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International Journal of Clinical Case Reports and Reviews

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Review Article

The Gut Micro Biome: The Hidden Driver of Human Health and its Scientific Foundations

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Received Date: February 27, 2026 | **Accepted Date:** March 04, 2026 | **Published Date:** March 13, 2026

Citation: Sabita Sinha, (2026), The Gut Micro biome: The Hidden Driver of Human Health and its Scientific Foundations, *International Journal of Clinical Case Reports and Reviews*, 34(4); **DOI:10.31579/2690-4861/1059**

Abstract:

Gut micro biome serves as a strong indicator to asses our health. It plays a vital role in our overall health. What does the gut micro biome define? It is the community for trillions of micro-organisms like virus, bacteria, fungi, and protozoa- that live in the digestive tract specifically the colon. Their daily activities influence overall health. It seems to be pretty silly, but they are the main contributing factor or determinant of almost all diseases. It can influence our overall health in positive and negative way. If we have good bacteria, it has positive impact in our body. It gives us negative impact in our health, when we are lack of good bacteria's. We can predict about good bacteria just seeing our overall health. If we have good bacteria loaded in our gut micro biome, we are energetic, enthusiastic, and active, in good mood and fall sick less often. Reverse is also observable, when we have harmful bacteria's, we have parasite infection, lethargic, brain fog, mood swing, falling sick frequently is the key note of it. So, we can enjoy good health if we just figure out this gut micro-biome dysbiosis and fix it. In this article we will discuss about gut micro biome in depth and discover hidden contribution of gut micro biome in almost all diseases.

Keywords: antioxidants; oxidative stress; free radicals; urolithihin A; and Akkermansia Muciniphila

Introduction

When we were little kid and whenever we were getting sick - our grandparents use to tell that something is wrong with stomach. They might not be aware of scientific name; however, their diagnosis was so correct. They were talking about gut micro biome, which we came to know little late. So what is this gut micro biome in real? Gut micro-biome plays crucial role in human health. It is the eco-system for trillions of micro-organisms like virus, bacteria, fungi, protozoa-which lives in our digestive tract especially colon. Their daily activities have influence in every aspect of human physiology. We have so many tiny guests in our gut micro-biome and their temper reflects in our overall health and behavior. If we feed them daily basis with healthy fiber rich food, they grow. Again, they do not prefer same kind of food every day. Varieties of plant-based food make them happy and grow. When we hit them knowingly or unknowingly with different kind of chemicals, processed and junk food, it hurts them and kills. However, it is favorable micro environment for harmful antigen to grow. Neuro specialist Dr. Sweta Adatia has conducted an experiment on her. Every day she was taking same kind of food. After 1 month, when she performed gut micro biome test, it was shocking for her. Her good bacteria didn't grow at all. However, she took variety of fiber rich food and performed gut micro biome test, she found her good bacteria had movement and it grew in number. Gut bacteria are also like human being. They do not prefer to have same kind of food every day. Important things to be noted, most of us do not have beneficial bacteria's and this is the important factor contributed in disease development.

We will discuss here how gut micro biome influences every aspect of human physiology:

1. Digestive and metabolic function:

a) ***Food break down:*** Gut micro biome helps to digest foods like fiber, protein, complex carbohydrate, which human enzymes cannot process. We can see how powerful this gut micro biome is. They are one step ahead than human enzymes. Whatever human enzyme cannot do, they do it easily.

b) ***Nutrient synthesize:*** They produce vitamins like B12, folate, biotin and K.

i) B12 production in gut.....> whatever we eat, not all food gets digested. Undigested food reaches in colon (large intestine). Bacteria take part to make basic building block. They use amino acids+ sugars+ cobalt (Co). With the help of multiple enzyme reactions, bacteria build a complex ring structure, which is called corrin ring. Trace mineral cobalt is embedded into the center of the ring. Substitute groups are introduced and active vitamin B12 is produced (cobalamin).

