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Research Article

The concept of repair of Microbes from Biomedicine and Ayurveda Discipline, A review.

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Microbes are the important factor in gut health. But the maintenance of microbes is a lifetime responsibility. Its not a "Short cut way", as you take some tablet and get lifetime freedom from its misgovernance. Microbes are useful in digestion of food, and according to Ayurveda the same task is explained by Agni , the digestive fire. The digestive fire should be maintained by some dietic rules. Similarly microbe governance should be maintained by meticulous diet and rules. As an Ayurveda teacher and researcher, I find many similarities in Agni concept and microbes. However the side effects of microbial repair treatment and cost of the medicines in biomedicine. especially the procedures like fecal transplant can be exchanged by simple remedies of Ayurveda. This article focuses on the same understanding. The initial part of this article explains all remedies of microbial repair in Biomedicine and later explains the Ayurvedic remedies for Agni. In our View the rules for Agni maintenance may achieve the goal of Microbe maintenance as both are like 'Goldilocks principle'. More practical research is to be needed in this view. To explore the concept let us understand some terminologies from biomedicine.

Synbiotics- These are supplements which are the combinations of Pre and Probiotics .
In the Probiotics the microbes may be live or dead when you ingest them and by the time they exit .
The environment in the intestine which is favorable for microbes should be moist and not too dry with right amount of mucus and good enteric neuro muscular communication and steady varied food supply for beneficial microbes. Enteric nervous system (ENS) controls the digestive tract effectors consisting of musculature, secretory glands and blood supply. ENS is a little brain because this is a mini brain in the gut where there are hundreds of neurons which have a link between mood, and digestion.

Prebiotic - There are some Pre-Biotics which contain food for microbes. There are some post biotics containing products of microbes which help our body in certain medical conditions. Specially the post biotics are useful in underdeveloped countries as they use less preserved food This food enhances growth of microbes. They increase commensal microbes and deplete pathogenic microbes. Oligosaccharides, pectin are such type of food which are absent in high processed food. Normal food is

the normal household freshly prepared food. It contains the fibers which when gets fermented feed commensal microbes. In overprocessed food there is lack of fiber and lack of capacity to generate the nutrition of commensal microbes. Also since it is overprocessed, gets digested in stomach and do not reach colon to make habitat of commensal microbes.

If the less health promoting microbes are crowded in the intestine we should replace them with commensal microbe through correct food and nutritional supply for beneficial microbes. The live microbes are claimed in certain number at the time of manufacture in the tablets of probiotics. Some are Shelf-stable, some are stable after some proprietary process of some companies. These companies are known to keep these microbes in hibernation stage till they could wake up in the gut where there is optimal heat/environment for them to wake up. Some cases they are in spore form which survive in the colon. (1)

Some researchers say that giving probiotics externally may inhibit the natural flora in the intestine. It is like introducing invasive species to alien environment. The author is not against Probiotics but she advices not be dependent lifetime for probiotic supplements from outside, instead of taking probiotic medicines some bio-available dietary supplements which can regularly create natural flora of microbes instead of pumping it from outside is preferable for the same. (2)

In Ayurveda many oils and fats which are medicated like Dipana Ghrut are given to enhance the mucous inner lining. This medicated ghee inevitably feed these communities. The enteric nerves should also be in good condition, and it will be achieved by ideal dietary style like—"Ushnam Ashniyaat, Snigdham Ashniyaat natidruta Vilambitam"It means have warm food,unctus food ,Don't eat too fast and not too slow also. If there is lack of mucous we have to balance it by continued use of suitable medicated Ghruta. On the contrary if the mucous is too thick or more we have to scrap it with appropriate roughage and herbs etc(Pachan, Shodhan or Virechan).

In the Journal "The conversation" (3) the article by Jeff Leach he says that the modern day microbiota is in disaster Zone because of modern food. Modern day gut flora is like "Canary in the coal mine", which indicates devasting state of microbial life. The decreased diversity is associated with disease. Good diversity is sign of health.

Probiotics – (4) Gibson and Roberfroid introduced probiotics that is live bacteria induction

Probiotic contains the live bacterias induced in body which are beneficial. These microbes many times temporarily stay in body. If the overall environment in body is favorable for microbes they can make the colony. Author Brigette shea says this as fad diet. "There is a crowd-pleasing false solution which is now a days popular called the probiotics. This is a fad diet (5) If a person is having disease of the elementary canal, for some time the probiotics are useful ,but they will not get repopulated in gut and can get excreted from stools leaving the problem persisting. Here Ayurveda may find a solution that the Yush and some medicated light food having little ghee can make the intestinal flora and environment suitable for repopulation of microbes.

Sometimes the packed probiotics contain the microbes which are dead but the metabolites of them are little helpful. The timely eating food, eating freshly prepared good food ect may make suitable environment in gut.

Ideal Environment for Microbes –

The moist environment with right amount of mucous, good enteric neuromuscular communication, a steady varied food is good for commensal microbes. There should be "Goldilocks gut" Not too hot ,not too cold, not too wet ,not too dry, not too fast, not too slow but just right.

This is explanation of author Brigette Shea in the book cultivating the microbe. Ayurveda explains the similar thing about food. Eastern medicine like Ayurveda gives emphasis on digestion. So maintenance of continuous environment in gut is important than supplementing the probiotics. Many of probiotics do not colonise may get them in capsules and powder forms. Some probiotics are single strained and some are double strained. Some may need refrigeration. Some are labled as "shelf safe "If they are not getting continuous freezing facility at the time of transport ,they can't survive then. Also there is no guarantee that they will survive in your acidic stomach. On the other side the naturally reproduced anerobic commensal microbes are generated in your large intestine and get naturally colonized.

Glitches of Probiotics-

Some companies say that "at the time of manufacturing it is having these many microbes "There can be varied situations and we may not get live microbes which probiotics should have.(ref -shea)A person may need some other microbes and he may consume some other microbes. Long time side effects are not studied of these supplements costing lots of Dollars. Pumping too much with microbes to gut may disturb the natural flora of gut. So bioavailable thing like soup of green gram or buttermilk with herbs can colonise naturally the microbes. Thus in Bridgette sheas words " probiotics is the bandage covering a big problem". Which will surely create further problems as because it is covered instead of giving correct solution.Some companies make own process that microbes are in hybernition process till they are habitual in gut.Some are soil based microbes which are in spore form.They are in natural shell till they are habitual in gut.

Naturally made curd or Yoghurt is having natural unpredictable process and have natural variety of microbes. Instead of it artificial yogurt pumped with microbes is like a clone in lab.

The yogurt which is made in lab contains the exact amount of microbes, instead of it, naturally made curd at home may have a varied naturally made number of microbes. Hence the microbe supplemented factory made yoghurt is a clone. In Sheas words it may disturb the natural intelligence of nature(6) .If we eat non genetically modified food and organic food we may cultivate our own probiotic in intestine naturally .Refined sugar,factory made meat,boxed or canned food should be avoided as it gets digested completely in stomach and is detrimental in production of microbes.

Lactose free milk or processed nut milk should be avoided. It do not generate microbes and of less use instead you can make it freshly.

