a good emulsifier and can produce effects inside as well as outside the body.
- X. Inhibition of fungal growth – It bounds moisture (as moisture is inside the feed particle) it does not evaporate thereby maintains the nutrient value intact without any loss and inhibits the growth of yeast and mold. It also helpful for uniform mixing of not only fats or oils but also liquid amino acids, liquid vitamins and liquid acidifiers.
- XI. PEGR acts as a lubricant during feed production which helps in better pellets production with less energy consumption. Also, due to the lubrication property, there is less friction in the dye which helps to increase the dye life.
- XII. The process of pelletizing feed requires the use of steam at conditioning however steam and oil have no compatibility. The PEGR are known to improve the feed production process by reducing the interfacial tension between two immiscible phases of oil and water leading to quality feed production.
- XIII. PEGR having excellent property to work synergistically with bile salts.
- XIV. Aqueous solution of PEGR is stable in the presence of low concentrations of electrolytes such as acids or salts.

Table 3. Performance Report:

Performance Report			
Trial report of Emulso-V on commercial broilers (Chicks placed on 15/10/19)			
Parameter	Positive control (Normal diet)	Negative control (Diet with reduction of 6 kg soya oil from normal diet)	Treatment Group (Diet with reduction of 6 kg soya oil from normal diet + 250 gms Emulso-V per ton of feed)
Placed Chicks	1500	1500	1500
Avg. Body Weight (in Kg)	2.481	2.467	2.488
FCR	1.73	1.78	1.71
CFCR	1.61	1.66	1.59
Cum. Mortality	56	60	67
Cum. Mortality %	3.73	4	4.47
Mean Age	42	42	42
Reduced Oil Cost per kg feed in Rs. (Soya Oil cost @ Rs. 72/kg)	0	0.432	0.432
Addition of 6 Kg Maize instead of oil in negative control and test groups (Rs 21 / Kg feed)	0	0.126	0.126
Emulso-V Cost per kg feed (in Rs.)	0	0	0.05
Per kg Feed Cost (in Rs.)	31.5	31.19	31.24
Production Cost per Kg Meat (in Rs.)	64.77	65.86	63.64

Mechanism of Action –

- I. Upon entering into the Jejunal area or small intestine, Emulso-V starts breaking the large fat globules into smaller one and helps to expose their surface active area.
- II. Pancreatic lipase identify exposed active surface of fat globules and starts its hydrolysis mechanism (i.e. Triglycerides from oils or fats divides in to one Monoglyceride and two Fatty Acids)
- III. Emulso-V helps to form more “Micro micelles” with the help of Monoglycerides, Phospholipids and bile salts. “Micro micelles” can be absorbed easily through intestinal villi.

Trial Reports:

We have conducted several trials in broilers using Emulso-V as an emulsifier to study the efficacy of emulsifiers.

Note - In below mentioned trial, we have reduced 6 kg soya oil from per ton of feed and same is replaced with 6 kg maize per ton of feed resulting in reduction of 32.8 kcal ME per kg of feed in negative control as well as treatment groups.

The trial shown that usage of Emulso-V improved broiler performance resulting in reduction of production cost/kg broiler weight as compared to control groups (Positive and Negative control), by better utilization of added fats/oils in the feed.

Table 4. Fat digestibility trial:

Test Groups	Total Digestibility % of fat	Unutilized Fat %
PC	75.81	24.19
NC	76.43	23.57
NC + Emulso-V @ 250 gm	77.23	22.77
Increased than PC	1.42	-1.42
Increased than NC	0.80	-0.80

Conclusion - Emulso – V helps to increase total digestibility of fat.

*PC – Positive Control (Normal Diet), *NC – Negative Control (diet with reduction of 6 kg soya oil from normal diet and addition of 6 kg maize per MT of feed).

Table 5. Fat yield trial:

	Positive Control	Negative Control	NC + Emulso-V @ 250 gm
Total Live Body Weight %	100	100	100
Dressed Weight %	70.90	70.04	71.03
Breast Meat Weight %	22.28	21.91	22.59
Fat Weight %	1.38	1.35	1.23

Conclusion – Emulso –V helps to reduce abdominal fat pad, liver fat and helps to increase breast meat weight as well as dressed weight.

Table 6. Serum cholesterol level:

Day 22	Triglycerides (mg/dL)	Total Cholesterol (mg/dL)	LDL Cholesterol (mg/dL)	VLDL Cholesterol (mg/dL)	HDL Cholesterol (mg/dL)
PC	51.69	108.14	20.21	10.34	78.59
NC	50.83	106.77	19.46	10.17	77.14
NC + Emulso-V @ 250 gm	50.49	109.17	18.87	10.10	80.20
NC + Emulso-V @ 300 gm	49.71	113.01	18.91	9.94	84.16

Conclusion – Emulso – V / PEGR is responsible for the increase a total serum cholesterol level but it increases HDL not LDL and Triglycerides and same is explained by Verlag Eugen Ulmer (2019).

Recommended dosage levels:

Dose of Emulso – V is 250 to 300 g per ton of feed (we can reduce 32.8 kcal energy per kg of feed by using Emulso – V).

Summary (about Emulso-V):

- **Emulso-V** (A unique nutritional synthetic emulsifier) is a blend of Phytogenic Hydrophilic Emulsifiers and major constituent is **Glycerol Polyethylene Glycol Ricinoleate** which having strong activity to dissolve oil in water.
- It has good HLB value (Above 13.10) with strong surfactant activity than Phospholipid (Lecithin), Lysophospholipid (Lysolecithin) and other commercial emulsifiers and synergistically acts with Bile salts.
- **In Vivo Activity** - It has good activity to increase surface active area of fat/oil which triggers the activity of pancreatic lipase in fat digestion process and helps to form more micro-micelle for better absorption of fat and fat soluble

Table 7. Serum cholesterol level:

Day 48	Triglycerides (mg/dL)	Total Cholesterol (mg/dL)	LDL Cholesterol (mg/dL)	VLDL Cholesterol (mg/dL)	HDL Cholesterol (mg/dL)
PC	72.63	102.07	31.65	14.53	55.89
NC	75.54	98.89	27.04	14.11	57.74
NC + Emulso-V @ 250 gm	72.12	102.38	28.26	14.42	51.59
NC + Emulso-V @ 300 gm	65.96	105.52	25.67	13.11	65.74

vitamins. It reduces viscosity also, hence compatible with NSPs.

- **In Vitro Activity –** Binds moisture (i.e. moisture available at inside of grinded particles) for avoiding its evaporation, good lubricant property beneficial for pellet mill and reduces interfacial tension between steam and feed during conditioning process.
- It helps to reduce abdominal fat pad, liver fat and helps to increase fat digestibility and HDL cholesterol (good cholesterol).
- It helps to gain average body weight with reduction in FCR.
- Energy saving effects (we can reduce upto 32.80 Kcal ME per kg of feed with using Emulso-V as per recommended dosage) which can help reduces cost of feed formulation.
- Strongly compatible with all kinds of oils (either rich in saturated or unsaturated fatty acids, e.g. Tallow, RB oil, Palm oil, Blended oil and Soya oil etc), grains having NSPs and some amount of saturated fatty acids (e. g. Wheat, SBM, Broken Rice etc).
- **Dose –** 250 to 300 gms per MT of feed.

References –

References will be shared on demand.

BROILER LIFTING RATES FOR THE MONTH OF JULY 2020

Place	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
Hyderabad	92	97	102	104	110	110	112	112	112	112	105	100	100	91	93	95	97	99	99	99	90	90	92	94	94	94	94	82	78	78	80	82
Karimnagar	92	97	102	104	110	110	112	112	112	105	100	100	91	93	95	97	99	99	99	90	90	92	94	94	94	94	82	78	78	80	82	
Warangal	92	97	102	104	110	110	112	112	112	105	100	100	91	93	95	97	99	99	99	90	90	92	94	94	94	94	82	78	78	80	82	
Mahaboobnagar	92	97	102	104	110	110	112	112	112	105	100	100	91	93	95	97	99	99	99	90	90	92	94	94	94	94	82	78	78	80	82	
Kurnool	92	97	102	104	110	110	112	112	112	105	100	100	91	93	95	97	99	99	99	90	90	92	94	94	94	94	82	78	78	80	82	
Vizag	92	97	100	105	105	105	107	112	112	112	112	112	110	110	110	110	110	110	110	105	105	105	100	100	90	90	85	80	80	85	90	
Godavari	92	97	97	100	105	105	105	110	110	110	105	105	100	100	100	100	100	100	100	95	95	95	95	95	90	90	85	80	80	85	90	
Vijayawada	88	92	92	97	102	102	104	107	107	107	100	100	97	97	97	97	97	97	97	97	94	94	94	94	90	90	85	80	80	85	87	
Guntur	88	90	90	96	101	101	103	106	106	106	98	98	95	95																		
Namakkal	75	77	77	79	81	81	84	86	86	88	88	88	88	88	88	88	90	90	90	90	90	90	90	90	85	85	85	85	85	85	87	

