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CHAPTER 8

Roles of Normal Microflora in Human Health

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Introduction

Every organism protects itself from invading pathogens. Our environment is surrounded by millions of flora, this flora works as protective as well as harmful effect on the host. Microflora consists of bacteria, fungi and some extent to protozoa, but viruses are not generally considered as normal flora. Recent studies on human and animal suggested that microflora influences human anatomy, physiology, life span and death of individual also. Some microflora in human food carry out fermentation and produce ferment product which maintained the normal health of human, hence ferment food is the elixir for human. Flora boosts the defence system. Immune system of human is well studied. Immunology is branch of science, which deals with study of immune system of an organism, OR it is the state of protection from an invading pathogens. When pathogen

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overcome the immune system then they causes infection and produce disease. Human body composed of about 1×10^{13} cells and at same time Human body carries about 1×10^{14} microorganisms in and on the body. Before birth baby is free from microbes in the womb of mother, when baby born large number of environmental flora deposited on the body. Some microbes act as normal micro flora and other act as harmful flora. At the age of six month baby starts to develop its own immune system.

Normal micro flora protects from pathogenic microorganism. For example skin micro flora create acidic environment which prevent growth of pathogenic microorganism on the skin. Some microorganism symbiotically associated with the host and help in growth. For example *Escherichia coli* synthesize vitamin B-12 and vitamin K, riboflavin, thiamin in the colon of human, these vitamins cannot synthesize by humans. Some flora in intestinal tract carries out fermentation and produce acetic and butyric acid which inhibit salmonella species in gut. Lactobacilli in veginal cavity ferment the glycogen and produce the lactic acid which maintains the acidic pH and prevents the growth of many pathogens in urogenital tract. Normally flora kept their number up to 10^6 / gm. of solid matter in gut; if his number exceed or decrease it tremendously influence the health, this number influence by food and antibiotics. Some studies showed that antibiotics reduces the flora and allow some pathogen to induces several diseases like diabetes, rheumatoid arthritis, muscular dystrophy, multiple sclerosis obesity fibromyalgia and so on. Overall human health is depending on the flora of body. Emerging therapy evolves uses of flora with successful stories. Recently fecal transplant was successfully treated several diseases in human.

1. Normal Microflora of Human Body

Normal microflora (micro biota) means the microorganism present in and on the human body. Before birth baby is free from microbial flora. At the time of birth baby acquires microbial flora from mother and also from the surrounding environment. Normal microflora help human to survive in the constantly changing environment. There are more than 10 times microbes residing on human body than the total number of the body cell. Microorganisms interact with human through different associations like symbiosis, mutualism, commensalism and parasitism. Two kinds of microflora can be detected 1) Resident microflora 2) Transient microflora.

Resident microflora: Always present in the sites such as mouth, skin, mucus membrane veginal opening and intestinal tract.

Transient microflora: They present in certain dry location where resident microflora is found even pathogen can be transient microflora.

Some common microflora can become pathogen when host immune system weaken or prolonged use of antibiotics and immunosuppressive drugs. Physical and mental stress also weakens the immune system. When Normal microflora became pathogen then they are called as opportunistic pathogen and they cause opportunistic infection.

Bacteria, fungi and some protozoa are considered as normal microflora but viruses are not, however some viruses are able to reside in the human body without producing disease symptoms unless there is changing in the immune status of that host. For example the virus such as herpes simplex, Estein- barr, Cytomegeli viruses reside in host for longer time and induce their effect when immune system altered

1.1 Normal microflora of the skin

The whole skin of the adult human possesses about 2 m^2 of the skin. The chemical composition and moisture contains is depends on the site of skin. For example veginal skin possesses different physical and chemical composition and P^H and skin of armpit has different physical and chemical compositions. Skin surface is not a suitable for microbial growth because it is acidic and periodically dry. Most skin normal microflora is dependents on the secretions of the skin glands. Skin is acid in nature and produce nutrients like urea, amino acid, salt, lactic acid and lipids. Skin microflora consists of bacteria, fungi and yeast, among these bacteria are considered as a major flora of the skin. Skin microflora changes according to age and environmental conditions. Overall 180 species of bacteria and several species of fungi are reported from human skin. The most common and stable resident microorganism on the skin are Gram positive bacteria like Streptococcus, Staphylococcus and various species of *Corynebacterium, Propiobacterium* recorded on the skin. These four genera account one half of all species found on the skin. Gram negative microflora such as *Acinetobacter* and *E. coli* is also reported on human skin. Near about 5 species (C.albicans, *Saccharomyces ceriviase, Pityrosporumovale* and Malassezia) of fungi are reported on human skin among these Malassezia spp fungus is the most common fungi on skin. Malassezia furfur grows on skin as dandruff. Antibiotics like ketoconazole or zinyrithione or seleniumsulphide containing shampoo control the growth of this fungus.