Vitality

According to Brigette shea (7-A) the Eastern sciences like

Ayurveda and chinese Medicine accept the concept Vitality is named as ***Jeevan, Pranadharan***.Vitality is animating force which governs physical and mental activities. As an Ayurvedic Doctor we know that vitality is counted in term of Oja, Prana and Atma. The oja stays in all molecules that is paramanu of body ,oja is said as vital power of body. The fresh food contains vitality. Microbes generate from fresh food in large intestine.Shea says that commensal Microbes are having vitality as they are life within life . There is exchange of intelligence between microbes and body cells. There is interaction ,learning and teaching between two. Food, nutrition, digestion, microbes, blood circulation and spirit is having a internal connection. Though this sentence is apparently unscientific according to modern intellect, still it is correct as per ancient wisdom as in Ayurveda blood and soul ,force of Vayu, and Digestive fire all are praised with the words like life, God, administrator being vital in all life processes.

Hence the over processed food do have less vitality and also microbial flora gets reduced due to it. Research papers reveal some other types of food- Classificationof food – mainly it comprises of 3 groups

1. **Dietary Supplements**: The "dietary ingredients"

Vera, Garlic, Ginger, Bitter guard, Turmeric, Methi seeds etc.The Shaka Varga, Phala Varga are dietary supplements.

2. **Functional foods**: are designed to allow consumers to eat enriched foods close to their natural

state, rather than by taking dietary supplements

manufacture. Eg. Rice, Dal, Roti etc. Hence Krutanna Varga concept like Yusha, Khada Yusha , dhanaVesvaar,manda,peya, vilepi, panak, rasala, Mansarasa, raga, khndav

3. **Medical foods**: A medical food is "A food which is formulated to be consumed or administered enterally under the supervision of a physicianand which is intended for the specific dietary management of a disease or condition for which distinctive nutritional requirements, based on recognized scientific principles, are established by medical evaluation. (7-B)

Medical food-

History of Medical Food-

- Before 1972, medical foods were regulated as drugs by the FDA. One of the first products regulated as such was Lofenalac (Mead Johnson), which was used in the dietary management of patients with phenylketonuria (PKU), an inborn error of metabolism.
- In late 1972, Lofenalac was moved to the category of foods for special dietary use (FSDUs). As applied to food, *special dietary use* was defined to mean uses supplying particular dietary needs that exist by reason of age or uses supplementing or fortifying the ordinary or usual diet. This topic is addressed in more detail in the section "Differentiating Medical Foods and Foods for Special Dietary Uses."
- In 1988, the Orphan Drug Act was amended and created a *statutory definition* of medical food [21 USC 360ee(b)(3)]

It is intended only for a patient receiving active and ongoing medical supervision wherein the patient requires medical care on a recurring basis for, among other things, instructions on the use of the medical food.

Medical foods can be ingested through the mouth or through tube feeding. Medical foods are always designed to meet certain nutritional requirements for people diagnosed with specific illnesses. Medical foods are regulated by the FDA and will be prescribed/monitored by medical supervision According to the Food and Drug Administration (FDA), "A medical food is prescribed by a physician when a patient has special nutrient needs and the patient is under the physician's ongoing care. The label must clearly state that the product is intended to be used to manage a special medical disorder or condition" Medical foods can be separated into four categories according to the FDA: (1) nutritionally complete formulas that can be used as sole-source nutrition; (2) nutritionally incomplete formulas, i.e., modular products of fat, protein, or carbohydrates; (3) oral rehydration products that are electrolyte/fluid replacements for dehydration; and (4) disease-specific nutritional formulas, which are specifically developed to help manage conditions such as phenylketonuria.

One of the specifications by the FDA definition is that a medical food must be used for special dietary needs and must be managed under the care of a physician. In recent years, oral nutritional beverages have become commercially available due to increasing demand by consumers who use them as meal replacements and supplements as well as for the management of special dietary needs. However, if they are consumed without the supervision of a physician then they do not meet the FDA's definition of a medical food. This definition is important from a regulatory standpoint. For clinical application, the main question is whether a product meets an individual's medical needs. Therefore, to avoid confusion all oral nutritional beverages will be referred to as **medical nutritional supplements**.

Clinicians often think of MNSs as a standard or disease-specific formula. Standard MNSs contain appropriate levels of carbohydrates, protein, and fat and usually at least 25% of the Recommended Dietary Intakes (RDI) for vitamins and minerals per serving. Some can be used as the sole source of nourishment, while others can be used only as a supplement. Disease-specific, or specialized, formulas may have varying levels of macronutrients and micronutrients as appropriate for the indicated disease state. These formulas may also contain unique ingredients such as structured lipids, special fatty acid blends, prebiotics (e.g., fructooligosaccharides), peptides, protein hydrolysates, and free amino acids (e.g., L-arginine, L-glutamine).

Thus this food can repair the governence of microbes temporarily as they contain probiotics,

Modern View of medicinal food

Disease-related etiology (e.g., inflammation, trauma) leads to physiological impacts on nutrient requirements (e.g., gut absorption, metabolism, excretion) Impaired absorption or metabolism of nutrients in turn affects human nutrition (e.g., whole-body deficiency, conditionally essential nutrients, and nutrient toxicities) or related biomarkers The workshop examined examples of disease-induced deficiency that included genetic diseases (e.g., PKU, mitochondrial metabolic disorders), tissue dysfunction and regeneration [e.g., inflammatory bowel disease (IBD), chronic kidney disease (CKD)], and disease states that induce conditionally essential nutrients (e.g., arginine in sickle-cell anemia and trauma

associated with surgery).

"Abnormal physiological manifestation or physical impairment" includes the following conditions associated with acute and chronic diseases or health conditions:

i. a limited, impaired, or disturbed capacity to ingest, digest, absorb, metabolize, or excrete ordinary food or certain nutrients or metabolites, or

ii. other medically determined requirements for nutrients/other food substances of biological value.

Ayurveda View of medicinal food

Aushadh siddha ahar is medicinal food 1 Prameha- yava preparation along with triphal ,trikatu ect which will reduce meda.

2. Grahani- Takra and added many grain floors cooked and processed by deepan dravyas.

The deepan dravyas increase agni and reduce Ama .Hence it may reduce the harmful microbes reducing the inflammation. Many Yavagu which are processed in Herbs reduce inflammation in intestinal flora. Dipaniya yavagu- panchakola siddha yavagu-shulaghnayavagu-29 yavagu are used

- Panchamuliki peya- cha su 2/17-contains bilwa,buttermilk,dadim-pachan,grahi, vata anulomak
- Laja peya- sunthi and dadim siddha in Arsha that is piles
- Takra yukta yusha-laja shaktu, takra avalehika-takra odan,takra avalehika C.Chi.14/79-80. For one Month the patient is given Buttermilk by processing it with various materials.
- Processed leafy vegetable- Nishottar, Danti, Changeri, Chitrak Leaves- Cooked in oil and Ghee add Curd, + Dhanyaka and Shunthi – Given to patient for Anuloman.
- Dashamool Siddha Peya- In Shwasa and Shotha Vyadhi. The peya that is gruel of rice having dashmula herbs is useful to reduce the inflammation in lung,
- Various Kalpanas from Madya Varga- Ex- Gaudika , Sharkar etc
- Kulattha Yusha – Yusha prepared from kulattha grains.

Another type of food is fortified food.

