

Seminars On: Recent Developments In Food Control System & Microbiome And Health

**Thursday, May 5, 2016
New Delhi**

REPORT



Organized By

International Life Sciences Institute-India

INTRODUCTION

On the occasion of its 2016 Annual Meeting on May 5th ILSI-India, Regional Branch for South Asia, organized the following Seminars in Hotel Le Meridien, New Delhi:

- **Seminar on Recent Developments in Food Control System**
- **Seminar on Microbiome and Health**

The Seminars were attended by about 100 participants representing Industry, Government and Academia. Highlights of the Seminars are given in this Report.

Welcome Address

Mr. D H Pai Panandiker
Chairman ILSI-India

Mr. D H Pai Panandiker, Chairman of ILSI-India welcomed the two leading speakers for the Seminars viz; Mr. Pawan Kumar Agarwal, CEO, Food Safety and Standards Authority of India (Recent Developments in Food Control System & Seminar on Microbiome and Health) & Dr. B Sesikeran, Former Director, National Institute of Nutrition (Microbiome and Health) and the participants. Mr. Panandiker briefly explained the activities organized by ILSI-India and said that the tripartite approach adopted by ILSI-India has helped develop practical science based solutions to public health issues. The training programs organized by ILSI-India have assisted capacity building and the research sponsored by ILSI-India has enabled assessment of different nutrients in human health.

Mr. Panandiker underlined the importance of an efficient “Food Control System” for protecting consumer’s health. He said that it is necessary that the food laws and regulations, food control management, inspection services, modern laboratory services and information, education, communication and training work in harmonization to enable FSSAI to give guidance to food chains about safety of food products and in turn help the food chains to design their food production and food safety management system in a way that there is compliance with food laws and regulations.

It needs also to recognize that science and technology are not static but continuously change. To be in tune with this change the

food control system has to be dynamic and not only allow but also encourage innovation in products, packaging and so on while ensuring food safety and public well-being. The system works best in the interest of the consumers when the authorities at different levels and the food chain work in cooperation so that immediate corrective action is taken if there are any deficiencies in food safety.

For instance food fortification has been one of the important goals of ILSI-India because of the high incidence of malnutrition in the population. In many cases it would not be enough to go by RDAs but by safe upper limits (SUL). This issue was discussed at ILSI-India Expert Consultation and the Government is actively considering it. SUL have been adopted by five major countries/region. He emphasized that the food control system needs to adapt to such new concepts in science.

Speaking on “Microbiome and Health” Mr. Panandiker pointed out that research on microbiome started only in the 1990s and recognizing its importance microbiome is often described as ‘forgotten organ’. The microbiota consists of trillions of friendly microbes of about 1000 species. Two-thirds of the microbes are unique to each individual. They have an important role in digestion and also produce certain vitamins like B and K. Deficiencies in the composition can result in many autoimmune diseases like diabetes, arthritis, multiple sclerosis and even cancers. Some studies have also demonstrated that defective microbiota may be responsible for obesity.

Recent Developments in Food Control System

Mr. Pawan Kumar Agarwal
CEO, Food Safety & Standards Authority of India
Ministry of Health, Government of India

Addressing the Seminar on “Recent Developments in Food Control System” Mr. Pawan Kumar Agarwal, made the following observations:

- ILSI-India has been doing good work and the publications brought out by ILSI-India are quite useful and informative. When he joined FSSAI the first report that he read was from ILSI-India. ILSI-India Conference Reports have been useful source of information on food safety for him. He has greatly benefited from them.
- ILSI-India has provided leadership on food safety for a long time even before FSSAI came into existence.
- With the establishment of FSSAI, the earlier system of multiple authorities was replaced by a single authority and a new approach for looking at food safety emerged.
- Food standards should be implemented across businesses and across all food categories.
- The biggest challenge for ensuring food safety is from small and medium enterprises.
- FSSAI has closed certain offices and less number of offices mean more effectiveness and focused attention to food safety. FSSAI is moving towards empowerment and better vigilance. Food businesses can reach out to FSSAI and enforcement can be aligned. Consumers will also be involved at large.
- A new division has been set up in FSSAI called “Food Safety Management System” (FSMS). There are plans for drawing up FSM plan for each food category. Food businesses would be involved in enforcement of FSMS.
- The earlier paradigm of looking at end product quality is changing. There is more emphasis in controlling the safety aspects during different processes. The emphasis of regulatory infrastructure is on inspection services and enforcement of FSMS. The new approach emphasizes on risk base approach as against adulteration.
- FSSAI has to go a long way in ensuring food safety. It is very important that all food businesses operators i.e. marketing businesses; manufacturers of processed foods and catering services, follow food safety norms.
- FSSAI is also moving in the direction of empowering consumers.