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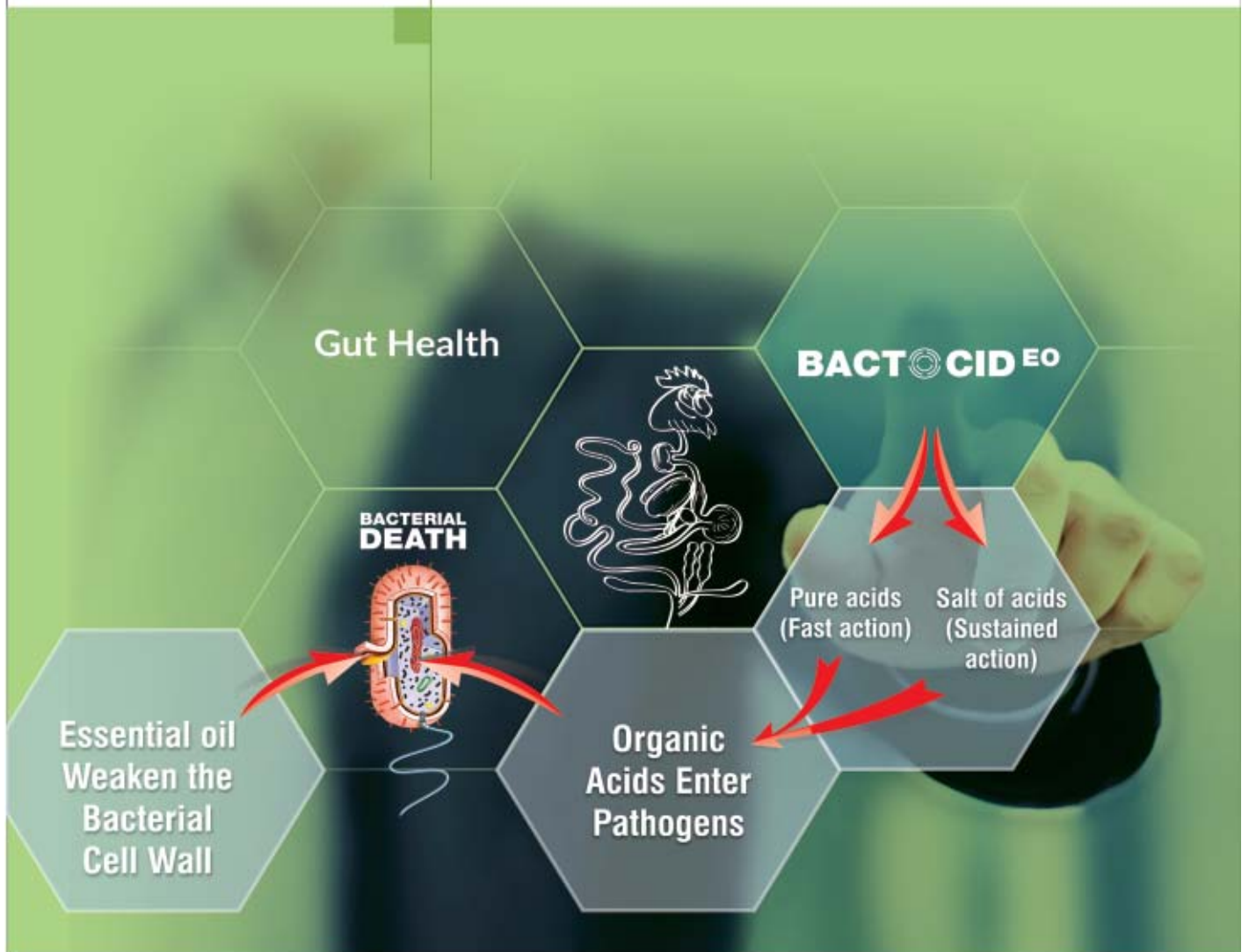
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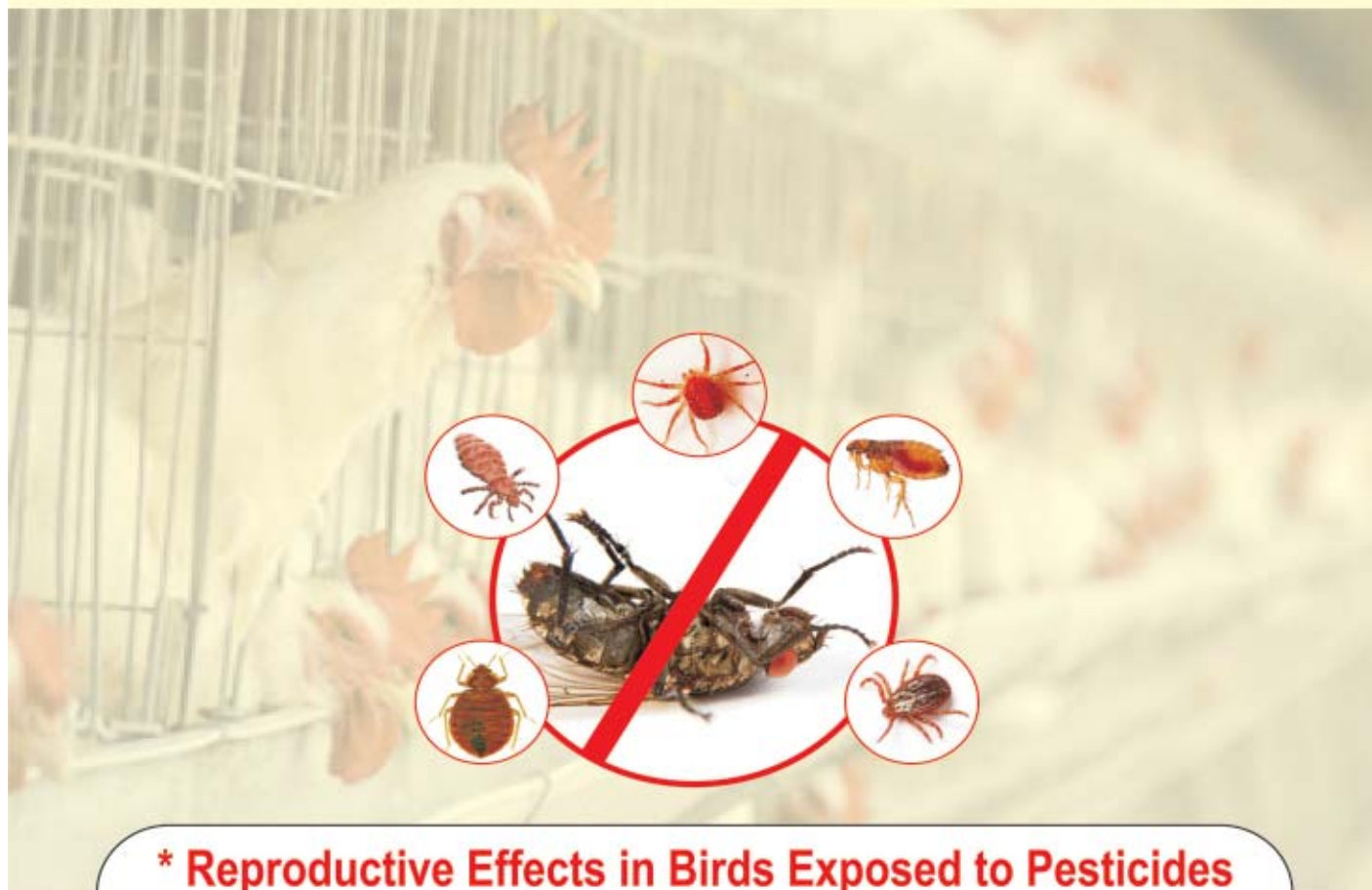
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* D. Michael Fry - Department of Avian Sciences, University of California, Davis, California - Environ Health Perspect 103(Suppl 7):165-171 (1995)

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Why You Should Test Your Feed for Mycotoxins

Even with all necessary procedures and safeguards in place, every farmer should still prepare for potential feed contamination by mycotoxins.



In Brief

At every stage from feed processing to ingestion, there are risks that – if not managed – can result in a reduction in productivity. Regular analysis of your feed equips you with the information you need to protect against a reduction in your farm’s efficiency.

How contamination occurs

When purchasing feed, trusted suppliers are a reliable measure of quality, but this does not guarantee freedom from contamination. Feed is never always the same, no matter the source – even if you produce your own, nutrient levels can vary. Testing feed helps to ensure that it meets the requirements for your animals’ performance. Animal health, protein and vitamin intake, and level of grain supplementation are all affected by the composition of feed ingested.

Contamination is possible even in transit. Raw materials are transported in bulk, and outside elements might enter



the materials before being processed into feed. However, there are safeguards in place: magnets remove harmful materials during the manufacturing process, and most physical contaminants do not create food safety risks for the animal.

The risk of mycotoxins

The greater risk comes at the chemical level; specifically, the possible presence of mycotoxins. Mycotoxins are natural products of mold and fungi found in agricultural commodities worldwide. Although the average farmer underestimates the danger of these contaminants, a **BIOMIN study** of over 16,000 samples showed that 94% contained 10 or more mycotoxins and metabolites. Symptoms of mycotoxin poisoning can be difficult to identify, but can cause a real cumulative impact on an animals’ productivity, even when at very low levels, due to prolonged exposure and synergistic effects.

How to test for mycotoxins

In a BIOMIN webinar, growers were asked how they tested for mycotoxins. 55% use an external analytical service, and a further 25% test on-site. For an easy solution that adapts to each individual farm’s needs, BIOMIN sister company, **Romer Labs®** offers both options as preferred.

No matter the method, a correct sampling plan is the basis for reliable results. 88% of total analytical errors stem from improper sampling, so it’s important to follow set procedures. Both the **FAO** and **EU** offer full step-by-step guidelines for sampling to ensure correct testing. Mycotoxins are not necessarily distributed in a uniform way. Concentrated areas of toxins (referred to as “hot spots”) can later contaminate other areas of feed, even if previous tests came back as negative. For accurate results be sure to take several samples from across the whole batch – and at different heights – for a thorough representation.

Be prepared

Mycifix® can be used as a complete solution, containing multiple EU approved ingredients that utilise three crucial strategies – adsorption, biotransformation and bioprotection – to transform present mycotoxins into environmentally-safe metabolites.



WHY YOU SHOULD TEST YOUR FEED FOR MYCOTOXINS

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Preservation of Eggs

B. Obula Reddy*, D. Maheswara Reddy, R. Sai Dilip Gupta and G.V. Bhaskar Reddy

Department of Livestock Products Technology, College of Veterinary Science, Proddatur-516360. AP.

In order to preserve eggs only good quality eggs should be produced. Therefore any method of preservation starts from the point of production itself.

The following practices are recommended as routine for the production of quality eggs on the farm.

- Collection of eggs at least 3 times daily.
- Using a clean receptacle with ventilated sides and bottom, preferably filler flats.
- Careful handling of eggs during collection and while keeping in filler flats etc.,
- Cooling the eggs quickly to 50°F or less at 75-85% relative humidity.
- Marketing the eggs at least twice weekly.

Preservation

- The shell of an egg normally carries a wide range of microorganisms on its surface which are mostly responsible for spoilage of eggs.
- Many methods have been used in the past to counteract this and extend the shelf life of eggs. These include:

Dry packing

- Eggs are kept in an earthen pot with clean dry packing material and the pot is buried in wet sand.