FOOD FORTIFICATION AND ENRICHMENT- Food fortification is the process of adding micronutrients (essential trace elements and vitamins) to food. It may be a purely commercial choice to provide extra nutrients in a food, while other times it is a public health policy which aims to reduce the number of people with dietary deficiencies within a population. Diets that lack variety can be deficient in certain nutrients. Sometimes the staple foods of a region can lack particular nutrients, due to the soil of the region or because of the inherent inadequacy of the normal diet. The four main methods of food fortification (named as to indicate the procedure that is used in order to fortify the food): 1) Bio-fortification (i.e. breeding crops to increase their nutritional value, which can include both conventional selective breeding, and modern genetic modification) 2) Synthetic biology (i.e. addition of pro-biotic bacteria to foods) 3) Commercial and industrial fortification (i.e. flour, rice, oils (common cooking foods)) 4) Home fortification (e.g. vitamin D drops) Some examples of food fortification are Iodized Salts, Folic Acid, Niacin, Vitamin D, Fluoride, Golden Rice, White Rice, etc.

An enriched food – It is a food to which nutrients have been added. Typically, the added nutrients were present in the food in its original form, but were removed at some point during processing. White bread -- to which certain vitamins are added. whereas enrichment is defined as "synonymous with fortification and refers to the addition of micronutrients to a food which are lost during processing. Restoration is the addition of a nutrient to a food in order to restore the original nutrient content. Both restoration and enrichment programmes usually involve the addition of nutrients that are naturally available or present in the food product. Standardization is the addition of nutrients to foods to compensate for natural variation, so that a standard level is achieved. Standardization is an important step to ensure a consistent standardized quality of the final product. Supplementation is the addition of nutrients that are not normally present or are present in only minute quantities in the food. More than one nutrient may be added, and they may be added in high quantities. As compared with restoration and standardization, fortification has a special meaning: the nutrient added and the food chosen as a carrier have met certain criteria, so that the fortified product will become a good source of the nutrient for a targeted population. Nutrients added for food fortification may or may not have been present in the food carrier originally(8)

Ayurvedic view of food fortification-

EX- Rice cooked in Mamsa Rasa in Rajayakshma Chikitsa. As in patients of T.B the rice if cooked in mamsarasa can increase the depleted muscles.

Rice cooked in Gomutra is used in Udara Vyadhi Chikitsa according to Ayurveda . This rice removes water in form of urine and stool and reduces water accumulation.

Thus we can think of food processed in Jeerak and Ajawayan as medical food. One research entitled-

"Antimicrobial and anthelminthic impacts of black cumin, pawpaw and mustard seeds in livestock production and health" explains importance of spices,

(8-B) Antimicrobial activity of black cumin, mustard and pawpaw seeds Nutritional manipulation of commensal gut microbes as a means of enhancing intestinal functions is an interesting approach to prevent disease in animal and human Gut microbes influence nutritional, immunity system, economic, health, endocrine system of livestock and the health of consumers. Nutritional quality of animal food product and the properties of animal wastes are influence by the extent of microbes residing in the gut .

The use of antibiotics in treatment and prevention of diseases often has a negative effect on host tissues and organ(8-C)(To protect animals from tissue and organ damage, use of plant and plant extract due to the bioactive compound present are highly recommended due to their potential. Several microbes residing in the gut are food borne disease and reducing their population in the gut might prevent or reduce the instance of food borne disease. For instance, E. coli, Campylobacter jejuni, Salmonella sp., Listeria monocytogenes and indirectly protecting the animal itself from the proliferation of pathogenic microbes such as coccidia parasite, and C. perfringens. Studies have shown the antimicrobial activity of plants against disease causing microbes such as E. coli and C. perfringens, which help to reduce the

development of secondary problem like colibacillosis and necrotic enteritis (8-D)

Khan et al. (2012) evaluated different levels (0, 2.5%, and 5%) of black cumin seeds and 0.1% antibiotics on ceacal microbial population of broilers. The influence of black cumin seeds on pathogenic microbes like coliforms and E. coli at 2.5% and 5.0% supplementation was similar to the antibiotics used. This reduction in pathogenic microbes would help to decrease the competition for nutrient with beneficial commensal microbes. Gut microbial population dynamics may be influenced by the ability of phenolics to suppress or stimulate some certain members of the microbial community(9)

Cumin Seed destroys biofilm of pathogenic microbes-

Thymoquinone of black cumin seeds Biofilm formation is the means by which microbes reduce the impact of antibiotic; by hiding themselves within the polymeric matrix (10) reported thymoquinone which is a bioactive ingredient helps to prevent biofilm formation among bacteria. This is very advantageous to in livestock production as biofilm is usually the protective screen used by pathogenic microbes to protect themselves from the impact of antibiotics or chemical that could destroy them; allows microbes to survive in hostile environmental conditions (11)This could also mean that by combining black cumin seeds with other plant part or bioactive ingredient more potent than thymoquinone, it could lead to a synergy of bioactive ingredients.

Ayurvedic view of processing of food to increase microbes load-

Ghee processed in black cumin seeds -cow ghee, regardless it is produced from butter or cream, certainly is not a probiotic type of food by the strict definition of the term. But the uniqueness of ghee is that it works like probiotics. Like a probiotic, ghee is smooth and light for the digestive system. Is ghee a probiotic? the answer is no. But ghee offers support to maintain a healthy colon. It happens due to ghees butyrate content, which is a proven natural supplement for a healthy colon.

We can combine the Black cumin seeds with Go-Ghruta so that cumin will destroy biofilms of Pathogenic bacteria whereas Ghruta will enhance the biofilm of commensal bacteria (Ghruta being Samskaranuvartan, Sneha is doing Pranadharan Karm and here Prana is Cell mictochondrian and Vitality.If we use only cumin seed and such bioactive ingredient like Thymoquinone, it may damage the cell wall and reduce cell vitality. The antibiotics destroy Pathogenic bacteria as well as commensal bacteria. Instead of it if we use the ghee medicated with cumin seed it might remove the pathogenic bacteria with thymoquinine and ghee will enhance the biofilm of commensal bacteria.Buttermilk is added with Cumin seed may do same action Black pepper is gastroprotective and anti inflammatory hence may not kill comencal bacterias.

It is antimicrobial hence might kill pathogenic bacteria.

We can combine the food with black pepper as said in the research paper-(12)

“Black pepper and health claims: a comprehensive treatise”

Thymoquinone of black cumin seeds ----Biofilm formation is the means by which microbes reduce the impact of antibiotic; by hiding themselves within the polymeric matrix (Høiby et al. 2010). Chaieb et al. (2011) reported thymoquinone which is a bioactive ingredient helps to prevent biofilm formation among bacteria. This is very advantageous to in livestock production as biofilm is usually the protective screen used by pathogenic microbes to protect themselves from the impact of antibiotics or chemical that could destroy them; allows microbes to survive in hostile environmental conditions (Mah and O’Toole 2001). This could also mean that by combining black cumin seeds with other plant part or bioactive ingredient more potent than thymoquinone, it could lead to a synergy of bioactive ingredients. As hymoquinone would be preventing biofilm formation, other active ingredients would be inhibiting, lysing, blebbing or denting the microbes. In Goel and Mishra (2018), thymoquinone performed it antimicrobial function by dents and blebbing, cell lysis and prevention of biofilm formation and was capable of destroy biofilm forming between 6 and 24 h, but does not show cell membrane damaging characteristics. 12.5 lg/ml of thymoquinone was required for to prevent Bacillus subtilis and Pseudomonas aeruginosa, 50 lg/ml for Staphylococcus aureus and 250 lg/ml for Escherichia coli to prevent more 90% biofilm. Another mechanism of action of Thymoquinone is through generation of ROS which impaired cellular electron transport, leading to prolonged oxidative stress which causing irreversible damage to bacterial DNA, proteins, and membrane leading to cell death due to quick aging). Thymoquinone are bifunctional because they can protect the cell from oxidative stress, and can also induce stress in cells. The former is by intracellular reduction by (quinone oxidoreductase 1) of thymoquinone to dihydrothymoquinone with the reduced compound scavenging for free radicals, including hydroxyl radical, singlet oxygen, superoxide anion radical or by countering xanthine oxidase system in order to obstruct generation of oxidative stress (Badary et al. 2003). While the latter is by reduction of thymoquinone to semiquinone via (mitochondrial ubiquinone oxidoreductase) which can then be oxidized by oxygenproducing superoxide anion radicals (Cells exposed to thymoquinone produces superoxide dismutation (dismutase) which is present in the mitochondrial matrix, generates hydrogen peroxide, which leads to the formation of disulphide bond in adenine nucleotide transporter, thereby, inducing the formation of permeability transition pores and reducing CM-H2DCF oxidation rate, triggering programmed cell death in the process .