- There is a huge gap in understanding food safety related issues in State Governments and food authorities at state level. FSSAI will work with State Governments and food authorities at state level to bring about alignment in thinking between state food safety commissioners and national level.
- There is concrete thinking on the issue of strengthening food testing system in the country. The central food laboratories which are referral laboratories will be made more robust. State food laboratories will be strengthened and upgraded. A plan will be rolled out in next few weeks. One or two laboratories at state level (depending on size of the state) will be brought up to desirable level.
- Mobile food laboratories will also be developed for testing, surveillance and reaching out to consumers, schools and colleges.
- Networking of all laboratories is required to put all test results in one place and store the data on test results to facilitate assessment of risks in various food categories.
- FSSAI has set up “Risk Assessment Cell” which will be expanded to a full-fledged center.
- FSSAI has to look at interests of various stakeholders. Standards cannot be set at levels which are not achievable. Food standards should be set looking at Indian scenario and with ultimate objective of reaching global levels.
- Food standards should be pragmatic. Good inputs are required from industry and other stakeholders.
- SMEs have to be educated about food safety and hygiene. Big businesses can undertake the task of educating their associates and distributors. Associations can also undertake training programs.
- It is important to connect to the common man. Credibility of food supplied in the market is poor except for food supplied by some brands.
- It is important to create high visibility of regulator to assure that food available in the market is safe and consumers have confidence that a food product with FSSAI Logo is safe.
- ILSI-India’s help is required in the endeavor to provide safe food.

Q & A

Question: Stringent penalty should be imposed to punish those whose products fail. (Dr. R K Saxena)

Response by CEO: Many businesses serve unsafe food due to lack of knowledge. Public education is important. It is necessary to educate street vendor as well as food businesses. Further, food standards have to be reasonable.

Question: It is felt that many health claims provided by manufacturers are not correct? (Dr. Veenu Seth)

Response by CEO: Claims are area of concern. Many countries have permanent panels on claims. FSSAI will put something in place. At present FSSAI is working with Advertising Standards Council of India. The ASCI has conveyed that in 80% to 90% of cases of complaints against claims, food businesses make corrections. A regulation on claims can be brought out by FSSAI.

Question: FSSAI should introduce food safety knowledge for children. Small booklets can be prepared. (Dr. V Prakash)

Response by CEO: Nutrition and Food Safety program for schools is being prepared. Two meetings have been held. It will be first launched in Delhi. Any support will be welcome. It is proposed to train master trainer for nutrition education for schools.

Videos will be prepared for learning portals. Anyone can prepare videos and send it to FSSAI.

Videos will be used for behavioral changes.

Question: State laboratories personnel should be educated on principle of food safety. (Dr. Kamala Krishnaswamy)

Response by CEO: An e-learning portal INFLBNET is being extracted from food laboratory personnel.

Dr. P K Seth recommended that center and state relations should be strengthened and CSIR laboratories can also be involved in food testing.