Immersion in liquids

- This is fairly an old method and it primarily prevents the evaporation of moisture from the egg.
- Depending on the liquid used it may also inhibit bacterial decomposition by chemicals action or by physical means such as occlusion of air passages/pores.
- **Lime water treatment**
- Lime water is prepared by mixing about 0.5kg of quick lime (calcium oxide) in about 1 litre of boiling water.
- The mixture is left to settle overnight and the clean supernatant liquid is poured out into a jar.
- Sodium chloride of 112 grams per litre may also be added to increase the specific gravity of water and will minimise the chance of breakage of eggs.

- In this solution, 2.5 liters of cold water is added and filtered through muslin cloth.
- Keep the eggs to be preserved in a glass jar or earthen pot and pour the lime solution over the eggs till all the eggs are completely immersed.
- Eggs have to be kept in this solution for 24 hours to get maximum beneficial effect.
- After 24 hours they are taken out, dried and arranged in filler flats.
- Eggs can be kept for 2-3 months in a good edible condition at normal ambient temperature.
- The only disadvantage however, is the taste of lime can be detected in the eggs.

Water glass method

- A 10% solution of sodium silicate is prepared in hot water and allowed to cool.
- The cooled solution is poured into a jar containing the eggs till they are immersed completely.
- The jar is covered and kept in a cool place where the temperature should not exceed above 70°F.
- Eggs preserved by this method are usually punctured before boiling to avoid the breakage of shell while boiling and it also helps for easy peeling of shell.

Shell - Sealing treatments

- When the shell is sealed through this treatment the water vapour and CO₂ do not escape and microorganisms are unable to penetrate the shell.
- Coating with oil
- The rate of CO₂ escape is considerably reduced.
- This is a fairly successful method of rendering the egg less permeable.
- It can be done by simply dipping the egg in a bowl of tasteless, odorless, colourless edible oil, having a specific gravity of about 0.855 to 0.870 at 15°C; viscosity should not be more than 70 to 90 and having a high boiling point so that at lower temperature it remains in the liquid form.
- The eggs are immersed only for a moment and are then removed and the excess oil is allowed to drain.

- If oil treatment is to be effective it should be done preferably at the point of production the day after the egg is laid.
- Oiling is not a substitute for refrigeration.
- These eggs must be held at a low temperature.
- Cotton seed, linseed and groundnut oil are good sealing agents but mineral oils are preferable since they are less subject to oxidative changes during storage. oil immersed eggs and these eggs are not likely to absorb foreign odours.
- The oil treatment can also be done by spraying using a hand or electric sprayer.
- Eggs can be sealed under vacuum.
- Oil may be successfully used in vacuum impregnation method.
- The egg is first immersed in oil and then subjected to reduced atmospheric pressure, when normal pressure is restored the tendency of the air to enter the pores of the shell causes the solution also to be drawn in.
- The oil does not penetrate through the egg membranes.
- The commercial egg treatment with oils are
 1. Heavy paraffin oil (Central Food Technology Research Institute)
 2. Myvacet 9-40 (developed at CFTRI - Mysore)
 3. Myvacet 5
 4. Myvacet 7
 5. Petroleum jelly
 6. Liquid paraffin
 7. Paraffin wax
 8. Coconut oil
 9. Dalda
 10. Carboxyl methyl cellulose
 11. Technical white oil.

Thermostabilization

- This method is good for fertile eggs since it kills the embryos and therefore is also known as 'defertilization' method.
- It essentially consists of immersing shell eggs in hot water at 130°F for 30 minutes which tend to coagulate the albumin and then the egg is cooled under tap water.
- Treated eggs remain edible for 3 to 4 weeks even during summer months.

- Though this method has many advantages such as stabilizing of the albumin and sterilization of the egg shell, the egg loses the property of foaming to a remarkable extent.
- Moreover, embryonic development in fertile eggs is completely arrested.

Over-wrapping

- For over wrapping of eggs polyethylene, cellophane, polyvinylidene and other transparent, thin but sufficiently strong, films are used.
- These films should be impervious to gases and moisture.
- Over wrapping of eggs in different atmosphere like carbon dioxide, vacuum etc. have been tried.

Cold storage

- This is the best and most efficient method for commercial storage.
- Eggs for cold storage must be clean, unbroken, and free from fungus and other infections.
- A temperature of 0°C or 30-32°F and relative humidity of 85-90% is recommended for cold storage of eggs to preserve them for 5 to 8 months.
- For short period of preservation of 2 to 3 months, eggs can be stored at 10-12°C or 50-55°F with a relative humidity of 60-70%.
- Intact eggs are held at the lowest possible temperature that will avoid freezing and bursting of the shells.
- It has been observed that intact eggs do not freeze at temperature between -1.5°C and -2°C and the relative humidity must not go beyond 90%.

Dried and frozen eggs

- This is another method of preserving egg contents or edible eggs.
- Egg products of commercial utility are prepared by drying or freezing eggs.
- Albumin flakes, yolk and egg white powder can be produced by drying process.
- Frozen yolk or frozen egg white can be produced by freezing.
- For egg white powder production the best known method is spray drying and for albumin flakes, pan or cabinet drying method is mostly adopted.

Nutritionally and functionally enhanced Designer Egg: An Overview

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World egg production and consumption have been increasing for the past few decades. Eggs, owing to their exceptional dietary composition, are one of the most ancient foods of mankind. Eggs provide a completely packaged, highly nutritious food including essential nutritional components. The proteins, minerals and vitamins which are important in different biological processes are present in eggs in significant quantity and a biologically easily available form. Egg production by the layer species is expanding actively worldwide the reason being quantitative surge in the growing potential of food industry, as eggs are undoubtedly one of the healthiest basic foodstuffs. The quantitative development is relatively due to the number increase of laying hens, the genetic progress, and last but not least the amelioration of the environmental factors such as feeding and management. The uncertainties are related to the cholesterol levels in eggs. The cholesterol level derived from eggs can easily be transformed by poultry feeding practices.

However, in order to meet the growing demands of health conscious consumers, the egg industry is developing new designer eggs. Designer eggs are those specially produced eggs which are rich in additional nutrients and health promoting components like carotenoids, chelated minerals, EPA and DHA like omega 3 fatty acids, selenium, vitamin E and other immune-modulating factors that set them apart from generic eggs.

Designer egg approach was reported in 1934 by Cruickshank, who modified the fatty acid composition in egg yolk by making feed interventions. The internal component of eggs can be simply transformed or fortified by the simple

techniques like feeding etc. (Ahmed and Abdelati, 2009 and Singh *et al.*, 2010).

Nutrient contents of Ordinary egg and Designer egg

Nutrient content	Quantity per 100 g of 2 egg contents	
	Ordinary egg	Designer egg
Total saturated fatty acids	3.3g	2.8g
Total unsaturated fatty acids	6.4g	6.9g
Mono unsaturated fatty acids (MUFA)	4.4g	4.4g
Poly unsaturated fatty acids (PUFA)	2.0g	2.5g
Linoleic acid (ω -6 fatty acids)	1.9g	1.4g
α -linolenic acid (ω -3 fatty acids)	0.03g	0.7g
ω -3 fatty acid (EPA+DHA)	0.08g	0.4g
n6/n3 ratio	17.3	1.27
Unsaturated/saturated fatty acids	1.94	2.46
Cholesterol	400mg	320mg
Carotenoids	1.5mg	2.2mg
Vitamin E	2mg	15mg
Selenium	Traces	1.8 μ g
Chromium	Traces	1 μ g

(Narahari, 2005)

In the market several types of designer eggs are available. These are as follows-

Omega 3 Poly Unsaturated Fatty Acids enriched egg

A diet balanced in omega-3 (Linolenic acid, Eicosapentenoic acid and Docosaheptaenoic acid)

and omega-6 fatty acids (Linolenic acid and Arachidonic acid) is important during human evolution (Hargis and Van Elswyk, 1993 and Simopoulos 2000). Omega-3 fatty acids are proved to be beneficial in various disorders such as cardiovascular disease, hypertension, autoimmune, allergic, and neurological disorders and it is also indispensable for normal functioning of the human physiology not only in normal adult but also in pregnant and lactating women. Hens, fed diet high in omega-3 fatty acids (flaxseed, marine algae, fish meal and fish oil), produce eggs with high omega 3 fatty acid content in the yolk. In designer eggs, the omega-6 fatty acids and omega-3 fatty acids ratio is reduced to about 1.5, from as much as 20 in regular eggs. This beneficial change in designer eggs, will supply about 50% of the daily requirement of n-3 PUFA to the consumers, without changing the sensory quality of the egg. Bourre and Galea (2006) produced designer egg fortified with omega-3 fatty acid by feeding hens with linseed, minerals, vitamins and lutein. Since the omega 3 PUFA will undergo rancidity quickly, it is important to prevent the rancidity of the designer egg yolk lipids, by amalgamating anti-oxidants like vitamin E, selenium and carotenoid pigments in the hens' diet.

Vitamins enriched egg

Designer eggs can be produced with higher concentrations of several vitamins (mainly vitamin A and vitamin E) by feeding diet rich in these vitamins to the hen. Efficiency of the hen for the transfer of different vitamins into the egg varies from 5-80% (Naber, 1993). For niacin, thiamine, or pyridoxine, the contents of eggs were reported to be insensitive to dietary manipulation (Leeson and Caston, 2003).

Minerals enriched egg

Trace minerals like selenium, iodine, chromium and copper can be incorporated in hen's diet for making of mineral enriched designer eggs. These trace minerals are very important for the human health because deficiency of them lead to development

of certain deficiency diseases (Al-Massad *et al.*, 2011). Bennett and Cheng (2010) in their study on the production of Se enriched egg concluded that feeding hen up to 5.1 µg/g of Se will increase the concentration of Se in egg without affecting egg production.

Antibodies enriched egg

Chicken egg is abundant in antibodies like "IgY"; which can be utilized in the cure of human rota virus, E. coli, Streptococcus, Staphylococcus, Pseudomonas, Salmonella infections besides prolonging the life of immunosuppressed patients like AIDS patient. In a 6-week period, a hen produces about 298mg of specific antibodies. The functional feed rich in omega - 3 fatty acids and anti-oxidants itself will promote the IgY level in the egg. Herbal supplementation (such as Basil leaves or Tulasi @ 0.3-0.5% dietary level) will further augment the IgY level in the egg.