ii) Folate (B9) production in gut.....>Undigested food

/

Bacteria use

/

Glucose+ amino acid

/

Form molecule

/

PABA (para-aminobenzoic acid + Added glutamate component

/

Active form of Folate (Tetra hydrofolate)

iii) Biotin (B7) formation in gut.....>Undigested food

/

Bacteria use

/

Fatty acid pre-cursors

/

Form ring structure (pimeloyal-ACP) + added sulfur atoms

/

Multiple enzyme reaction modifies the structure

/

Final version is Biotin (B7)

iv) Vitamin K production in gut.....>Undigested food

/

Bacteria use

/

Amino acid (chorismate)

/

Converted into menadione nucleus + added Isoprenoid side chain

/

Final version is Vitamin K2 (menaquinone)

c). ***Energy regulation:*** It ferments fiber into short chain fatty acid (SCFAs) like acetate, propionate, butyrate, which strengthen colon cells and regulate metabolism. Function of these 3 short chain fatty acids:

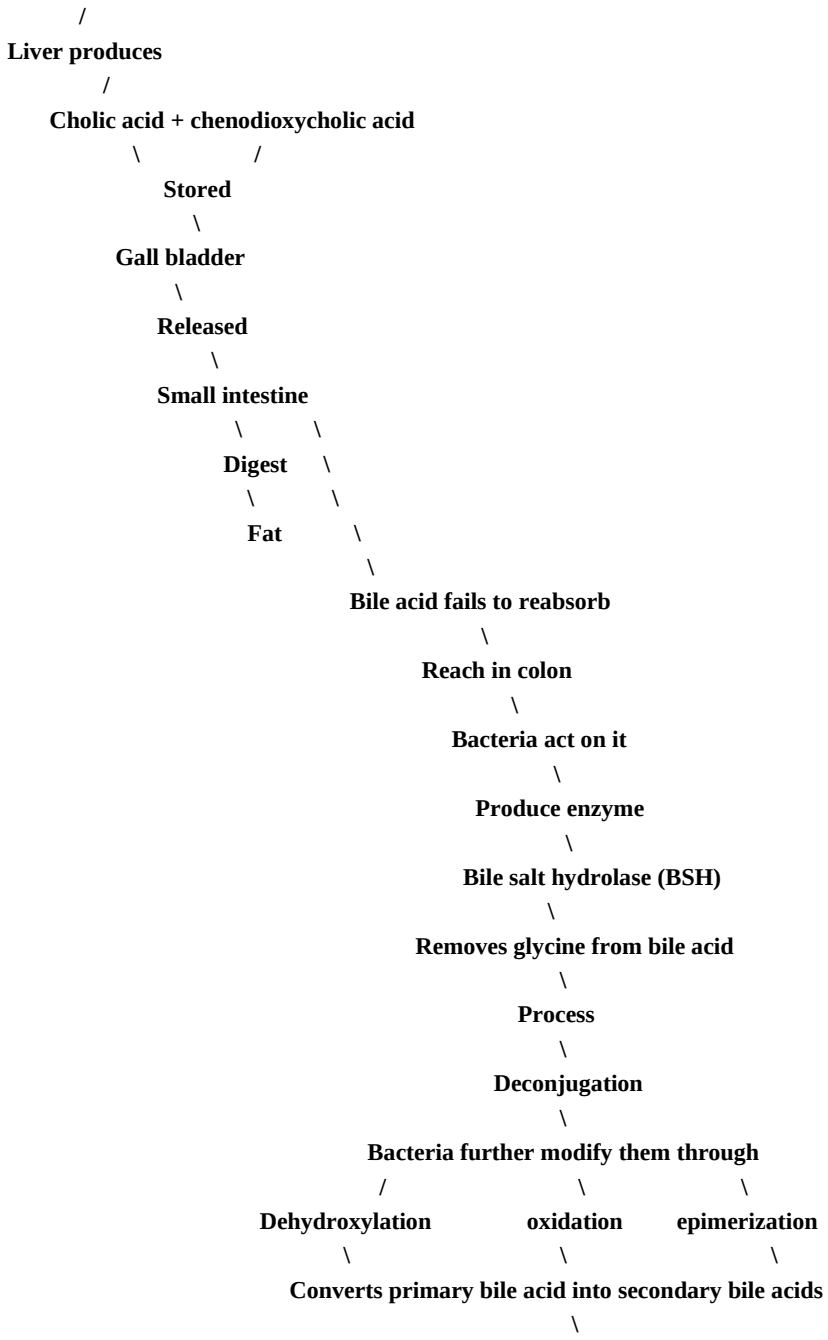
i) Acetate.....> helps.....>energy metabolism