Microbiome And Health

Dr. B Sesikeran

Former Director, National Institute of Nutrition

In his presentation entitled “The Gut Microbiota – a Super Organ” Dr. Sesikeran informed that microbes colonize all of the surfaces of the human body that are exposed to the environment, with the majority residing in the intestinal tract. There is presentation of diversity of bacteria in the human intestine. Based on 8903 representative, 16S r RNA gene sequences are there. The intestinal microbiota includes:

- Bacteroides dominated enterotypes
- Prevotella dominated enterotypes
- Ruminococcus dominated enterotypes

Dr. Sesikeran explained that Gut microbiota is typically dominated by bacteria – members of the division Bacteroidetes and Firmicutes. Despite huge range of variations, the microbiota of most individuals can be categorized into one of three variants or “Enterotypes”. The Enterotypes are based on three dominant genera *Bacteroides*, *Prevotella* or *Ruminococcus*. These clusters are characterized as a ratio of the abundance of *Bacteroides* and *Prevotella*, with the *Ruminococcus* enterotype folded into *Bacteroides* group. These broad patterns are driven primarily by dietary effects.

The focus of Dr Sesikeran’s presentation was on Gut Microbiota studies in India, Dr.

Sesikeran pointed out that many challenges are faced in conducting these studies due to:

- a. Geographic distribution*
- b. Heterogeneity of Indian population*
- c. Ethnicity and genetic diversity*
- d. Diversity in dietary habits*
- e. Disease risks of Indian population*

Dr. Sesikeran said that Gut Microbiome studies in India have been conducted on the following:

- a. Mode of Obstetric Delivery*
- b. Bacterial Transition with Age*
- c. Over nourishment and under nourishment – Obesity and Malnourishment*
- d. Ulcerative Colitis and Crohn’s Disease*

Dr. Sesikeran gave an overview of studies conducted in India.

Mode of Delivery (Vaginal vs. Cesarean)

- This is first study from the Indian subcontinent The study showed that there were four major phylogenetic groups in both groups: *Firmicutes*, *Clostridia*, *Proteobacteria*, *Actinobacteria*.
- Most abundant species in vaginal birth were - *Actinobacterbacter* sp. (*A. pitti*, *A. junii*, *A. baumannii*) *Bifidobacterium* sp. (*B.longum*, *B. bifidum*, *B. breve*) and *Staphylococcus haemolyticus*.

- The cesarian birth had the following species: Citrobacter species, *Escherichia coli*, *Clostridium difficile* (11%), Absence of Bifidobacteria.
- Bacteroides - Prevotella-Porphyrromonas main constituent of fecal bacterial flora in older children and adults.

Conclusions:

- Fecal microbiota of VB infants differed distinctly from their CB counterparts on day 7.
- Lower species richness in VB compared to CB infants.
- Composition of VB similar to earlier works except for Acinetobacter species—clinically important taxa, opportunistic pathogens.
- Absence of Bifidobacteria in CB infants and presence of *E. coli* and *Clostridium difficile* in CB infants - aberrant gut microbiota and presence of nosocomial pathogens.

Bacterial Transition with Age

- This study was conducted in Village in South India on 130 healthy children and adolescents (2-17 yrs.) and 30 healthy adults (median age 42 yrs.).
- The study showed that:
 - Lactobacillus and Bifidobacterium species predominant at 2-3 years of age but were found to be decreased in adults.
 - Increase in Bacteroides, *E rectale*, and *F prausnitzii* during late childhood.

Conclusions:

- Changes in bacterial flora occur during childhood and adolescence characterized by reduction in Bifidobacteria and Lactobacillus species and increase in Bacteroides *E. rectale* and *F. Prausnitzii* during late childhood in this population.
- Continuing and gradual change in fecal bacterial flora beyond early childhood which continues into adolescence and adulthood.

Two Indian Families

- This study was conducted on two healthy Indian Joint families (T and S) with three successive generations staying under one roof 22 strict anaerobic bacteria isolates were obtained from fecal samples of three healthy volunteers.
- The study showed presence of: Fecalibacterium and Roseburia in T1 (age 14 years), Dialister, Prevotella in T2 (age 42 years) and Prevotella in T3 (age 62 years) in family T.
- Streptococcus and Weisella were formed in S 1 (infants) and Fecalibacterium and Roseburia in S2 and S3 (age 26 and 62 years respectively) in Family S. Further,

isolates from samples of S1 (age 26 years) and S3 (56 years) belonged to the genus *Bacteroides*, *Clostridium* and *Parabacteroides* while *Megasphaera elsdenii* was isolated from S3 only.