The skin resident microflora remain more of less constant, various environmental condition and host environment such as weather, age and personal hygiene changes the normal microflora of the skin.

1.2 Normal microflora of the oral cavity

Oral cavity of human is full of nutrients; saliva contains water, amino acids, proteins, lipids, carbohydrates and inorganic compounds, which support the microbial growth. When baby born they harbours' many microbial flora in their oral cavity from the veginal cavity of the mother. Oral cavity contains most aerotolerent anaerobes such as Streptococci, Lactobacillus, Acetomycetes, Neisseria,Veilone and yeast.etc. Acidic glycoprotein of the saliva form a thin organic film for the supports the excessive growth of *S. sanguis, S sobrinus, S. mutan, S. mitis* and causes the plaque. Streptococcus mutant produce glucan, a sticky polymer of glucose that allows microbes to bind with teeth surface and causes teeth disease. Fructose is fermented by streptococcus and produce lactic acid which dissolve the enamel of teeth and cause teeth decay. The normal flora of human gum (gingiva) are Streptococcus sanguis a facultative organism, the gum disease caused by prophyromonas,,bacteroids, fusobacterium, selenomonas.

Flagellated Trichomonas tenax may occur in gum margins and in plaques and cavities of the teeth, its presence is usually associated with poor oral hygiene.

1.3 Normal microflora of gastrointestinal

Human gastrointestinal tract is stars oesophagus to large intestinal tract. The intestinal tract is a fermentation vessel. The microflora of human intestinal tract is responsible for good health; microflora of gastrointestinal tract absorbs nutrient and produce vitamin B12 and K, thiamine and biotin. Gut microflora maintain the digestion ability of human. Steroid produced in liver and released into intestine from gall bladder as bile are modified and activated steroid compound are the absorbed from the gut. Without gut microflora it is not possible to survive. It has been estimated that about 10^{10} to 10^{11} microbial cell/ml of stomach contain is reported.

Stomach contains Gram positive Proteobacteria, Actinobacteria, fusonacteria, helicobacter pylori. Small intestine is the very large and have possess huge number of microorganisms, lactobacillus, cornebacterium, yeast Candida albicans, Bacteriods B. fragilis, B. melaninogenicus, B. oralis, fusobacterium, Escherichia coli are reported. Gram positive species such as Bifidobacterium (baby feeding on mother milk have Bifidobacterium in their gut where as baby feeding on bottle has lactobacillus in their gut), Eubacterium, lactobacillus. Clostridium perferinges major causative agent of gas gangrene is also reported in colon. Person who consume meat whose gut flora contain large number of Bacteroids and less number of lactobacillus and coliforms

Large intestine is like fermentation vessel and microbes utilize the undigested food and produces gases. It has been estimated that the 25% of stool sample is composed of microorganisms.

Near about 300 species of microbes isolated from human feces. Microflora present in large intestine are belong to E.coli, protease,klebsiella,Enterobacter,candida albicans, protozoa like trichomonas hominisinhabitantsof the cecum,ventamobeaendlimax are commensal of the colon. Entamoeba histolytica is commensal of gut but it causes the disease amebic dysentery. Gut microflora affected when the antibiotics used to treat the disease and gut microflora can be killed and patient may face problem of diahhorea, to normalizethe gut flora health professional suggest probiotics (containing gut common microflora).