Antimicrobial activity of black cumin, mustard and pawpaw seeds Nutritional manipulation of commensal gut microbes as a means of enhancing intestinal functions is an interesting approach to prevent disease in animal and human). Gut microbes influence nutritional, immunity system, economic, health, endocrine system of livestock and the health of consumers. Nutritional quality of animal food product and the properties of animal wastes are influence by the extent of microbes residing in the gut). The use of antibiotics in treatment and prevention of diseases often has a negative effect on host tissues and organ To protect animals from tissue and organ damage, use of plant and plant extract due to the bioactive compound present are highly recommended due to their potential. Several microbes residing in the gut are food borne disease and reducing their population in the gut might prevent or reduce the instance of food borne disease. For instance, E. coli, Campylobacter jejuni, Salmonella sp., Listeria monocytogenes and indirectly protecting the animal itself from

the proliferation of pathogenic microbes such as coccidia parasite, and C. perfringens. Studies have shown the antimicrobial activity of plants against disease causing microbes such as E. coli and C. perfringens, which help to reduce the development of secondary problem like colibacillosis and necrotic enteritis Black cumin seeds (Nigella sativa Linn.) Black cumin seed contains many bioactive compounds that is common among other plants such as flavonoid, polyphenol, saponin etc. uniquely, black cumin seed contains thymoquinone which a wide range of anitmicorbial activity against gram positive and gram negative bacteria. El-Nagerabia et al. (2012) evaluated the effect of black cumin oil (1, 2 and 3 ml/ 100 ml) on growth and production of aflatoxin B1 by Aspergillus parasiticus (CBS 921.7) and Aspergillus flavus (SQU 21) strains. One and 2 ml/100 ml of N. sativa Linn. oil was able to inhibit aflatoxin B1 by 49.7–58.3% while 3 ml/100 ml inhibited aflatoxin production by 32–48% but they had no effect Aspergillus species. This inhibition effect could be that N. sativa Linn. seed oil transpired with the biosynthesis pathway of aflatoxin (El-Nagerabia et al. han et al. (2012) evaluated different levels (0, 2.5%, and 5%) of black cumin seeds and 0.1% antibiotics on ceacal microbial population of broilers. The influence of black cumin seeds on pathogenic microbes like coliforms and E. coli at 2.5% and 5.0% supplementation was similar to the antibiotics used. This reduction in pathogenic microbes would help to decrease the competition for nutrient with beneficial commensal microbes. Although E. coli is a commensal microbes of the gut, excessive proliferation might increase that concentration of lipopolysaccharide (endotoxins) which might enter the blood stream through inflammation of the gut hence reducing the function of the tight junction of the enterocytes to damage the liver and reduce growth rate and giving room for secondary infections and indication of weakened immune system. So by inhibiting their growth, there won't be need for them to be killed let alone have overwhelming level of lipopolysaccharide; as endotoxin consist of 75% of gram negative cell walls (Biomin 2016) Microbiota shifts affect morphology of the gut wall and induce immune reactions, which by affecting energy expenses of the host animal may promote their growth (Teirlynck et al. 2009). Similarly, Abd El-Hack et al. (2018) evaluated the antimicrobial activity of cold-pressed black cumin oil in quail for 6 weeks. The black cumin oil was supplemented at (0, 0.5, and 1.0 g/kg diet). The black cumin oil reduced ileal population of total bacterial count, coliform, E. coli, and Salmonella sp. more than the control while 1.0 g/kg black cumin oil was lower than 0.5 g/kg. The reason for this might be attributed to the synergy of phytochemicals (thymoquinone, Flavonoids etc.) present in black cumin oil.

Functional foods-

For millennia, spices have been an integral part of human diets and commerce. Recently, the widespread recognition of diet-health linkages bolsters their dietary importance. The bioactive components present in them are of considerable significance owing to their therapeutic potential against various ailments. They provide physiological benefits or prevent chronic ailment in addition to the fundamental nutrition and often included in the category of **functional foods**. Black pepper (Piper Nigrum L.) is an important healthy food owing to its antioxidant, antimicrobial potential and gastro-protective modules. Black pepper, with piperine as an active ingredient, holds rich phytochemistry that also includes volatile oil, oleoresins, and alkaloids. More recently, cell-culture studies and animal modeling predicted the role of black pepper against number of maladies. The free-radical scavenging activity of black pepper and its active ingredients might be helpful in chemoprevention and controlling progression of tumor growth. Additionally, the key alkaloid components of Piper Nigrum, that is, piperine assist in cognitive brain functioning, boost nutrient's absorption and improve gastrointestinal functionality. In this comprehensive treatise, efforts are made to elucidate the antioxidant, antimicrobial, anti-inflammatory, gastro-protective, and antidepressant activities of black pepper. Moreover, the synergistic interaction of black pepper with different drugs and nutrients is the limelight of the manuscript. However, the aforementioned health-promoting benefits associated with black pepper are proven in animal modeling. Thus, there is a need to conduct controlled randomized trials in human subjects, cohort studies, and meta-analyses. Such future studies would be helpful in recommending its application in diet-based regimens to prevent various ailments.

Gastroprotective-

Currently, gastro protection is defined as the ability of certain endogenous factors and drugs to counteract gastric mucosal damage through mechanisms unrelated to inhibition of acid secretion.

Some herbs are said as Gastroprotective like lichen. A research paper reveals that uses of lichen-(14) In a research paper of lichens the relation with digestion and microbe is stated,

"LICHENS: MIGHT BE CONSIDERED AS A SOURCE OF GASTROPROTECTIVE MOLECULES?"