ii) Propionate....>promote....> Liver glucose metabolism

iii) Butyrate.....>major energy source for colon cells

They strengthen gut lining, reduce inflammation and play crucial rule to support overall metabolic health.

d). *Bile metabolism:* It modifies bile acid.



i) Deoxycolic acid

ii) Lithocholic acid

Secondary bile acids are excellent in regulating metabolism, help in fat absorption, reduce inflammation, they can send signal through receptors like FXR and TGR5. Their activities influence diabetes, obesity, and liver health and balance cholesterol.

3) Metabolic and Systematic Health:

i) Weight regulation: Whatever we eat is not completely getting digested. Undigested food breaks down by certain bacteria. They produce short chain fatty acid. These short chain fatty acids provide extra energy and calorie to body. Well, some micro biome draws out extra energy and calorie to body, which contributes to weight gain. Moreover, activities of gut micro biome influence appetite and hunger. They influence hormones like-GLP-1(glucagon like peptide 1, PYY (Peptide YY), Ghrelin (hunger hormone). When we have large number unhealthy gut micro biome, it increases hunger, no control over appetite and the result is weight gain.

ii) Strong bond between fat storage and metabolism: Few micro biomes affect fat storage in body. When we have slow metabolism, body burn fewer calories and rest will go and deposit as fat in fat prone areas like arms, thighs, abdomens. Mostly slow metabolism is observed in case of metabolism related disorders like hyperglycemia, hypothyroidism, and obesity. It happens due to insulin sensitivity, inflammation, and dysbiosis

in micro biome. Harmful bacteria cause inflammation- more visceral fat in body for prolonged period, lack of few beneficial bacteria may cause imbalance in gut micro biome. So, we can see how gut micro biome influences fat storage and slows down metabolism.

iii) Cardio vascular health: when we eat food like egg and meat, it reaches in our gut. Certain bacteria convert choline (egg) and carnitine (meat) into TMA (tri methylamine). Then liver enzyme (FMO3) converts TMA into TMAO (Trimethylamine N-Oxide).

Choline + Carnitine….>reaches....>gut….>certain bacteria....> converts into....>TMA

TMA (certain gut bacteria) + FMO3 (Liver enzyme).....TMAO

What happens when TMAO level is elevated?

i) It causes heart disease

ii) Increases tendendency of blood clotting

iii) Plaque buildup tendency

iv) Kidney failure issue

v) Inflammation

vi) Increases oxidative stress

How can we reduce TMAO level?

i) Plant based foods

ii) Fiber rich foods

iii) Physical exercise

iv) Kidney function optimization

v) Reducing red meat consumption

What is this oxidative stress?

Oxidative stress is a condition caused in body when we have no control over free radicals and it exceeds antioxidants.

Oxidative stress=	**Free Radicals >**	**Antioxidants**
Normal Metabolism	i)Normal Energy production (ATP) I mitochondria	i) Vitamin C
+	ii) Chronic inflammation	ii) Vitamin E
Environmental	iii) UV radiation	iii) Glutathione
Exposure	iv) Radiation (mobile, cancer treatment)	iv) Antioxidants found in vegetables and fruits
	v)Smoking	
	vi) Pesticides and chemicals	
	vii) Heavy metals	
	viii) Fried and processed foods	

How can we minimize oxidative stress?