Roe *et al.* (2002) developed an egg yolk immunoglobulin against *Helicobacter pylori* whole cell lysate, which reduces gastric inflammation due to *H. pylori*.

Anti oxidants enriched egg

In addition to natural antioxidants present in egg (vitamin E, Se, carotenoid pigments, flavinoid compounds, lecithin and phosphatidylcholine), synthetic antioxidants (like Ethoxyquin) and antioxidants of herbal origin (such as lycopene, curcumin, sulforaphane, carnosine and quercetin) are added to the hen's diet to raise the anti-oxidant levels in the designer eggs. This antioxidant enhanced diet will protect the fat soluble vitamins and other yolk lipids from oxidative rancidity.

Pigment enriched egg

The yolk colour is the indicator of pigment content of egg. Consumers may have a preference for a specific yolk colour based on perception that darker yolks have health benefits or originate from healthier chickens. Carotenoids like canthaxanthin and lycopene are usually used for producing pigment enriched yolk by feeding the hen diet having high

concentration of canthaxanthin and lycopene (Grashorn and Steinberg, 2002 and Kang *et al.*, 2003).

Herbal egg

Herbal active principles like allicin, betaine, eugenol, lumiflavin, lutein, sulforaphane and taurine are used to produce herbal enriched eggs (Narahari *et al.*, 2004). Moreover these eggs have 25% less cholesterol in their yolk.

Low cholesterol egg

A large egg contains about 213 mg of cholesterol per yolk (USDA, 1991). Even though the nutritional superiority of the egg has been proved beyond doubt, the egg consumption in India is very low due to vegetarianism as well as cholesterol scare. Hence, there is an urgent need to reduce the egg yolk cholesterol levels as well as to incorporate several other health promoting components in the egg. A more recent study suggests that daily egg consumption does not show unfavourable effects on cholesterol in the blood for the majority of people (Fernandez, 2010), but promotes favorable shifts in high density lipoprotein (HDL) lipid composition and function, beyond increasing plasma HDL cholesterol in metabolic syndrome (Andersen *et al.*, 2013). Parker *et al.* (1999) reported significant decrease by 4 mg/g the cholesterol content of the yolk comparatively to the control after supplementation of beta cyclodextrin @ 6% in the feed. Certain other compounds also reduced the level of the cholesterol in the yolk significantly such as chromium, nicotinic acid, statin, garlic, basil and n-3 PUFA after the supplementation in the feed to the hen. By reducing the cholesterol level in the plasma, we can reduce the chances of coronary heart disease and heart attack.

Conclusion

Designer eggs provide options for consumers who want eggs with different nutritional benefits or properties than generic eggs. Eggs can be enriched with different micronutrients like omega-3 fatty acids, selenium and vitamin E through nutritional

manipulations without degrading egg quality. In developed countries, designer foods have played a major role in improving the diet and eradicating nutritional deficiencies. An important advantage of designer food approach is that it does not require any change in dietary habit or pattern of the population and it can deliver recommended amount of nutrients regularly. However, it should be strictly synchronized with stringent quality control measures to ensure that there is no excessive intake of specific nutrients. Designer eggs are expensive compared to regular eggs. That's why not all classes of the society can afford to buy these eggs.

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Doubling the Income of Farmers by Poultry Farming

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Introduction: Commercial poultry farming in India has creating profitable business opportunity for entrepreneurs. Poultry farming

business can provide a great employment source for the job seeking people. This is such as business in India that can never dry up. All types of poultry product have a great demand in the market inside India. There is no religious taboo about consuming the poultry meat and egg. Highly productive local and foreign breeds are available for commercial production. Requirement of initial investment for

poultry farming is not too high. You can start small scale production and elaborate it gradually. Bank loans are available throughout the country. Numerous forms are available and you can easily learn about poultry farming from those established farmers. Krishi Vigyan Kendra, Samba and Animal Husbandry department of Jammu & Kashmir are providing lot of scheme and vocational training regarding poultry farming for betterment of farmers.

Present status of poultry in India:

- Per capita recommended Egg: 180 eggs per year
- Per capita recommended Meat : 11 kg per year
- Per capita availability of Egg: 63 eggs per year

- Per capita availability of Meat: 2.96 kg per year
- Total poultry population in India: 851.81 million (2019 census)
- Total egg production in India: 88.03 billion
- Rank of India in poultry population: 5th
- Rank of India in poultry meat production: 4th
- Rank of India in egg production: 3rd

Present status of Jammu & Kashmir:

Per capita availability of eggs in Jammu & Kashmir is only 38 eggs per person per year while the same on a national level is 63 eggs. The Poultry Industry in the J & K state is estimating to be touching Rs. 2000 crore. In Jammu & Kashmir, import of egg is

Table 1: Poultry Population in India:

Category	Population (Million) 2012	Population (Million) 2019	% Growth
Total poultry	729.21	851.81	16.81
Backyard poultry	217.49	317.07	45.78
Commercial poultry	511.72	534.74	4.50

Table 2: Poultry population 2012 & 2019 of major cities

Sr. No.	States	Population (Million) 2012	Population (Million) 2019	% Change
1	Tamilnadu	117.3	120.8	2.92
2	Andhra Pradesh	80.6	107.9	33.85
3	Telangana	80.8	80.0	-0.93
4	West Bengal	52.8	77.3	46.34
5	Maharashtra	77.8	74.3	-4.49
6	Karnataka	53.4	59.5	11.33
7	Assam	27.2	46.7	71.63
8	Haryana	42.8	46.3	8.11
9	Kerala	24.3	29.8	22.61
10	Odisha	19.9	27.4	37.95

87.75 crore, broiler chick is 96 lakh number and day old chick is 5.84 crore.

Table 3: Details of duck, turkey, other and all birds in poultry farms at Jammu & Kashmir:

Type of birds	Number of birds
Female Duck	33
Drake	5
Duckling	6
Total Ducks	44
Male Turkey	13
Female Turkey	50
Total Turkey	63
Quail	24964
Other poultry birds	10549
Fowl	5026828
Turkey and other	35576
Grand Total	5062448

Broiler farming:

A broiler is any chicken that is bred and raised specifically for meat production. Most commercial broilers reach slaughter weight between 4 to 7 weeks of age, although slower growing breeds reach slaughter weight at approximately 14 weeks of age. Typical broiler has white feathers and yellowish skin. Due to extensive breeding selection for rapid early growth; broilers are susceptible to several welfare concern, particularly skeletal malformation and dysfunction, skin and eye lesion and congestive heart conditions. Management of ventilation, housing, stocking density and in house procedures must be evaluated regularly to support good welfare of the flock.

Advantage of broiler farming:

- Lower initial investment compared to layer farming
- The rearing period of 5-6 weeks only
- Broiler have high feed conversion efficiency in comparison to other livestock
- Faster return on investment
- Demand for poultry meat is more compared to sheep or goat meat
- Cheapest animal protein in India

Layer farming:

Layer poultry farming means the raising of egg laying poultry birds for the purpose of commercial egg production. Layer chickens are such a special of hens which need to be reared from when they are day old. They start laying eggs commercially from 18-19 weeks of age. They remain laying eggs continuously till their 72-78 weeks of age. They can produce about 1 kg of eggs by consuming about 2.25 kg of food during their egg laying period. For the purpose of producing hybrid eggs layer, consider the various characteristics of cock and hen before breeding. There are various types of highly egg productive layer breeds available throughout the world.

Layer breeds:

According to the nature and colour of egg, layer hens are of two types.

White Egg Laying Hens:

These types of hens are comparatively smaller in size. Relatively eat less feed, and the colour of egg shell is white. Among those are *Isa White*, *Lehman white*, *Nikchik*, **Bab cock BV-300**, *Havard white*, *Hi line white* and *Bovanch white* are popular white egg laying chicken.

Brown Egg Laying Hens:

Brown egg laying hens are relatively longer in size. They eat more feed compared to white egg layers. Layers lay bigger eggs than other laying breeds. Egg shell is brown color. There are many types of brown layer available. Among those are *Isa brown*, *Hi Sex Brown*, *Cab cock BV-380*, *Gold line*, *Bablona Tetro*, *Bablona Harko*, *Haward brown etc*

Backyard Poultry Forming:

Backyard poultry farming is a low cost input business with high economic returns. Rural population living in India constitutes 72.2% of the total population; which is predominantly occupied by poor, marginal farmers and landless labours. Backyard poultry production is an old age profession of rural families of India. It is the most potent source for subsidiary incomes for landless and poor farmers. It is an enterprise with low initial investment but higher

economic returns and can easily be managed by women, children and old age persons of the households.

Now a days, poultry meat and eggs have been seen the best and eggs have been the best and cheapest source for meeting out the per capita requirement of protein and energy for rural areas of India. Though, India has shown a tremendous growth in poultry production over decades but rural poultry farming is still lagging behind and always found neglected. As it is the best alternative for the small scale farmers to subsidize the income with negligible inputs. Backyard poultry can easily start with good egg laying birds of RIR (Rhode Island Red), Chabro, Punjab Red and Partapdhan breed. Backyard poultry production system is a low input business and is characterized by indigenous night shelter system, scavenging system, natural hatching of chicks, poor productivity of birds, with a little supplement feeding, local marketing and no health care practices.

Desi chicken birds of India:

A large number of fowls of different size, shape and colours and for the most part resembling the jungle fowl are found all over India. There are only 4 pure breeds of fowls in India which are Aseel, Kadaknath, Bursa and Chittagong.

Aseel:

Aseel is noted for its pugnacity, high stamina, and majestic gait and dogged fighting qualities. The best specimens



of the breed are encountered in parts of Andhra Pradesh. Although poor in productivity, the birds of this breed are known for their meat qualities. Broodiness is the most common and the hen is a good sitter and efficient mother. They possess pea comb which are small but firmly set on head. Wattles and ears are bright red and beak is short. The face is long and slender and not covered with feathers. The eyes are compact, well set and present bold

look. The neck is long, uniformly thick but not fleshy. The body is round and short with broad breast, straight back and close set strong tail root. The general feathering is close, scanty and almost absent on the breast. The plumage has practically no fluff and the feathers are tough. The tail is small and drooping. The legs are strong, straight and set well apart. Standard weight: Cock: 4-5 kg, Hen: 3-4 kg, Cockerel: 3.5-4.5kg, Pullet: 2.5-3.5 kg.