Many herbs like Lichen are gastroprotective as well as antibacterial/bacteriocidal and immunomodulatory as well. Thus it can be inferred that such substances may be harmful for the commensal bacteria

Buttermilk- It is considered as having Bioactive peptide.(15) Bioactive Peptides: Synthesis, Sources, Applications, and Proposed Mechanisms of Action

Buttermilk is a refreshing drink obtained in the preparation of butter from dahi or by churning cream. It is rich source of phospholipids and other constituents of MFGM. Therapeutic Properties of Buttermilk is described in Ayurveda texts. Consuming buttermilk on regular basis offers manly health benefits. Presence of MFGM has given buttermilk an added value. Cultured buttermilk also serves as a good source of bioactive peptide which can offer additional therapeutic values. Bioactive peptides generated from food proteins have great potential as functional foods and nutraceuticals. Bioactive peptides possess several significant functions, such as antioxidative, anti-inflammatory, anticancer, antimicrobial, immunomodulatory, and antihypertensive effects in the living body. Therapeutically, there are many benefits from peptides that make them more useful than traditional medicines. For example, bioactive peptides have more specialized activities on the target tissue and therefore have little or no toxic effects; they are also effective even at low concentrations. This feature is operative in treating chronic diseases. On the other side, synthetic chemical compounds that are commonly used as drugs

have a cumulative effect on the body. While they are still active, these chemicals may cause environmental problems due to their excretion.Dairy products such as milk and cheese are ideal options for extracting animal bioactive peptides. In most cases, the mechanism of action of antimicrobial peptides appears to be different from that of conventional antibiotics (For this reason, these peptides are very interesting as new drugs to fight infectious agents Thus, antimicrobial peptides have opened a new chapter in the sciences, which has attracted the attention of many scientists and researchers, hese antimicrobial peptides provide the first line of defense against pathogens in eukaryotic organisms and are generally effective against bacteria, fungi, and viruses. In addition to the direct killing of microbes, these compounds also participate in processes related to inflammation and innate and acquired immunity. Antimicrobial peptides, which are innate immune mediators, increase phagocytosis and trigger the release of prostaglandins. They also neutralize the shock effects of liposaccharides caused by bacteria. These peptides transport and accumulate immune cells at the site of inflammation, induce angiogenesis, and heal wounds. The production of cytokines is also affected by these peptides. Antimicrobial peptides also have a chemotactic role . All of these actions eliminate the cells of bacteria. The results showed that these compounds are bactericidal at high concentrations of mg/mL and have a safety regulatory role at lower concentrations.Given all of the above, antimicrobial peptides are probably involved in all stages of host defense.

Ayurvedic view-

Buttermilk being probiotic is antibacterial ---(15)

As Buttermilk is probiotic still c/a antibacterial, thus it might be enhancing the commensal bacteria in gut and killing the pathogenic bacteria reducing the pain and inflammation in gut.

Influence on gut health Studies on rat by Sprong et al. (1998) revealed that when the experimental animals were fed with lactase treated sweet butter milk powder it protected them from gastrointestinal infections by preventing colonization of L. monocytogenes. Also MFGM and peptide hydrolysates, generated by proteolysis with immobilized digestive enzymes, gave antibacterial activity against Salmonella enterica and Pseudomonas fluorescens protein component of MFGM reduced gastric mucosa infection in mice caused by H. pylori on oral administration of MFGM. Periodic acid–Schiff VI/VII, one of the protein present in MFGM promoted mucosal healing . MFGM-enriched milk offered protection to young children against gastrointestinal infections as revealed by some researchers say XDH/XO fulfills protective, antibacterial functions in the alimentary tract and reduced inflammation in human with help of neutrophils (Fong et al. 2007).Researchers reported that cultured buttermilk prepared by blending dahi and fermented whey in 60:40 ratio by employing L. helveticus MTCC 5463 showed antimicrobial activity against S. aureus, S. typhi and E. coli.

In Ayurveda buttermilk is advised for treatment of intestinal bowel syndrome (IBS), for improving digestion (Pachana), edema (Shotha), diarrhea (Atisara), hemorrhoids (Arshas), abdominal tumors (Gulma), Parasitic infection (Krimi), Diabetes (Meha), ascites (Uadar Roga), anemia (Pandu Roga), vomiting (Chardi) etc.

On basis of the estimated availability of buttermilk and the scope for the development of healthbased value added foods, it can be concluded that buttermilk, as a byproduct, needs proper attention for its judicious utilization. The MFGM components could be used safely for pharmaceutical preparation. Buttermilk is truly a nutritious drink available in the kitchen of each home whose nutritional qualities remains untapped. It is a promising ingredient for development of functional foods and more research on therapeutic properties of buttermilk need to be carried out.

Takrarishta-

Ayurveda has a unique formulation named as **Takrarishta**. The self generated alcohol preparation of buttermilk.It is good appetizer and digestive . Hence might have good result on microbes, **Food Substances can be be antibacterial and probiotic at same time**

Based on the results of this study, present probiotic bacteria in natural resources can be used for inhibition and reduction of pathogens, including enteric pathogens and antibacterial effects of their metabolites are active and stable under different conditions of temperature and acidity. Due to this, characteristic and similar antimicrobial effects of probiotics bacteria, increasing use of the probiotics as a natural and modern method for prevention of different diseases is recommended.

Kshirpaak – It is a Unique Ayurvedic formula in which targeted herbs are added with goat or cow milk. Cow milk enhances biofilm for commensal bacteria and the herbs are antioxidant, immune-modulatory and bioactive which inhibit the pathogenic bacteria.

Legumes- Yush

Legumes are a staple food in many countries around the world. The most commonly eaten varieties are beans, faba beans, chickpeas, peas, lentils, cowpeas, lupins, and soybeans. Legumes are suitable for growing under adverse environmental conditions and in a variety of growing systems due to their low input requirements, short growing season, and nitrogen fixation capacity . As shown in Table 2, legumes are a rich source of carbohydrates (30–60% of total content), dietary fiber (9–25%), and protein (19–36%) containing the necessary amino acids such as lysine, leucine, and arginine. The carbohydrates include monosaccharides, oligosaccharides, other polysaccharides, and starch. In legumes, starch is the main source of available carbohydrates (45% of total content) along with oligosaccharides (1.8–18%) and dietary fiber (4.3–25%). Legumes are usually low in fat and contain no cholesterol, with a favorable fatty acid profile dominated by unsaturated fatty acids (Table 2). They are also a good source of iron, calcium, zinc, selenium, magnesium, phosphorus, copper, potassium, and B-group vitamins; however, they are poor in vitamin C and fat-soluble vitamins. The moisture content of all dry legumes varies between 9 and 3%, which makes them suitable for long-term storage

Legumes contain bioactive substances that play a significant metabolic role in the human body. Their action can be considered positive, negative, or in some cases, both. Dietary fiber, resistant starch, polyphenols, and phytosterols are referred to as health-promoting ingredients. Legumes are rich in both soluble and insoluble fiber. The seed coat is rich in water-insoluble polysaccharides, while the cotyledon fiber consists of hemicelluloses, pectin, and cellulose with varying degrees of