1.4 Veginal microflora

Veginal cavity is open cavity and important system for reproduction. Veginal cavity in young women composed of health microbes in it and mentation the health of young woen, microflora of healthy veginal cavity consist of complex mixture of aerobic Lactobacillus species, including L. acidophilus, L. jensenii, and L. rhamnosus L. acidophilus, L. crispatus, L. jensenii and yeast. These microbes utilise glycogen and produce acid and hydrogen peroxide and prevent biofilm formation and also restricts their replication. Lactic acid inhibits histone deacetylases enzyme thereby enhancing gene transcription and DNA restoration processes. The presence of these potential pathogens is primarily linked to vaginal infections such as non-specific bacterial vaginitis, Neisseria gonorrhea, and other sexually transmitted diseases like gonorrhea, syphilis, and vaginal thrush. Research study demonstrated that variation in flora depend on (1) age (childhood – adolescence – young adulthood – elderly), (2) the regular menstrual cycle, (3) sexual intercourse, (4) personal hygiene, (5) fashion-related habits, and (6) the use of intravaginal microbicides or spermicides like nonoxynol-4. In relation to the aforementioned dynamics of vaginal microflora presence, research study confirmed that most healthy women experience short-term fluctuations in vaginal microflora composition which depend on environment condition. About 22–26% of healthy women possess lactobacilli as a predominant flora. Personal behaviours, hormonal changes, stress and other external factors may influence the dynamic nature of vaginal microflora. The evolution of normal flora is a lifelong continuous process that starts immediately after the birth. It is believed that colonization starts during the parturition process. **Veginal microflora**.

2. Factors that Contribute to the Existence of Normal Microflora

a) Biological Age

Age is an important factor, with increasing age physiological changes occur and hormonal production rate is also changes in different age and the skin microflora reported in different age groups. Physiology is also changes with the age. Study of Maffei et.al reported that, increasing

biological age in community-dwelling adults is associated with gastrointestinal dysbiosis. Microbial diversity of the skin tends to increases with age, in addition to this age is also related with the alteration in the number of microflora. The alteration in number of microflora is still not known, whether they grow slowly (gradual) or suddenly fast (progressive). The ability to define these deficits in populations of different ages may help to determine a chronological age threshold at which deficits occur and subsequently identify innovative dietary strategies for active and healthy ageing of the people. The diversity of microflora to increases with age increase with. The increase in diversity during the first eight years of life is associated with a reduced dominance of the lactobacillus sp.

b) Geography

Geographical condition also impact on the microflora of the human body. Several studies report differences in normal microflora depending upon geographical condition; research study reported by Benno et al. among Japnies people. In this study he selected urban vs. rural regions. On the whole, the diversity and counts of faecal matter microflora were found to similar. Urban people have significantly less Bifidobacterium adolescentis but significantly more number of bacilli, clostridium species. As compared to those who live in rural area. These differences in gut microflora might be due to difference in the diets (high fiber) in the rural population. Recent research data have clarified critical separation in the microflora composition between healthy persons from different races and ethnicities. Scientific community believed that geographical differences in the composition and diversity of normal microflora reported in certain populations are actually not of genetic origin, but due to the variation in diet composition. The microflora of the gut varies according to the milieu interiors of the body.

c) Nutrient

In Indian mythological tale in Marathi "**Ana tari and ana mari**" i.e. (food can save and food can kill). Read meet, see food and food rich with fats allow read meet eater bacteria and produce the trimethylamine oxide (TMAO) which leads to cause heart attack human large intestine is one of the most densely packed microbial ecosystem on our planate with 10^{12} cell/gm. of faecal matter. Food naturally also associated many floras in it, feeding baby has bifidobacterium it their gut and human milk selectively allow this bacteria to grow. Milk products are good for health because they restore the good bacteria in the gut. The quantity and quality of food also impact on the microflora of the gut. One study reported that daily dietary uptake of calcium tends to precipitate and induce cytotoxic compound such as bile acids which reduced cytolysis, a condition of changes elicited by inulin and galacto-oligosaccharide consumption. A diet supplemented with calcium in an animal