Kadaknath:

The original name of the breed seems to be the Kalamasi; which means fowl with black flesh. It is popularly



known as Kadaknath. It is bred by the tribals in Jhabua and Dhar district in western Madhya Pradesh. The eggs are light brown. The day old chicks are bluish to black with irregular dark stripes over the back. The adult plumage carries from silver and gold spangled to bluish black without any spangling. The skin, beak, shanks, toes and soles of feet are slate like in colour. The comb, wattle and tongue are purple. Most of the internal organs show intense black colouration which is pronounced in trachea, thoracic and abdominal air sacs, gonads and at the base of the heart and mesentery. Varying degree of black colouration are also seen in the skeletal muscle, tendons, nerves, meninges, brain etc. The blood is darker than normal blood. Black pigment due to deposition of melanin. The flesh, although repulsive to look at, is delicious. A medium layer lays about 80 eggs per year.

Advantageous values of indigenous birds in rural areas:

1. Available everywhere in India.
2. Comparatively cheaper than exotic breeds.
3. Feeding cost is cheaper.
4. Excellent broodiness trait.
5. Easily escapes from predators attack.
6. Hardy and resistant to many tropical diseases.
7. Good for table purpose for better flavor and taste.

Table 4 : Chemical composition of egg:

Components	Total (%)	Water (%)	Protein (%)	Fat (%)	Ash (%)
Whole Egg	100	65.5	11.8	11.0	11.7
Albumen	58	88.0	11.0	0.2	0.8
Yolk	31	48.0	17.5	32.5	2.0
		Calcium carbonate (%)	Calcium phosphate(%)	Magnesium carbonate(%)	Organic matter(%)
Shell	11	94.0	1.0	1.0	4.0

Nutritive value of egg: An egg contains about 6 gm of protein. Egg protein is of such a high quality that its biological value has been taken as 100 and it acts as a standard for evaluating a biological value of other food proteins. All the essential amino acids required in the human diet are present in egg protein. Egg also provides 5-6gm of easily digestible fat, wherein the proportion of much desired unsaturated fatty acids (especially oleic acid) is more as compared to most other livestock products. Egg is an important source of fat soluble vitamins (A, D, E and K) and water soluble vitamins of B-complex group. *However, it does not contain vitamin C.* With a little carbohydrate, egg has a remarkably low caloric value which justifies its inclusion in the food for people on

because it contains all the essential amino acids in balanced proportion. Such high protein diet insures overall development of the body and plays an important role in tissue repairs. Chicken meat with low fat content offers good quality food to the consumers. It provides the much desired essential fatty acids which form necessary constituents of the cell wall, mitochondria and other cell constituents. This help in maintaining the health of the consumers. Due to its low energy value, chicken meat is good food for weight control diets. Chicken meat contains more phospholipids risks due to diabetes and heart diseases. Chicken meat is a good source of vitamins and minerals in human diets. It is rich in niacin and moderately rich in thiamine, riboflavin and ascorbic

Table 5: Chemical composition of poultry meat:

Species	Water (%)	Protein (%)	Fat (%)	Ash (%)	Food Energy (Cal/100gm)
Broiler chicken (8 weeks)	74.0	18.5	6.0	0.80	125
Spent hen chicken	72.0	19.0	6.5	1.25	120
Quail (8 weeks)	70.5	20.5	5.5	1.20	125
Duck (8 weeks)	58.0	20.0	19.8	0.50	300
Turkey (8 weeks)	60.0	19.5	18.0	1.00	270

restricted diet. Egg is very good source of important mineral such as iron, phosphorus, potassium, and trace elements which are necessary for the formation of blood, bone and soft tissues. The cholesterol content of the egg is 230 mg/egg and after consumption of egg, it is not significantly influence the blood cholesterol level unless taken indiscriminately because cholesterol is found in blood, nerve tissue and other parts of the human body as a normal constituent of the cell.

Nutritive value of poultry meat: Poultry meat is a food of high nutritional value. It is higher in protein contents as compared to red meats, poultry meat proteins are classified under first class category

acid. Chicken meat is also a good source of iron and phosphorus. Due to high biological value and easy digestibility, it is a choice food for aged persons as well as children.

Conclusion:

For doubling the income of farmers, there is need to do mix farming with poultry farming. On the basis of agriculture, it is very difficult to double the income of farmer, because agriculture totally depends upon the nature for rainfall; and partition of lands also. Poultry farming is such a business that farmer get cash every day for their livelihood. Farmer can survive in better condition with adapting poultry farming and also can double their income.

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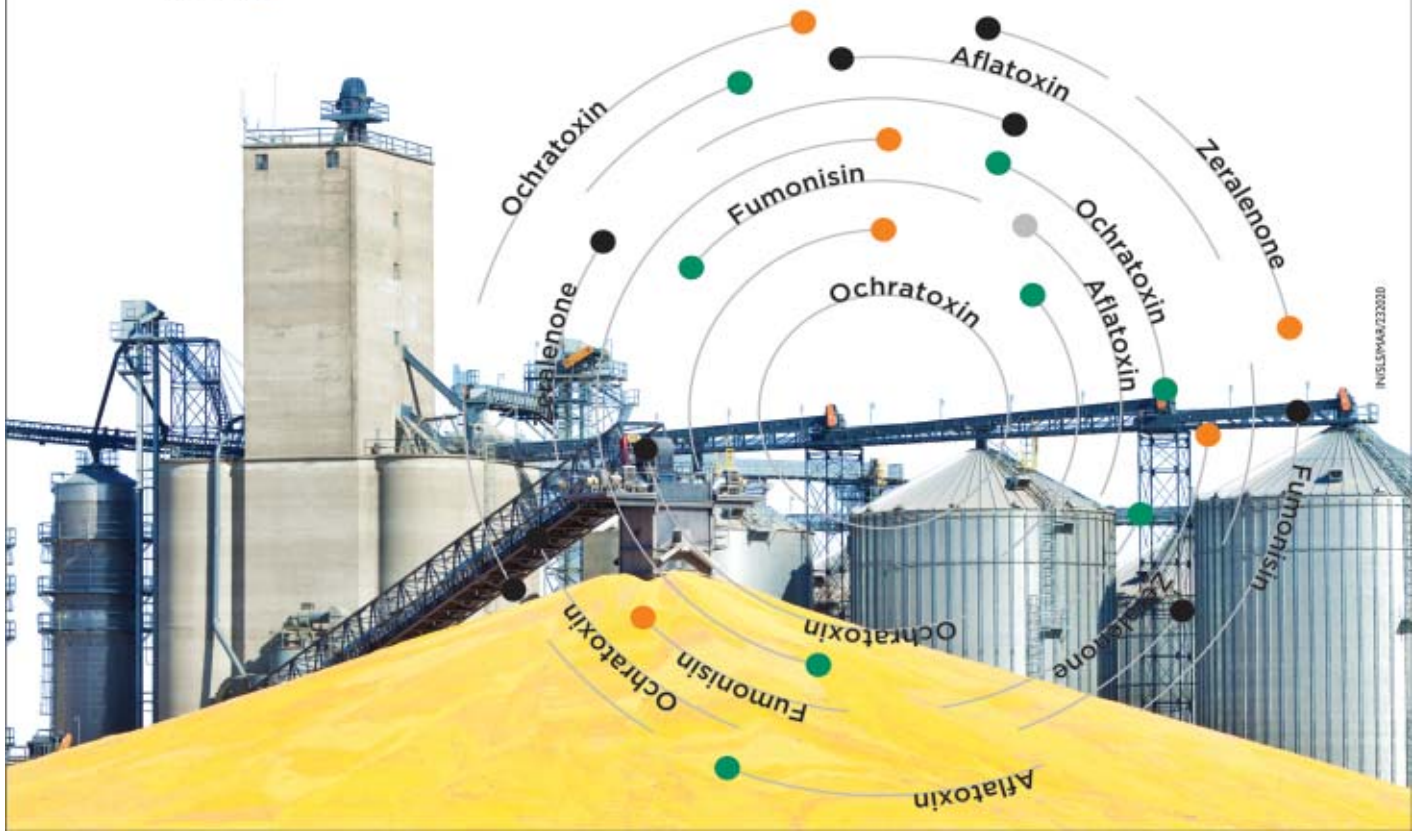
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WELTEC BIOPOWER and Nordmethan to Operate under a Single Name Closer Link between Energy Plant Construction and Operation



WELTEC BIOPOWER and Nordmethan to Operate under a Single Name. Closer Link between Energy Plant Construction and Operation.

For many years, the German companies WELTEC BIOPOWER GmbH and Nordmethan GmbH have been cooperating as part of the same group. While WELTEC builds biogas and biomethane plants around the globe, Nordmethan supplements the portfolio with the operation of energy plants. Within the scope of a strategic realignment, all companies of both businesses will henceforth operate under the globally recognised umbrella brand WELTEC BIOPOWER.

This brand realignment was necessary in order to perpetuate our global success story and reinforce our positioning as a competent biogas specialist in all areas of the industry. By operating under a single name, we intend to further increase the efficiency of the synergies between the individual business areas, which we had already been making use of, explains Jens Albartus, Director of the WELTEC Group, pointing to the main motives for the closer cooperation.

In the course of its history – which started in 2001 with the establishment of WELTEC BIOPOWER GmbH – more and more components of the biogas value chain have been developed and bundled within the Group. Key elements include the design, planning and setup of energy plans. To date, we have set up more than 300 plants with an output of up to 10 MW each in 25 countries. Soon, five additional biogas plants are going to be built in Asia. Moreover, we are currently rolling out projects in several European countries, says Albartus. He adds: The high proportion of custom-developed components is a key USP that enables us to reduce interfaces.

As far as the operation of biogas plants is concerned, the WELTEC Group does not concentrate solely on its own nine sites, which produce about 96 million m³ of climate-friendly biogas and biomethane a year. We also share our expertise with other operators and take care of the plant operation on behalf of banks, liquidators and investors on a temporary or ongoing basis, says Albartus and adds: What is more, we regularly assist customers who run their own biogas plants with our mechanical and biological service.