solubility. Resistant starch is a non-digestible fraction of starch, which, after passing into the large intestine, functions physiologically similarly to dietary fiber. Consuming fiber as part of one's daily diet is essential for nominal intestine function, which is implied in lowering the risk of development of many chronic diseases, including colon cancer, heart disease, and diabetes. Resistant starch and fiber pass through the stomach and small intestine in undigested form until they reach the colon, where they play a prebiotic role. Fiber and resistant starch also help reduce body weight, increase stool volume, and decrease colon pH, while also lowering serum cholesterol and triglycerides. In addition, they reduce the glycemic index of legumes, regulating postprandial glycemia and insulin sensitivity. The polyphenols present in legumes are bioactive compounds that have a broad therapeutic potential due to their antioxidant activity. They work by delaying or preventing the oxidation of lipids, proteins, and DNA by reactive oxygen species. The amino acids of legume proteins (mainly tyrosine, phenylalanine, tryptophan, and cysteine) also exhibit antioxidant properties that result from their ability to donate protons to free radicals. Epidemiological evidence shows that dietary intake of legume antioxidants provides a protective effect against certain chronic diseases associated with oxidative stress such as cardiovascular disease, cancer, obesity, diabetes, and hypercholesterolemia. Phytosterols are plant sterols with a structure similar to cholesterol. These compounds belong to the group of steroid alcohols that occur naturally in legumes. As a natural component of plant structures, phytosterols contribute to the regulation of the fluidity and permeability of cell membranes. The most common phytosterols are β-sitosterol, campesterol, and stigmasterol. Phytosterols are well known for a wide range of health benefits, the most important of which are lowering blood LDL cholesterol and reducing its absorption in the intestine. Certain bioactive substances of legumes have been found to be ANFs. Some of them play an important role in the mechanisms used by plants to protect themselves against predators or environmental conditions, while others are storage compounds, accumulated in seeds as an energy reserve. The major ANFs of legumes include oligosaccharides from the raffinose family, protease inhibitors, phytates, and saponins. These factors, apart from their negative impact on the body, often also have a positive and health-promoting effect, which has provoked some debate as to whether it is necessary to reduce their content in legumes.

In general, probiotics elicit a positive effect on the human body, e.g., by competing with pathogenic bacteria to bind to the cells of the intestinal epithelium; enhancing the function of the intestinal epithelial barrier; inhibiting the growth of pathogens by secreting antimicrobial peptides; stimulating the production of immunoglobulins; enhancing phagocytosis; increasing the activity of NK (Natural Killer) cells; promoting cellular immunity against pathogens; and preventing inflammation. In addition to lactic acid, probiotic LAB produce several bioactive metabolites (antimicrobial and shelf-life extending), such as organic acids, short-chain fatty acids, carbohydrates, antimicrobial peptides, enzymes, vitamins, cofactors, or immune signaling compounds—these substances are also known as postbiotics. Consuming probiotics is beneficial to many aspects of health, especially in the prevention and treatment of infections and gastrointestinal diseases. The therapeutic uses of probiotics also include the prevention of genitourinary diseases, constipation relief, protection against traveler's diarrhea, management of hypercholesterolemia, protection against colon and bladder cancer, as well as prevention of osteoporosis and food allergies.

LAB often represent the indigenous microflora of legumes. Therefore, in the production of fermented legumes, fermentation is induced not only by inoculation of raw material with LAB but also through spontaneous fermentation. The use of LAB induces changes in the organoleptic, functional, and technological properties of legumes. The type and extent of these changes depend on the raw material, the bacterial species used, and the fermentation parameters. LAB are characterized by a variety of pathways to produce acids and other metabolites. The fermentation of plant matrices is dependent upon their ability to adapt rapidly and metabolize the available nutrients. Adaptation is speciesand strain-specific, as well as determined by the plant material. This is due to the diversity of plant environments and inherent chemical/physical parameters, such as phenols, fermentable carbohydrates, and environmental pH, which determine whether conditions are optimal for bacterial growth. The same microorganisms can behave differently in plant and animal matrices. Not all strains are endowed with an optimal portfolio of enzymes and metabolic traits, and therefore it is necessary to properly adapt the plant matrix and microorganisms for fermentation.

Prebiotic Ingredients in Legumes and Legume-Based Beverages Literature studies indicate that one of the most important determinants of human health is maintaining an optimal balance of the gastrointestinal microflora The relationship between gastrointestinal microflora and human health is being increasingly recognized. The influence of gastrointestinal microbiota on the host has been well characterized, including maintenance of the body's energy metabolism and immune system [2 source and the chemical structure of the compound, as well as by individual differences in the composition of the intestinal microflora.

Inclusion of the seeds of black cumin, pawpaw and mustard are capable of antimicrobial functions, reducing pathogenic microbes in the gut, microbial population in livestock. All the plants used have strong antimicrobial properties. Ten mg/ml and 1 mg/ml of Black seeds essential oil and thymoquinone respectively are capable of killing hydatid cyst within 10 min. The microbial growth stimulating potential of sinapine—a derivative of sinapic acid should be research to find it potency as probiotics. Furthermore, inclusion of 15% mustard oil in vitro reduced methane production without affecting fermentation processes or by product and it reduced protozoa population. The unique properties of pawpaw seed is its strong potency against ecto and endoparasites. Haemonchus contortus, Trichostrongylus spp., Strongyloides spp., Ostertagia spp., Caenorhabditis elegans, Eimeria spp., Heterakis gallinarum, Ascaridia galli, Trichostrongylus tenuis. Spraying of pawpaw seeds on animal would kill or inhibit the proliferation of Rhipicephalus (Boophilus) microplus eggs. Any plant that must be classified as phytogenic feed additive should be able perform at least antimicrobial functions alongside other function with about 2% of its presence in diet, while ingredient that perform same function in above 3% should be regarded feed ingredient

with multifaceted functions.

Sunthi

Lu, et al found in a preclinical study on isolates from intestinal microbiota that Sunthi can enhance the growth of beneficial Bifidobacterium and Lactobacillus species and control the growth of several Ruminococcus species.

Peterson performed a number of studies with various other researchers on the effects of herbs on the human microbiome. In a 2018 study, Peterson et al found that supplementation with Glycerrhiza glabra (Yashtimadhu); Triphala [a combination of Terminalia belerica (Vibhitaki), Terminalia chebula (Haritaki), and Phyllanthus emblica (Amalaki)]; and Ulmus rubra on anaerobic human fecal cultures significantly increased health promoting Bifidobacterium, Lactobacillus, and Bacteroides species and reduced the relative abundance potential pathogens, such as Citrobacter freundii and Klebsiella pneumoniae.38 A second study in 2018 found that Curcuma longa Linn. (Haridra) and one of its biologically active constituents, curcumin, enhanced healthy gut microflora in healthy human participants.39 In 2019, Peterson et al examined the effects of supplementation with certain herbs on fecal cultures, including: (1) Bacopa monnieri (Brahmi), (2) Evolvulus alsinoides (Shankhapushpi), (3) Centella asiatica (Mandukaparni), (4) Nardostachys jatamamsi (Jatamansi), (5) Boswellia serrata (Shallaki), (6) Eclipta alba (Bringaraja), (7) Mucuna pruriens (Kapikacchu), (8) Withania somnifera (Ashwagandha), (9) Asparagus racemosus (Shatavari), or (10) Tinospora cordifolia (Guduchi).40 Those researchers found that each herb influenced and promoted specific healthy bacterial species, emphasizing the strong and unique selective properties of the herbal substrates. In another study in 2019, Peterson et al found that C. longa, Z officinale, P. longum (Pippali), and P. nigrum could modulate the microbial community in human fecal cultures, which contributed to health-enhancing effects on digestive efficiency and health.41 In 2020, Peterson et al supplemented the diets of healthy individuals with the herbs Triphala and Rubia cordifolia (Manjishta) for 4 weeks and found no signature microbes in the gut, but the intervention altered the microbial picture with a trend toward a reduced F:B ratio.42 In a study in 2021, Peterson et al studied the prebiotic potential of 11 herbs—Terminalia arjuna (Arjuna), Crataegus laevigata (Hawthorn berry), Andrographis paniculata (Kalamegha), Picrorhiza kurroa (Katuki), Rubia cordifolia (Manjishta), Cyperus rotundus (Musta), Boerhavia diffusa (Punarnava), Embelia ribes (Vidanga), and Ipomoea digitate (Vidarikanda)]—and two formulations—Kanchanara guggulu and Triphala guggulu. 43 Each herb altered thecomposition of fecal microbial communities to varying extents relative to control cultures and formed three clusters: (1) Cluster 1 were communities supplemented with hawthorn berry, Andrographis paniculata, Picrorhiza kurroa, Cyperus rotundus, Picrorhiza kurroa, Boerhavia diffuea, and Ipomoea digitate, which had a relatively balanced structure comprised of multiple bacterial families; (2) Cluster 2 were communities supplemented with Triphala Guggulu and Kanchanara Guggulu and showed a strong expansion of Bacteroidaceae, driven by members of the genus Bacteroides; and (3) Cluster 3 were communities supplemented with Terminalia arjuna, Rubia cordyfolia, and Embelia ribes, which drove a strong expansion of Enterobacteriaceae. The authors concluded that the therapeutic efficacy of Ayurvedic herbs is mediated through the intermediary of the gut microbiome.---Comparable with Agni concept –if microbes are acting like medium of Agni