study (rats) showed the reduction inhabitation of Salmonella enteritidis in gut, some studies also confirmed that bottle feed babies have a more sophisticated such as Bifidobacterium spp., Bacteroides, Streptococcus and Clostridium spp, even though the difference between breast-fed and formula-fed infants is not really significant. The roles of normal in intestine can be summarized as below: (1) Digesting enteric metabolic substrates, (2) Resisting colonization by foreign non-self microflora, (3) Assembling vitamins, (4) Developing attachment sites, (5) Facilitating the immune system, producing exogenous enzymes, (facilitating intraluminal transit) (6) Advancing and turning over specific intestinal cells. Fructo-oligosaccharides (FOS), a specific sugar contained in fruit like bananas or plants, e.g., fresh onions, artichokes, and asparagus, are fermented largely by the bacteria Bifidobacterium species, and this turns out to be interrelated and influence each other. One study reported that daily consumption of 20 gram (FOS) enhance the growth of bifidobacterium and casus abdominal discomfort. Consumption of different kinds of fibre changes the levels of Bifidobacteria, Lactobacillus spp, and also fungi flora. Several fermentable fibers may facilitate the expansion of normal flora, yielding short-chain fatty acids, propionic acid and acetate and reduced colonic p^H, and inhibit the growth of certain bacteria, such *as C difficile.* Polyphenols present in tea when given to pigs increased Lactobacillus and reduced levels of Bacteroides.

d) Infection

Normal microflora does not allow exotic flora to grow on the host body. Parasites enter to the host body through several roots like oral faecal, nasal cavity, wounded skin etc. When they enter the body through the oral-faecal root and interact with the commensal flora of the gut and may causing abdominal discomfort like diarrhoea. Infection outnumbers the pathogen as compared with the normal flora and damage health of host. Some infection adds the pathogen to host body permanently for example **salmonella sp and herpes simplex viruses**. Infection also added many asymptomatic intestinal parasitic infections. Normal microflora may increase resistance to parasitic infections at mucosal sites via changes in the composition of intestinal bacteria, and it may also alter systemic immunity to these parasites.

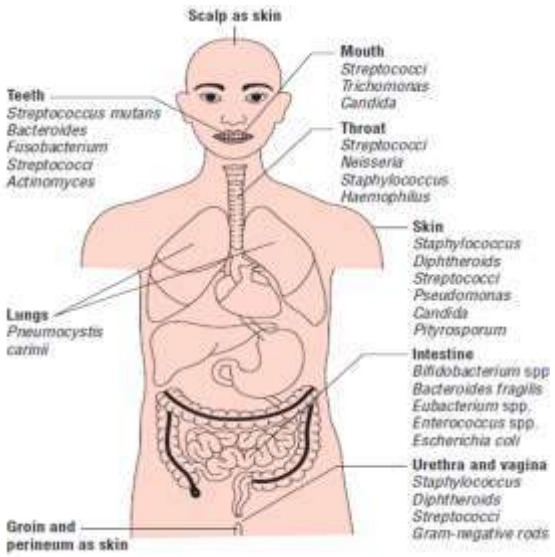
e) Stress

Stress is a very common problem in the modern era. Due to Morden life style and greed to become reach leads to stress. During the stress hormones like adraline and cortisol increases and the brain gut communication is disturbed. This leads to uncontrolled eating, which reduces the good bacteria. Uncontrolled autonomic alterations elicit series of episode that can make the worse condition. As a result, gut flora liberate more end-product such as, toxins, metabolites, and even neuro hormones that changes the food and mood habits. Those people who living in anxiety reduce

microflora can treat with normal flora but the continuous stress reduces the supplementary probiotic flora also.

f) Antibiotics

Use antibiotic to treat infectious diseases was initiated during the world war second. At the beginning penicillin was used as magic drug, later many antibiotic was descried to treat infectious disease, excessive use of antibiotics influences the microflora of hum. An antibiotic decreases the diversity of flora. Long term exposure to antibiotics creates dysbiosis in the host body. Antibiotics can work as a selective agent and can to produce the antibiotic resistance microflora to transfer antibiotic resistance gene to nearby species the antibiotic via gene transfer mechanism. Excessive use of antibiotics can leads to the outgrowth of common flora of gut C. difficile which cause diarrhoea. Depletion of the normal microflora may lead to reduced colonization resistance with subsequent overgrowth of pre-existing, instinctively insensitive microorganisms, like yeasts and New colonization by resistant potential pathogens may also occur and may spread within the body or to other patients and cause fatal infections.



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