For many years, the operations of the WELTEC Group have also included sustainable usage concepts for the output flows, e.g. in the form of heat contracting. Currently, the biomethane produced by the Group's plants is used to supply communities, horticultural facilities and other businesses at 16 locations.

In all its activities, the biogas specialist endeavours to remain close to its business partners and to roll out projects in an individual manner. Thus, the WELTEC Group's sales and service network

spans the entire globe. The range of customers includes businesses from sectors such as agriculture, food, municipal administration, waste and wastewater. Jens Albartus explains: The combination under a single name will in no way impair our existing collaboration. Rather, we will be able to align our service offerings even more effectively with our customers' quality requirements.

Company Portrait

The WELTEC Group from Vechta, Germany, has developed into a globally leading specialist for the construction and operation of biogas and biomethane plants since it was founded back in 2001. The Group designs, plans and sets up energy plants, operates them on a permanent or temporary basis, provides 24/7 service and delivers sustainable usage concepts for output flows, thereby covering the entire biogas value chain.

The establishment of individual, technically mature solutions up to a plant size of 10 MW is one of the strengths of WELTEC BIOPOWER. The high proportion of custom-developed components is a key success factor. Moreover, the use of stainless-steel technologies ensures flexible substrate input, quick and inexpensive assembly and a consistently high quality standard, regardless of the location. Following the commissioning, WELTEC's mechanical and biological service plays a significant role in ensuring the plant efficiency.

The company also boasts a wealth of experience in the field of biogas generation and utilisation. The company's nine decentralised plants generate 96 million standard m³ of biogas a year. Most of it is processed to biomethane and made available to energy suppliers and petrol station operators via the public gas network. Additionally, at 16 locations in Germany – e.g. in the field of horticulture, housing construction and healthcare as well as communities – the biomethane is used for generating heat within the framework of WELTEC energy contracting.

The biogas specialist is well aware of the importance of customer and investor proximity. Accordingly, the Group's sales and service network spans the entire globe. The range of customers includes businesses from industries such as agriculture, food, waste and wastewater. So far, the 120 employees of the WELTEC Group have implemented more than 300 energy plants in 25 countries on five continents. These plants save about 485.000 tons of CO₂eq a year.



While WELTEC builds biogas and biomethane plants around the globe, Nordmethan supplements the portfolio with the operation of energy plants. Within the scope of a strategic realignment, all companies of both businesses will henceforth operate under the globally recognised umbrella brand WELTEC BIOPOWER.

Effects of phytogetic feed additives on bird health

by Andreas S. Muller, Senior Manager R&D Poultry, Delacon Biotechnik GmbH.

From January 1st, 2006 onwards in the European Union (EU) antibiotics were banned as growth promoting feed additives. As the first and currently single Asian country the Republic of South Korea followed the EU example in 2011. It can be expected that numerous further big countries in the world will also remove feed antibiotics within the next few years.

The protection of consumers health is the main reason for these decisions. However, the removal of antibiotics at the same time means a big challenge, since alternative substances should be comparably effective with regard to their impact on the productivity of farm animals and with regard to the preservation of animal health.

Promising alternative

Within the alternatives to antibiotics, phytogetic substances represent the most promising class of feed additives. This opinion is based on the availability of an infinite number of available plants with highly active ingredients. The spectrum of effects mediated by plant derived compounds includes the disturbance of microbial communication, antioxidant properties, and anti-inflammatory effects.

In this article, two aspects of selected phytogetic compounds are looked at in more detail:

- Disturbance of microbial communication.
- Antioxidant and anti-inflammatory effects.

With regard to the efficiency to protect farm animals against disorders caused by pathogenic microorganisms, it has been frequently postulated, that phytogetic substances (in particular essential oils and their compounds) exert bactericidal effects. By definition, the term 'minimum inhibitory concentration' (MIC) towards a micro-organism (MO) means a reduction of MO viability by more than 90%.

The minimum bactericidal concentration (MBC) means a reduction of viability by more than 99%. Tables 1 and 2 give an overview of the MIC concentrations of selected essential oils and essential oil compounds against several micro-organisms.

Neglecting an additional dilution effect of the feed in the intestine, the MIC concentrations give evidence that genuine bactericidal effects of phytogetic compounds in the animal cannot be obtained with phytogetic additives.

Table 1. MIC values of selected essential oils (Burt, 2004).

Plant origin of essential oil	Bacteria species				
	Escherichia coli	Salmonella typhimurium	Listeria monocytogenes	Staphylococcus aureus	Bacillus cereus
	MIC (estimated range) $\mu\text{L}/\text{mL}$ ~ mg/mL ~ g/L ~ kg/t				
Rosemary	4.5 – 10.0	>20	-	0.40 - 10	0.20
Oregano	0.50 - 1.2	1.2	0.20	0.50-1.2	-
Thyme	0.45 – 1.25	0.45 - 20	0.15 – 0.45	0.20-2.5	-
Sage	3.5 – 5.0	10.0 – 20.0	0.20	10.0 – 20.0	-
Clove	0.40 – 2.5	>20.0	0.3	0.40 - 2.5	-

Table 2. MIC values of selected single compounds from essential oils (Burt, 2004).

Essential oil component	Bacteria species				
	Escherichia coli	Salmonella typhimurium	Listeria monocytogenes	Staphylococcus aureus	Bacillus cereus
	MIC (estimated range) $\mu\text{L/mL} \sim \text{mg/mL} \sim \text{g/L} \sim \text{kg/t}$				
Carvacrol (Oregano)	0.25 – 5.0	0.22 – 0.25	0.37 – 5.0	0.17 – 0.45	0.18 – 0.90
Thymol (Thyme)	0.22 – 0.45	0.07	0.45	0.15 – 0.22	0.45
Citral (Lemon)	0.55	0.5	0.5	-	-
Eugenol (Clove)	1.0	0.50	> 1.0	-	-

Essential oil concentrations in the feed, unrolling bactericidal effects, would:

- Result in a reduced feed intake and performance due to the strong taste of the oils.
- Be economically unmanageable.

Quorum sensing

Quorum sensing (QS), or bacterial cell-to-cell communication, is a mechanism of gene regulation in which bacteria coordinate the expression of certain genes in response to the presence of small signaling molecules (inducers).

This regulatory mechanism has been shown to control virulence gene expression in many different pathogens. Virulence factors include gene products involved in motility, adhesion to the host's intestinal epithelium, host tissue degradation, iron acquisition, and toxin production. The abundance of the signaling molecules in the environment thereby directly reflects the bacterial population density. If a certain threshold of inducer concentration is reached, the bacteria start to produce virulence factors, leading to the outbreak of the disease in the host.

The best characterized QS signaling molecule of numerous Gram-positive and Gram-negative pathogenic bacteria is N-Acyl-Homoserine Lactone (NAHL). Various pathogenic bacteria like *Pseudomonas aeruginosa*, *Vibrio spp.*, *Burkoldia cepacia*, *Yersinia enterocolitica*, *Escherichia coli* and *Salmonella spp.* have been shown to employ QS to regulate their virulence and pathogenicity.

Some bacterial strains use further sensing molecules, like catecholamines, in addition to NAHL sensing. Selected phytochemical substances interfere with QS of bacteria and therefore possess the ability to suppress the virulence of bacteria. This, so called quorum sensing inhibition (QSI), can be studied very well in the model organism *Chromobacterium violaceum*, which produces the fluorescent purple dye violacein due to achievement of the threshold population density.

Thus, *Chromobacterium violaceum* can be used as a screening tool to test the QSI potential of selected substances. However, to assay the impact of QSI towards pathogenic micro-organisms, other readout parameters are needed. In the context of QSI by phytochemical substances it could be shown that clove oil strongly inhibited violacein fluorescence in *Chromobacterium violaceum* at already subinhibitory concentrations (Table 3). Promising results for QSI by essential oils were also reported for *Campylobacter jejuni* and the enterohaemorrhagic *E. coli* strain O157:H7.

In the first mentioned study, already 0.10mmol/L carvacrol, corresponding to 15mg carvacrol/L, significantly inhibited the motility of *Campylobacter jejuni*. In the latter study, 1 mmol/L carvacrol (150mg/L) induced a strong heatshock response in *E. coli* and inhibited flagellin synthesis, essential for the motility of the pathogen. These results impressively show that phytochemical substances have the potential to disturb pathogenic micro-organisms very well.

Table 3. Cell viability and quorum sensing inhibition of CV, incubated with clove oil (compiled from: Khan MS, Zahin M, Hasan S, Husain FM, Ahmad I. (2009): Inhibition of quorum sensing regulated bacterial functions by plant essential oils with special reference to clove oil. Lett Appl Microbiol. 49: 354-360).

Clove oil concentration	g/100kg (kg/t)	Pigment production	OD of violacein	Reduction of absorption (%)	Cell viability Log CFU at 10 ⁵ dilution
Control (0.00)	0 (0.0)	+++	0.342	0.0	8.14
0.04	40 (0.4)	+	0.175	48.0	8.12
0.08	80 (0.8)	+	0.141	58.0	8.05
0.12	120 (1.2)	±	0.074	78.4	8.02
0.16	160 (1.6)	±	0.026	92.3	7.29
0.20	200 (2.0)	-	0.000	100.0	

In the future it is therefore of significant interest to force research into studying the efficiency of phytochemical substances on QSI of pathogenic bacteria.

In the post-antibiotic-era' the disruption of QS of pathogenic bacteria by phytochemical substances represents one core strategy to preserve farm animals from infectious diseases of the intestine.

Additives and inflammation

Due to the ban of growth promoting antibiotics, the infection of farm animals with species specific pathogenic micro-organisms represents an issue of growing importance. In numerous cases, the infection with pathogens, does not result in the full-blown clinical picture, but leads to a severe reduction of performance and causes economic damage. This aspect is well known with regard to the infection of chickens with *Eimeria tenella*.

Irrespective of its degree, an infection with intestinal pathogens induces an inflammatory response in the hosts. During an infection with pathogenic micro-organisms, intestinal cells secrete a variety of cytokines in order to attract cells of the immune system. In the early stages of immune response, macrophages, entering the affected tissues, produce a strong inflammatory reaction. In later stages T cells are also involved in the promotion of inflammation.