Vaman and MICROBES

A Kapha increase is also associated with certain disease conditions, such as allergic rhinitis or bronchial asthma, and emesis can help to reduce those conditions.51 While the effects of emesis have been studied, although sparsely, to the best of the current research team's knowledge, no studies on its possible influence on the gut microbiome have occurred. Gupta, et al tried to characterize the intestinal flora— Bacteroides and Eschericia coli—before and after emesis in healthy individuals but found no significant changes. They did, however, find that the procedure was safe and also found positive influences on several physiological and biochemical parameters that may have been influenced by the gut microbiome's modulation. They also found that bowel movements were regularized for all of the study's participants. Some studies have shown that an improvement the stools' consistency is associated with a shift in the fecal microbiota's composition at the level of community structure and diversity. From that finding, researchers can safely speculate a corrective action for the emesis procedure on gut dysbiosis.

VIRECHAN and MICROBES

Therapeutic purgation. Therapeutic purgation involves the prescription of herbs that are categorized as purgatives and laxatives. This therapy is recommended as a seasonal cleanse prior to the Fall season and for conditions associated with an increase in Pitta Dosha, such as migraines (ardhavabhedaka), skin diseases (kushta), or diabetes (prameha). In 2019, Chaturvedi, et al found that therapeutic purgation could reduce the colonization of aerobic bacteria— Escherichia coli—in obese individuals. In 2016, Chaturvedi et al had found that therapeutic purgation in Albino rats could decrease fat content in the feces; lower fasting blood sugar and serum triglycerides; reduce fatty changes in the liver, heart, and kidney; and increase insulin sensitivity in the insulin receptors present in skeletal muscles.Pooja and Bhatted found that gentle purgation, in conjunction with other therapies and diet as part of the Self-Directed Biological Transformation Initiative (SBTI), could significantly alter metabolomic profiles largely related to signaling and lipid digestion, mobilization, transport, and biosynthesis in healthy individuals.Further, one study showed that purgation enhanced the benefits of a dyslipidemialike medicated enema. The administration of purgation has also shown benefits in treatment of migraines and Parkinson's disease (PD). Considering that the pathways for lipid metabolism in dyslipidemia and the gut-brain axis in migraines and Parkinson's disease seem to be closely dependent on the health of the microbiome, researchers can hypothesize that purgation has the potential to alter gut dysbiosis.

Sansarjan karma-

Post procedural therapeutic diet guidelines (Samsarjana krama). This process involves modulation of diet by progressing from liquids to semisolids to a solid diet involving vegetarian and nonvegetarian components, typically prescribed before, during, and after a Panchakarma for a stipulated time. Such an

incremental progression helps the system to rest and reset after the elaborate procedures. This is in tune with the understanding of amending the amount of vegetable-based or animal-based food within the diet and of carbohydrate and fat intake that can prompt changes in the make-up of the intestinal microbiome.

Gut microbiome modulation through food items

Takra basti –

According to World Health Organization (WHO) fact sheet, approximately 39% of the global adult population is overweight or obese and prevalence has seen to be increasing worldwide. It has been established that gut microbiota plays a vital role in development of obesity and associated comorbidities. Microbes present in the gut are known to contribute for food absorption and low-grade inflammation therefore gut microbiome modulation is one of the ways to suppress the severity of inflammatory disorders like IBD, IBS as well as lifestyle disorders like type 1,2 diabetes, obesity and thus are considered potential sources of novel therapeutics .

Buttermilk is a known probiotic and used regularly as a part of the Indian diet . Milk fat globule membrane (MFGM) proteins in buttermilk are known to have cholesterol-lowering, antiviral, antibacterial, and anticancer properties. In the present study, we used buttermilk processed with medicinal plants for the treatment in obese patients. This was a first systematic study to assess changes in anthropometric and metabolic parameters along with gut microbial composition in obese individuals after a therapeutic course of medicated buttermilk. We used buttermilk prepared in 3 different batches. The buttermilk samples from all 3 batches were initially tested to understand batch-to-batch variation in bacterial diversity among the samples and the changes occurring in buttermilk after processing it with medicinal plants. An increased bacterial diversity was noted in processed buttermilk samples compared to plain buttermilk samples indicating successful processing. As the preparation of buttermilk involves a crude procedure, some variation in microbial composition was seen amongst 3 batches. However, this variation did not affect its therapeutic effects to large extent. The microbiota analysis revealed more abundance of organisms like *Geobacillus, Meoithermus, Aeribacillus, Culobacter* etc. in processed buttermilk. Of these, *Geobacillus, Meoithermus* and *Aeribacillus* are known thermophilic, whereas genus *Culobacter* is commonly obtained in aquatic and soil environments. These findings indicate that plants used for processing buttermilk may be the source of these genera.

The change in the microbial diversity at phylum and genus levels was observed immediately after buttermilk treatment (day16) which was restored to the original state (day 0) on day 45. An increase in Firmicutes abundance and decrease in Bacteroidetes level was observed on day 16. The gut microbiota on 16th day had an influence of the treatment of buttermilk enema and thus such change in the microbial community structure could be a possible response to rectal administration of buttermilk. No substantial difference was observed in the Firmicutes to Bacteroidetes ratio between day 0 and day 45.

Culinary Herbs and Spices

Culinary herbs and spices contain micronutrients and bioactive compounds (e.g., polyphenols, alkaloids, etc yet have not been widely studied regarding their impact on the GI microbiome in human populations, and thus represent a confounder in research investigating diet and microbiota. There is much pre-clinical evidence regarding the impact of culinary herbs and spices, or their active constituents, on GI microbiota. However, these often do not utilize the herbs and spices (or their active constituents) in doses, combinations or frequency of administration relevant to typical culinary use. In human samples, some herbal mixtures, containing culinary herbs and spices, have been used as interventions in clinical investigations, such as a single capsule of mixed curry spices , a single capsule of mixed culinary spices (cinnamon, oregano, ginger, black pepper, and cayenne pepper), and an herbal formula containing both culinary spices and specific nutrients , among others. There have also been evaluations of specific herbs and/or known active constituents on the microbiome (e.g., oregano , capsaicin, curcumin, etc.,). Many report findings in which the abundance of beneficial bacteria increase while that of opportunistically pathogenic bacteria decrease. While such studies may help elucidate a causal relationship between the use of specific herbs and changes in microbiota, and are thus important, they are not representative of how these products are consumed during typical cooking practices.