Conclusions:

- Difference in gut flora composition of individuals of different age belonging to the same family.
- Difference in anaerobic bacterial diversity with age within individuals in a family.
- Gut Microflora changes within genetically related individuals of different age.
- Consistent decrease in Firmicutes and consistent increase in Bacteroidetes in both families with an increase in age.
- Different bacterial genera dominate the gut flora in different aged individuals.

Gut Microbiomes of Indian Children Varying Nutritional Status

- This study was conducted in Birbhum district of West Bengal which is typical of rural and agricultural setting Birbhum Population Project, a health and demographic surveillance system. This study was undertaken against the background of the fact that a large percentage of children under age 5 who are moderately or severely stunted. 165 million children <5 yrs. are stunted, 101 million children <5 yrs. are underweight and 52 million children <5 yrs. are wasted.

- Taxonomic composition of the 20 gut microbiomes showed that across 20 microbiomes 72 % assigned at phylum level. 8 phyla present but only 4 dominant: Bacteroidetes, Firmicutes, Proteobacteria and Actinobacteria (*Spirochaetes*, *Fusobacteria*, *Synergistetes* and *Euryarchaeota*). 36.2% assigned at Genus level and 4.2% (1.4% to 12.4%) assigned at species level.

Conclusions:

- Impaired nutritional status is not only due to abundances of pathogenic microbial groups but also a result of depletion of several commensal genera.
- Higher number of virulence genes is present in children with lower nutritional index.

Iron Deficiency in Women

- This study was conducted in anemic and women non anemic women in the age group 18-25 years.
- The study showed:
 - Presence of *Bifidobacterium*, *Lactobacillus acidophilus*, *Bacteroidetes-Prevotella-Porphyrromonas* group.
 - Presence of *Clostridium leptum* and *Eubacterium rectale*.
 - Dietary intake of energy, carbohydrate, fiber and Fe - diet dairy for a week - same in both groups.
 - Fecal Lactobacilli was lower in anemic women.

Conclusions:

- No difference between the two groups with respect to any other bacteria.
- Relationship between Lactobacilli and Fe deficiency needs to be explored further.

Fecalibacterium prausnitzii - Obese Indian children

- A study was conducted on *Fecalibacterium prausnitzii* - Obese Indian children. The study included obese and normal weight children in age group 11-14 years. Consumption of energy, carbohydrates, fats and proteins were not different between the two groups.
- The study showed that *Fecalibacterium prausnitzii* was significantly higher in obese individuals. It concluded that increased numbers of *F prausnitzii* in feces of obese individuals in South India adds to the growing information on alterations in fecal microbiota in obesity.

Inflammatory Bowel Disorder Patients

- The study was conducted on 84 (72 UC and 12 Crohn's Disease) diseased and 65 healthy controls (All India Institute of Medical Sciences (AIIMS), New Delhi, India). It gave the following results:
 - Bacteroides abundant in healthy controls but was low in concentration in UC and CD.
 - Loss of commensal bacteria like Lactobacillus, Bacteroides,

Ruminococcus and Bifidobacteria in UC and CD.

- Clostridium leptum subgroup was reduced significantly in CD patients.
- Increase in Eubacterium and Peptostreptococcus in CD patients but not in UC patients.

Conclusions:

- Differential change in a subset of bacterial population may be associated with Ulcerative colitis and Crohn's Disease.
- Role of subsets of bacteria in the pathogenesis of CD and UC may be different.

Dr. Sesikiran said that diet has a dominant role over other variables such as ethnicity, sanitation, hygiene, geography, and climate in shaping the gut microbiota. Role of probiotic in preventing acute diarrhea in children has been examined in a community-based, randomized, double-blind placebo-controlled field trial in an urban slum. The study concluded as follows:

- "1 (0.88 cases / child / year vs 1.029/ cases/ child/ year) incidence of diarrhoea.
- Equivalent to reduction of diarrhoea risk or protective efficacy of 14% (P<0.01).
- Reduction of *Aeromonas* and *Cryptosporidium* in the probiotic group.

- Probiotics are useful in the prevention of diarrhoea in Indian children.