The most important intra cellular transcription factor, triggering inflammation in a cell is the Nuclear factor 'kappa-light-chain enhancer' of activated B-cells' (NFkB). NFkB on the one hand induces the synthesis of cytokines, responsible for the further recruitment

and attachment of immune cells (for example, IL6, VCAM, ICAM) and of Cyclooxygenase 2 (COX2), producing pro-inflammatory prostaglandins. On the other hand, NFkB action is needed to produce anti-inflammatory cytokines, responsible for the termination of an inflammation (for example IL- 10), and of antioxidant enzymes, which enable cell survival and help to terminate an inflammation.

The endogenous antioxidant enzymes, which are of particular interest for the termination of an inflammation are NAD(P)H Quinone-Oxidoreductase I (NQO I), Heme oxygenase I (HO I) and glutathione peroxidase 2 (GPx2).

A common feature of these mentioned antioxidant enzymes consists in their specific synthesis mechanism. Their transcription and synthesis take place, due to the release of the transcription factor 'Nuclear factor (erythroid-derived 2)-like 2' (Nrf2). In this context it must be mentioned that besides NFkB and oxidative stress, numerous phytochemical substances act as very strong Nrf2-releasing agents.

Curcumin from *curcuma longa* and the brassicaceae isothiocyanate sulforaphane are the best characterized inducers of endogenous antioxidant enzymes by triggering Nrf2-release. The induction of endogenous antioxidant enzymes concomitantly can reduce the severity of inflammation. In this context it could be shown that the induction of GPx2 reduces COX2-dependent prostaglandin E2 synthesis.

The results of our own investigations with growing broilers revealed a considerable induction of a broad

panel of Nrf2-dependent antioxidant enzymes and of phase II enzymes in the jejunum, by supplementing the diets with 150g/t turmeric oil or with sulphoraphane-containing broccoli extract. In an own rat study, it could be demonstrated that sulphoraphane feeding significantly induced intestinal antioxidant enzymes, while reducing the expression of COX1, COX2, VCAM, and Monocyte Chemoattractant Protein I (MCP1). In a recent study with *Eimeria tenella* infected broilers, the addition of capsicum and turmeric oleoresins to the diets strongly reduced intestinal lesion score and the expression levels of main pro-inflammatory cytokines.

The results of these and numerous further trials indicate that various phytochemical substances have

Conclusions

- Due to their content of an infinite variety of active ingredients, phytochemical substances represent one of the most interesting and important classes of current and future feed additives.
- Phytochemical substances beat the potential to effectively repress the pathogenicity of intestinal microorganisms and to prevent and treat infectious diseases of farm animals.
- In the future a broad-based research is needed to make the full potential of phytochemical substances usable in order to preserve the health of farm animals and consumers.

References are available from the author on request

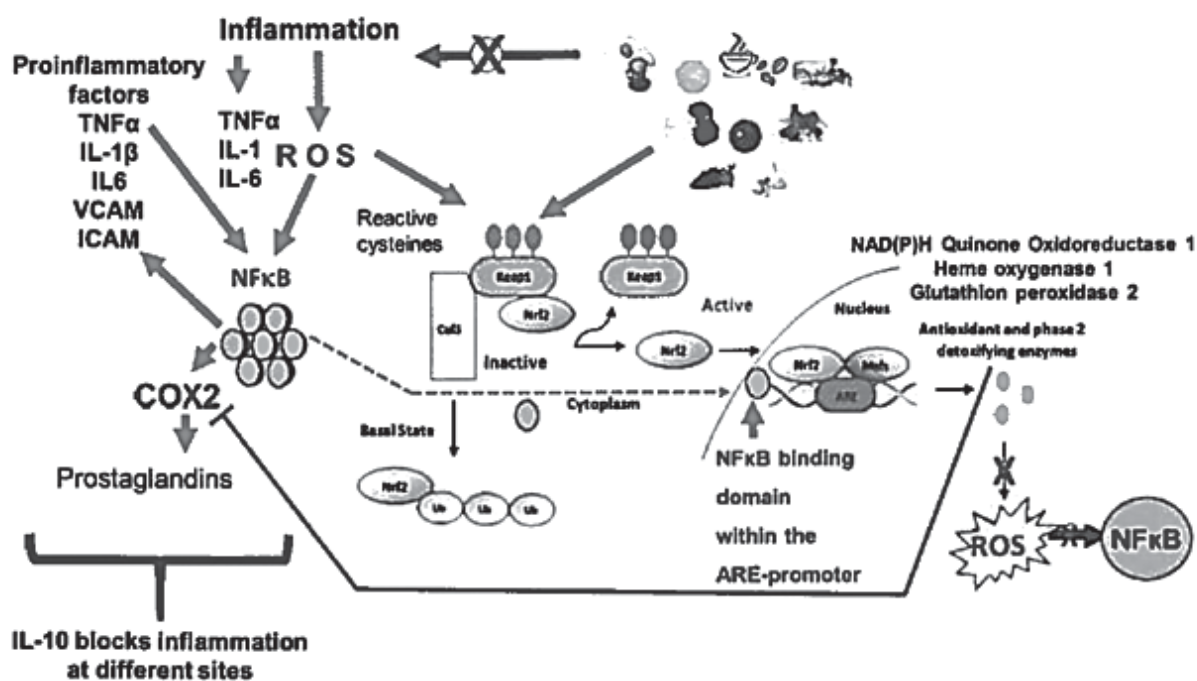


Fig. 1. Interfaces between inducible antioxidant enzymes and immune response.

promising effects with regard to the reduction of pathogen-induced intestinal inflammations in farm animals. In the future, research into the screening of anti-inflammatory phytochemical substances should be focused in order to develop phytochemical products with customized effects against species specific intestinal diseases. Moreover, there is a need to develop products with an increased content of active substances for the treatment of acute intestinal inflammation.

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Bacteriophages and their applications in the poultry industry

Aditya Vashista – Regional sales Head - North

The poultry industry is one of the largest consumers of antibiotics globally. Owing to the risk of increasing antimicrobial resistance, The European Union banned the use of antibiotics in food producing animals. However, they continue to be in use in other parts of the world. The emergence of multidrug resistant bacteria has been a cause for concern in poultry producers across the world. In the light of this crisis, scientists across the world are working to utilize microbial warriors as alternatives for antibiotics.

Bacteriophages are viruses that latch on to bacteria, replicate and destroy them from within. They kill bacteria and other microbial pathogens, but have no adverse effect on humans. They are remarkable because they have co-evolved with bacteria, and every single bacterium has a phage opponent that can be turned against it. Phages outnumber bacteria by a ratio of 10 to 1, and also play an important role in recycling the carbon in bacteria. They have both preharvest and postharvest applications in poultry production, and bacteriophage preparations are becoming increasingly commonplace in the global market.

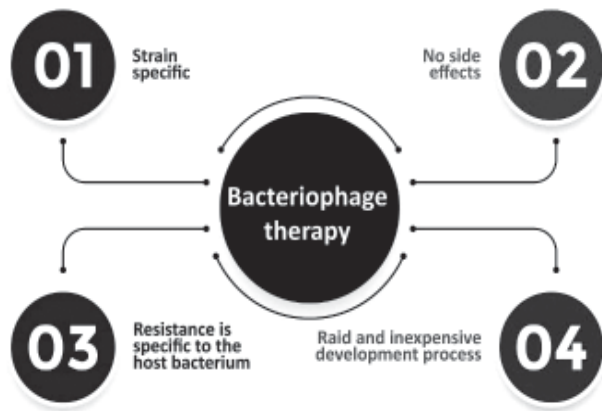
Treatment Of Bacterial Infections

Excessive use of antibiotics to treat pathogenic bacteria not only increases antimicrobial

resistance, but also can also affect intestinal microbiota, and cause dysbiosis, immunosuppression, and secondary infections.

- **Campylobacter** – This bacterium is commonly found in the gut of birds, on account of their conducive body temperature. Although chickens are carriers, they don't exhibit any clinical signs. Studies have shown a high prevalence of campylobacter in both layers and broilers. Campylobacter phages can reduce their abundance without affecting the gut microbiota. As of now, there have been no reports of phage resistant Campylobacter.
- **Salmonella** –The second most important zoonotic foodborne pathogen, salmonella infections can be grouped. The highest levels of salmonella positive samples are found in laying hens, breeding hens and broilers. Several outbreaks have been reported from India over the years, and researchers have successfully isolated antibiotic resistant profiles. Bafasal, a regulatory approved feed additive developed by Proteon pharmaceuticals, has a strong impact on food safety, with a high specificity towards Salmonella serovars, apart from improving feed conversion rate and reducing mortality.
- **Escherichia coli** – This gram-negative bacillus is a common inhabitant of the digestive tract of birds. Although most of the strains are non-pathogenic, certain pathogenic serotypes have been found to induce disease and cause mortality. It can act as both primary and secondary pathogen and E. Coli related infections are

Antibiotics	Bacteriophage therapy
Broad spectrum	Strain specific
Adverse side effects	No side effects
Resistance is not just limited to the target bacterium	Resistance is specific to the host bacterium
Time consuming and expensive development process	Raid and inexpensive development process



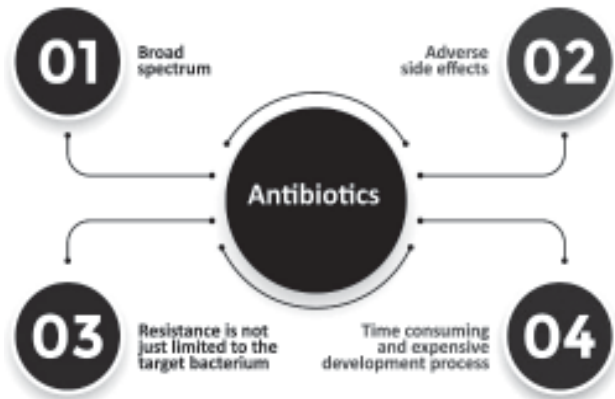
common among poultry of all ages and categories. Bacteriophages when used in combination with antibiotics, improved the effectiveness of colibacillosis treatments.