Due to the emerging role of the microbiome in health and disease , along with existing evidence that culinary herbs have the potential to modulate gut microbiota, evaluating associations between cooking with herbs and the gut microbiome may be hypothesis-generating for future experimental research, and provide insight into prospective therapeutic strategies. As such, the primary objective of this study is to evaluate if the frequency of culinary herb use is associated with microbiome diversity and abundance of certain phyla.

The culinary herbs surveyed included cumin, garlic, onion, cinnamon, thyme, ginger, basil, rosemary, cilantro, parsley, sage, oregano, mint, dill, clove, cayenne, allspice, nutmeg, paprika, saffron, cardamom, tarragon, chives, bay leaf, coriander, red chili, black pepper, and fennel seed.

Frequency was reported in the survey as never, once per month, 2–3 times per month, once per week, twice per week, 3–4 times per week, 506 times per week, or daily. Frequency was recoded into low frequency (never to 2–3 times per month), medium frequency (once to twice per week), or high frequency (at least 3 times per week).

The current study provides evidence for associations between the frequency of culinary herb use and Firmicutes and Proteobacteria abundance at the phylum level, and that this relationship may be impacted by the phenolic content of culinary herbs. This novel insight supports further investigation into the role of culinary herbs in modulating the microbiome and may have future implications for dietary recommendations in the context of health and disease. As such, we intend to carry out a follow-up study, with a modified culinary herb use questionnaire, estimations of polyphenol intake, and a wider participant recruitment pool.

Sandhana kalpana (fermentation preparation) is mentioned in ayurveda which is prepared with drava dravya (liquid materials) along with other medicinal drugs are put in a closed inert vessel for a specified time period to carry out fermentation. Sandhana

kalpana (fermentation preparation) is mainly classified into two i.e., madhya kalpana (alcoholic preparation) and shukta kalpana (acidic preparation).

Shukta varga: shukta kalpana (acidic preparation) includes aerobic spoilage processes brought about by film forming yeast and acetic acid bacteria, both of which grow at the expense of alcohol; converting it to acetic acid or to carbon dioxide and water in which the product is called chukra.

Madya sandhana kalpana (alcoholic preparation) are classified as sura, sidhu, varuni and asava- arishta. Sura is prepared by keeping completely boiled rice for fermentation, the clear supernatant fluid of sura is prasanna, the slightly thicker part is kadambari, the thicker and lower part is jagala, medaka is thicker than jagala and the left-overportion after filtration is termed as surabeeja or vakkasa or kinwa. 2

Asava are formulations that are prepared without the application of heat and arishtas are prepared by subjecting the drugs to the process of heat.

Shukta kalpas

1. Shukta is a preparation made by fermenting tubers, roots, fruits, etc. with oil and salt in liquid.
2. Tushodaka is a fermented drink prepared by fermenting the boiled broken yava (Hordeum vulgare linn.), godhuma (Triticum aestivum l) with husk.
3. Souviraka is prepared by fermenting boiled yava (Hordeum vulgare linn.), godhuma (Triticum aestivum l), without husk.
4. Kanjika is prepared by fermenting incompletely boiled masa (black gram), dhanya (cereals) with gruel prepared with rakta sali (Oroxylum indicum)
5. Sandaki is prepared by fermenting mulaka (Raphanus sativus), sarsapa4 (Brassica juncea), etc.
6. Maireya is the madhya (alcohol) prepared along with dhataki puspha (Woodfordia fruiticosa), guda (jaggery) and dhanya vishesha (cereals). 5
7. Chukra is that when the fermented liquid loses its amlata (sourness) or madhurata (sweetness) and the liquid gets spoiled and is called as chukra.

The advantages of acidic fermentation are said that they render the food resistant to microbial spoilage and the development of food toxins, they make the foods less likely to transfer pathogenic microorganisms, they preserve foods between the time of harvest and consumption, and they modify the flavour of the original ingredients and improve the nutritional value.

Pathya kalpana: the concept of pathya (wholesome) and apathya (unwholesome) is the uniqueness of ayurveda to fulfil its aims and objectives. The definition of pathya (wholesome) and apathya (unwholesome) include both material substances and specific regimes but in general these words had been particularly used for food articles in the texts of ayurveda.

A list of preparations made up of rice, cereals and milk products are mentioned under pathya kalpana (wholesome preparations). by adding fruit juices.

Dadhi kurchika is prepared by boiling dugdha (milk) and dadhi (curd) together over mild fire in an earthen vessel to a thicker consistency .Takra kurchika is prepared by boiling dugdha (milk) and takra (butter milk) together over mild fire in an earthenvessel to a thicker consistency.

Kambalika -

It is the yusa (soup) prepared using dadhimastu (upper liquid portion of curd). One part of amla (sour) dadhi (curd) added with 1/8th of mudga (Vigna radiata (l.) R. Wilczek), masa (black gram) etc are together boiled to prepare yusa (soup). To this needed quantity of sneha (oil or ghee), lavana (salt), jeeraka (Cuminum cyminum l.), nimbu (Citrus limon) swarasa (juice), twak (Cinamomum zeylanicum, breyn.), ela (Ellettaria cardamomum), patra (Cinnamomum tamala l), etc. Spices are added and the preparation is called as kambalika.

Discussion:-

Fermentation is said to be one of the oldest forms of food preservations in the world. It is said that during the process of fermentation the microorganisms convert the chemical composition of raw materials. Fermented foods contain many microorganisms that are present as natural indigenous micro biota in uncooked plant or animal substrates, utensils, containers, earthen pots, and the environment. Fermented rice products like sura, sidhu not just give the desired therapeutic effect but also nutritionally enriches the body. The fermented drinks with curd, buttermilk and the ayurveda dietetic preparations from the same like dadhi kurchika, takra and takra kurchika also give the same benefit. Dadhi is said to be rich in lactic acid bacteria and has the probiotic effect, which helps in intestinal health as helps in controlling diarrhoea in children. The lactic acid bacteria produce bioactive compounds such as diacetyl, hydrogen peroxide, and reuterin that suppress the normal growth of undesirable flora, especially E.Coli, bacillus subtilis, and staphylococcus aureus. The dahi kurchika mentioned in dietetic preparations of ayurveda will also have a probiotic effect.

The fermented preparations explained under pathya kalpana can be said to have the benefit of enriching the health with good bacteria. In the process of fermentation the microorganisms convert the chemical composition of raw materials. Fermentation not just alters the taste of the product but augments the therapeutic and nutritive value. Asava, arishta, pathya kalpanas where fermentation has a role provides the dual benefit. A lot of research can be carried out in these areas of fermented products of ayurveda pharmaceutics. The indigenous microbes from traditional fermented food as natural biological resource for health beneficial can be worked upon.

Conclusion- Thus with proper Ayurvedic diet and Medicines the repair of weakened governance of Microbes can be done by repairing the microbial flora and substratum.The Deepan Ghrita (medicated ghrita) and the Diet recepies like Medicated Mada and gruel of it. Legume soup/Yush and some fermented medicinal liqures may turn the weak mucosa in more active form.

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