Dr. Sesikeran informed that whole-Genome Shotgun sequencing of an Indian-Origin has been prepared for *Lactobacillus helveticus* MTCC 5463, *Lactobacillus rhamnosus* MTCC 5462 and *Streptococcus thermophilus* MTCC 5461. He also provided details of different species of microbiota in diseases. This is given in Appendix 1.

Dr. Sesikeran defined the mechanism linking the gut microbiome and glucose metabolism and talked about the recent studies on microbiome disease nexus:

Type 2 Diabetes

- Type 2 Diabetes (T2DM) is associated with gastrointestinal dysbiosis involving compositional and functional changes in the gut microbiome.
- Gut dysbiosis contributes to metabolic dysfunction - increased intestinal permeability, low grade endotoxemia, changes in the production of SCFAs, alterations in bile acid metabolism, and/or effects on the secretion of gut hormones.
- Understanding the mechanisms linking the gut microbiome to glucose metabolism and restoring a more healthy gut microbiome could be a new approach to prevent and treat T2DM

Microbiota and Brain Gut Axis

- Gut Microbiota influence brain development and behavior of the host through the gut brain axis.
- A bidirectional communication that integrates neural, hormonal and immunological signaling between gut and the brain.
- Microbiome may be linked to a wide variety of brain diseases and disorders.
- Studies in monkeys - stress alters the composition of the intestinal microbiome - predisposed to infections.
- Substances produced by the microbiota - quorum sensing molecules and fatty acids have the potential to bind to cells of the nervous system.

Liver Disease

There is distinctly altered gut microbiota in the progression of liver disease:

- The fecal microbiota at various liver pathological stages was analyzed by 16S rRNA gene pyrosequencing.
- Gut microbiota was significantly altered during the development and progression of liver disease.
- Spearman co-relation analysis revealed that bacterial species *Atopobium spp.*, *Bacteroides spp.*, *Bacteroides vulgatus.*, *B. acidifaciens.*, *B uniformis.*, *Clostridium cocleatum* etc. were markedly increased in mice model with progression of liver disease.

- The connection between the gut microbial ecology and the liver pathology may represent potential targets for the prevention and treatment of chronic liver disease and hepatocellular carcinoma (HCC).
- Third Trimester – Gut microbiome looked more like that seen in people with Inflammatory Bowel Disease or Metabolic Disorder.
- More opportunistic pathogens like *Proteobacteria* and *Actinobacteria* and increased levels of inflammatory cytokines.

Birth Mode-Dependent Association Between Pre-Pregnancy Maternal Weight Status And The Neonatal Intestinal Microbiome

- Association of maternal pre pregnancy Body Mass Index on stool microbiota – 74 neonates (18 born vaginally and 56 by elective C section).
- Excess maternal pre-pregnancy weight is associated with differences in neonatal acquisition of microbiota and had a distinct intestinal microbiome during vaginal delivery, but not Cesarean delivery.
- Predicted to result in functional differences in metabolic signaling and energy regulation.
- These differences may translate to altered maintenance of metabolic health in the offspring.
- Placenta – full of microbes – could it relate to women’s risk of condition like pre eclampsia?
- Babies born to mothers who have gained excess weight during pregnancy – more *Bacteroides* and *Staphylococcus* and less *Bifidobacterium*.

Microbiota During Pregnancy

- First trimester - Gut Microbiome of most women similar.

Dr. Sesikeran said that researchers at Emory University School of Medicine and Georgia State University have shown that probiotic supplements protected female mice from the loss of bone density that occurs after having their ovaries removed. The researchers say that one possibility is that sex steroid deficiency leads to decreased microbiota diversity that exacerbate bone loss, and that probiotics preserve greater diversity. Sex steroid deficiency-associated bone loss is microbiota dependent and prevented by probiotics.

Suggestions By Dr. V Prakash

During the course of discussion Dr Prakash made the following suggestions:

- Food intake and Microbiome project should be undertaken at national level to generate basal data.
- Database on traditional food habits and microbiome should be generated as this can also form the basis for developing innovative products.
- Children below certain age should be left to develop own microbiota as interference with this may lead to health issues later on.