- **Clostridium** – This gram positive bacterium is ubiquitous and a common inhabitant of the gut microbiota of chickens. Both types of the bacterium produce toxins that can cause necrotic enteritis, which is the most financially devastating diseases in poultry flocks. It can also cause foodborne diseases, making it a potential public health concern. The synergistic effect of lytic phages in combination with bacteriocin have been shown to significantly reduce the bacterial population.

Phages as disinfectants

From legal regulations to biosecurity strategies, a number of approaches have been suggested to reduce the bacterial contamination in poultry facilities. Since the main source of meat contamination is the flock, we need to reduce their prevalence in chicken farms. Bacteriophage based disinfectants can be used as biosanitizers in farms, hatcheries, and transport crates. They are effective in inhibiting bacterial biofilm formation. Aerosol

based sprays can also help prevent horizontal transmission of pathogens. In food processing plants, they can also be used to disinfect food contact surfaces, the skin of poultry carcasses, and in direct on-food application and food packaging.



Are they the future?

Antibiotic resistance is a problem that is not addressed enough. Once you have two microorganisms in a particular group that is resistant to an antibiotic, they reproduce in a short time span, and soon you have a generation of bacteria that are resistant to antibiotics. This makes bacteriophages the perfect ammunition to aim in the direction of bacteria. For diseases that are caused by only one type of bacteria, phage therapy is the perfect option. If the disease is caused by more than one type, then we need a cocktail of phages that are specific to each of the infecting bacteria. While more progress remains to be made on this front, this is going to be the area of focus as we move towards a post-antibiotic era in poultry farming.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3644580/>

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Srinivasa Hy-Line had hosted the first-ever India Technical School live Webinar on 30th July 2020. The webinar received a tremendous response with the participation of Poultry Farmers, Veterinarians, Poultry Consultants, and Nutritionists from Pan India.

The Technical School was focused on increasing profitability from the layer bird with topics covering the entire gamut of farm management, bio-security, nutrition and disease management.

The webinar had international speakers who are the domain experts of Hy-Line International, Dr. Ian Rubinoff, Dr. Petek Settar, Dr. Seiche Genger, Dr. Doug Grieve and Mr. Vitor Arantes.

The farmers had highly benefited with crucial information from the experts during the Q&A session. The session marked active and engaging participation from farmers and veterinarians.

Awards were instituted to acknowledge the exceptional contributions made by layer farmers across categories at all India and regional levels. Two top performing farmers at all India level were each awarded with a Certificate for Excellence and 10,000 Hy-Line W-80 Chicks. The regional level top performers were awarded with Certificates.



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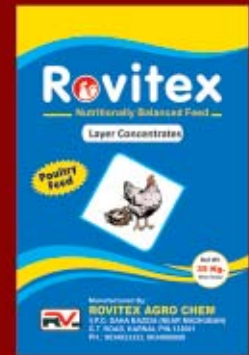
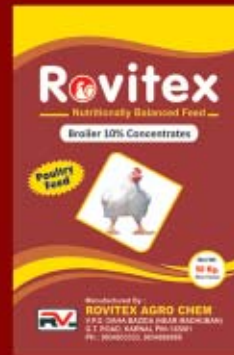
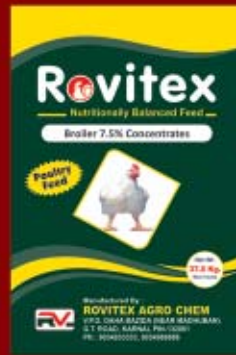
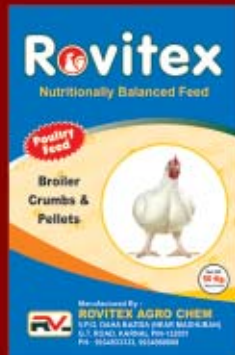
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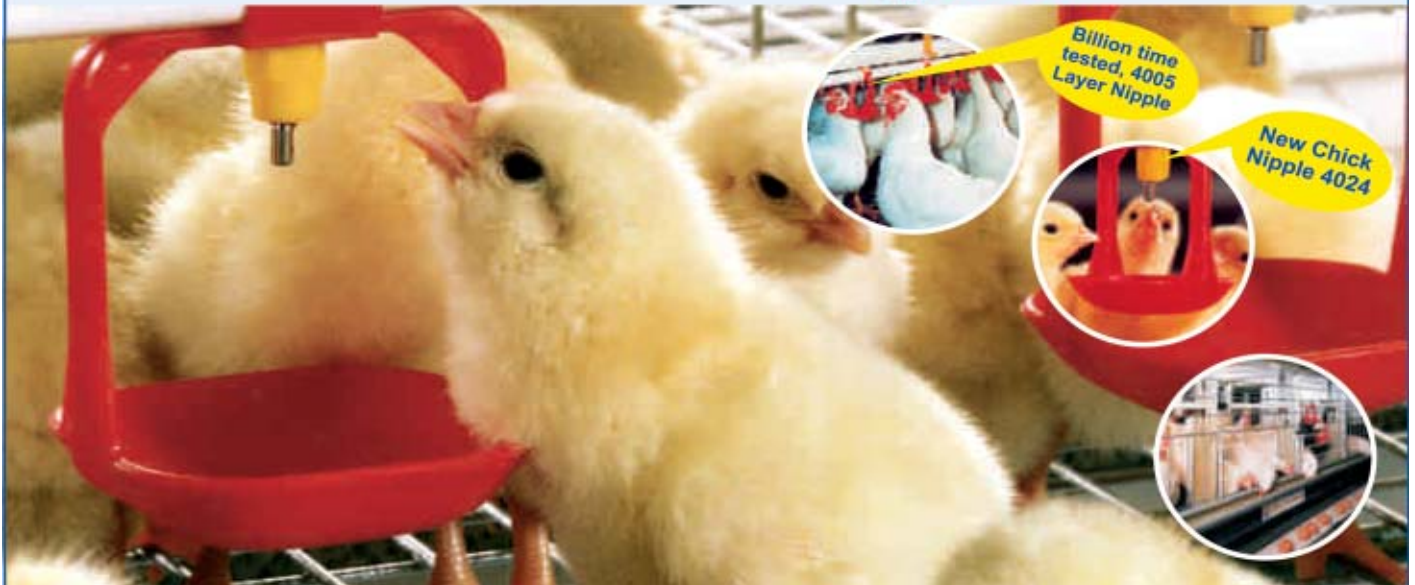
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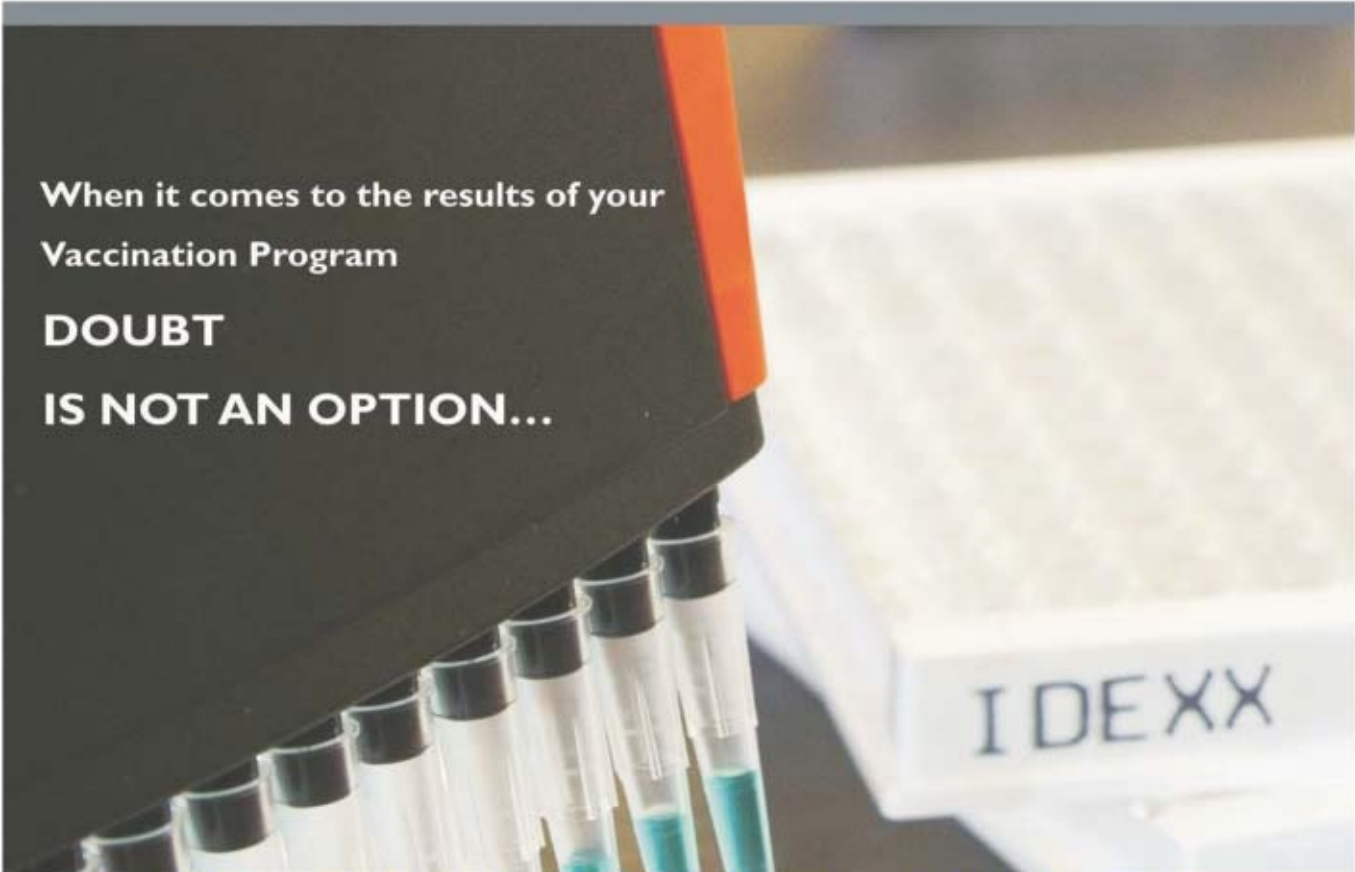
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