We cannot totally stop producing oxidative stress or free radicals in the body. Everyday body produces little amount of free radicals, while processing normal metabolism. However, we can have control over free radicals with healthy life style, diet and physical activity. Physical activity is such a powerful weapon to stay healthy and fit. As a Medical Oncologist, I have observed that cancer treatment outcome is successful in any medical system like conventional, holistic - Ayurveda, Homeopathy, Ayurveda, Unani, and Siddha and in naturopathy, when we include physical exercise as rehabilitation during treatment and after post treatment. Well, consistency does matter a lot with life style change, medication and proper diet.

We will try to explain how physical exercise influences mitochondria in energy (ATP) production:

Physical Exercise

****

Activates mitochondria

****

Through Energy demanding signal

Muscle contraction....>demands more ATP...>up regulate several powerful cellular pathways

i) Elevated ATP--□Demands....>AMPK activation [AMP-Activated Protein Kinase]…..>energy sensor....>cell

AMPK (Adenosine Monophosphate-Activated Protein Kinase)

****

Commands to cell

**/ **

Produce utilize energy substrates

More

Mitochondria

ii) PGC-1a activation (Peroxisome proliferator-activated receptor gamma coactivator 1-alpha)

When we do exercise, following changes happens inside cell....

Exercise....>muscle contraction....> increases.....>calcium level.....>calcium activates....>signaling protein.....>switch on PGC-1a (master regulator of mitochondrial biogenesis)

\

Functions

a) Activates NRF1+NRF2 pathway (proteins which have the ability to switch on or switch off genes involved in mitochondrial function and antioxidant

b) Enhances mitochondrial enzymes

c) Promotes oxidative phosphorylation

What is oxidative phosphorylation?

Oxidative phosphorylation
/
Process
/
Mitochondria
/
Use
/
Oxygen
/
Produce
/
ATP
/
Through Electron Transport Chain

iii) ROS (Reactive Oxygen Spices)…..>works as signal controller

Exercise
\
Produces
\
ROS (mild level)
/ \
High Low
/ \
Oxidative stress Protective signal
\

a) Activates NRF1+NRF2 pathway (proteins which have the ability to switch on or switch off genes involved in mitochondrial function and antioxidant

b) mtDNA replication (mitochondrial DNA)

c) Activates antioxidant enzymes (SOD +Catalase+ glutathione peroxidase)

iv) Enhanced Oxygen Utilization:

Exercise-→enhances--→capillary density

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Myoglobin content (protein found in muscle cell.....stores +carries Oxygen

It increases oxygen utilization and produces more ATP

Hypoxia is the one major cause of death in cancer in advanced stage. Most of the cancer patients feel difficulty in advanced metastasis stage and struggle to manage O2 level.

v) Mitophagy activation (Removing damaged mitochondria):

Exercise....>activates...>autophagy+mithophagy pathway...>damaged mitochondria would be removed

\

Good and healthy mitochondria will remain same and multiply

How antioxidants neutralize free radicals and reduce oxidative stress?

Here is the simple model to explain the above scenario in an understanding way.

Free radicals
/
Nature
/
Missing paired electron
/
Example
/

a) Superoxide radical

b) Ozonize radical

Remarkable point is that, when they are impaired, they are highly reactive free radicals and they can damage DNA, protein and lipid. However, they have tendency to be paired. On the other hand, antioxidants are such a molecule that neutralizes free radicals transferring one electron and sheiled the body from oxidative damage.

Where can we get Antioxidants?

We get antioxidant from colorful vegetables, seeds, nuts, beverages and our body also produces it. Cruciferace vegetables: Broccoli, cauliflower, cabbage- have sulferophane as in-active form. It has in -active glucoraphanin. We chop it and keep it for 40 min; one enzyme called myrosinase, come in contact with glucoraphanin and activates sulferophane. Myrosinase is heat sensitive and gets damaged in high heat. So, we have to prepare in low steam to get maximum benefit of activation of sulferophane.

Green banana (high amount of resistance starch), green peas (moderate level), sweet potato and normal potatoes have small amount of resitance startch. It depends upon, how do we prepare and activate it. Resistance starch is a healthy carbohydrate, which will go to our gut and gets fermented in large intestine. It feeds gut bacteria and assists to grow good bacteria.