Q&A

Question

- Chemicals could interfere with gut microbiota and could be eliminating some of the microbes. (Dr V Prakash)

Response By Dr. Sesikeran

- Science of Probiotics has its origin in aging. In certain regions people were consuming fermented foods and enjoying long life which led to evolvement of Probiotics.
- In future experts may look at effect of chemicals on gut microbiota before approving them.

Question

- Can food supplements with probiotics alter gut microbiota of children beyond certain age?
- What is the role of genetics in microflora of pregnant women? (Dr Tora Ganguli)

Response By Dr. Sesikeran

- Supplements with bacteria Lactoba-cillus is useful in checking infections in intestine and

in ulcerative colitis. There are physiological evidence of efficacy.

- This is a new area and a paper has been published in 2016 only.

Question

- Are there studies to show that transplanting microbes in colon have positive effects?
- Do babies born through vaginal vs. cesarean route differ functionally and what are the implications for health? (Dr Kamala Krishnaswamy)

Response By Dr. Sesikeran

- There are a number of studies which have shown that microbes can be transplanted.
- There are a number of publications on health effects of vaginal vs. cesarean birth. Babies born through cesarean route have less immunity, less growth and different body composition. This has formed the basis of Campaign for minimizing use of cesarean system.

Question

- What is the role of Probiotics in neonatal diarrhea?

Response By Dr. Sesikeran

- ICMR has published a paper based on its study in two regions in India where neonatal diarrhea was brought down when mothers were given probiotics. It also reduced morbidity in undernourished children. Now there is a plan to conduct a larger trial.

Question

- Is bacteria alive in Probiotic bread?

Response By Dr Sesikeran

- Bacteria will be alive only if added after bread is baked. In baked or boiled products bacteria don't survive. Probiotic will be called a Probiotic only if it has following characteristics: it survives gastric acid, it survives bile juices, it colonizes and it multiplies.

Question

- Whether **Helicobacter pylori** is a Probiotic?

Response By Dr. Sesikeran

- Helicobacter pylori bacteria's presence in intestine and its absence brings down the efficacy of intestinal functioning. However, if it exceeds certain limit it becomes harmful.

Question

- Is regular consumption of Probiotic drink safe?

Response By Dr. Sesikeran

- Safety of Probiotic drinks is well established. However, effectiveness depends on whether benefit studies have been and if they have been done then for what purpose such as constipation / diarrhea / IBS.

Question

- What is the role of gut flora on autism?

Response By Dr. Sesikeran

- The exact cause of autism is not known. However, studies are being conducted on autism and gut microbiota and results may be known in few years.

Question

- Science of gut Microbiome is new. One of the focus areas of work could be diarrhea. (Dr Nimish Shah)

Response By Dr. Sesikeran

- ICMR is concentrating on diarrhea. Probiotic products can have beneficial effect. However, wait for science to develop before making a claim.

Vote Of Thanks

Mr. N M Kejriwal
President, ILSI-India

Mr. N M Kejriwal, President, ILSI-India proposed vote of thanks to Mr. Pawan Kumar Agarwal, CEO, FSSAI for addressing the Seminar and informing us about the latest developments in food control system. He appreciated the fact that FSSAI is keen to build a healthy food safety environment in the country with cooperation of all stakeholders. He also thanked Dr. Sesikeran for making an excellent presentation on Microbiome and Health and provides information on studies conducted in India. He conveyed that this is a new area of work for ILSI and ILSI has taken the lead of setting up ILSI wide

platform on this subject and will be identifying activities to be undertaken.

Mr. Kejriwal thanked Mr. Panandiker, ILSI Board of Trustees, Project PIs and ILSI-India Secretariat for their excellent performance. Mr. Kejriwal also said that ILSI-India is always there to resolve public health issues using scientific approach in the areas of Food Safety, Nutrition, Agriculture Sustainability and Risk Assessment. ILSI is working without frontiers with more than 3000 scientists globally and it enhances issues ability to address issues efficiently.



International Life Sciences Institute-India

Email: info@ilsi-india.org