Green leafy vegetables and fruits are loaded with vitamins and minerals and antioxidants. Fruits like blueberry, strawberry, Kiwi, Pomegranate, avocado and green leafy vegetables such as spinach, amaranth, Malabar spinach, kale- all are good sources of antioxidants.

Urolithin A: It is a natural compound produced in our gut. When we eat food like pomegranate, strawberry, walnut-polyphenols in these fruits like ellagic acid and ellagitannis breaks down in gut with the help of special bacteria called gordonibacter Urolethinfaciens and produce Urolithin A. It reduces inflammation and strengthens intestinal lining. It enhances mitochondrial function, boosts immune system and empowers memory function. Everyone cannot produce Urolithin A. However, they can have the same benefit with Urolithin A supplement.

Akkermansia Muciniphila: It is a beneficial bacterium found in our large intestine. It feed on mucin and assist to maintain integrity of gut lining. More the akkermansia in our gut indicates strong metabolic function. It plays crucial role in metabolism. So, it prevents the risk of diabetes and obesity. Scientists are working on it for further therapeutic purpose. Renowned cancer researcher Dr. William Li's mother got diagnosed with endometrial cancer 4th stage at the age of 84 years. Her Oncologist informed Dr. Li that at this age, chemo and radiation would be more devastative than the cancer. So better to shift her in palliative care, where she can have good time until she survives. He introduced his mom to brand new Immunotherapy. They checked her akkermansia level and boosted it with food like pomegranate, green tea, and cranberry. When her akkermansia Level was up, it did wonder with immunotherapy. With little radiation and Immunotherapy, she reversed her 4-stage cancer to Zero (0) stage.

Even Dr. Lawrence Zigvitol, French Oncologist and Immunotherapist also proved that akkermansia is a powerful tool for immunotherapy. She conducted an experiment upon 249 cancer patients who were going through immunotherapy. Again, she separated 249 patients into 2 groups, who were giving response towards immuno therapy and who were not responding towards immuno therapy. What she found was quite shocking. People who were responding towards immuno therapy had high level of akkermansia, whereas who were not responding towards immuno therapy, had low level of akkermansia. Unfortunately, very few people have this beneficial bacterium in their gut. We can increase the level with food and supplement. I do prescribe Urolithin A and Akkermensia supplements to almost all patients as well as cancer patients. It has an excellent result in overall health.

How to support gut micro biome?

1. Diet: We can add fiber rich foods, fermented foods (yougert, Kefir, Kimchi), prebiotics (banana, onion, garlic). Few people cannot digest pre biotic and pro-biotic separately. In this context, we can mix both and it becomes synbiotic, which is very much effective.
2. We can use certain live bacteria supplements to help restore balance.

3. We can avoid unnecessary antibiotic and mouth wash, unless we need them. Rather we can have herbal anti-inflammatory herbs and medicines and instead mouthwash, we can use ancient oil pulling technique with sesame seed oil, extra virgin coconut oil.
4. A varied diet with plant-based foods promotes microbial richness, which maintains better eco system for gut micro biome.
5. Daily 3-4 Lt Water helps to flush out toxin and support normal metabolism, especially purine metabolism. I have observed that people who consume daily less than 1.5 Lt Water, visits clinic with complain of joint pain, knee pain and many other issues. I have designed a case study booklet, where I can check people who consume daily less than 1.5 Lt Water, complain about joint pain. I suspected it as elevated serum level of uric acid and even laboratory blood test also proved it.
6. Daily fruits and nuts should be included in our diet. We can add any kind of berry like strawberry, blackberry, raspberry, cranberry, Kiwi, Avocado, pomegranate and so on. Nuts like walnut, almond, cashew, pistachio, Brazil nut, hazel nut and seeds like chia seeds, flex seeds, sunflower seeds, pumpkin seeds, water melon seeds and so on.
7. All kind of processed food, junk food, refined oil like-sun flower oil, canola oil, and palm oil should be avoided. Stress should be controlled.
8. Vitamin supplements like Vitamin D3k2+Zinc, Calcium (cal+mag+D plus K2), Omega 3, B12, Vitamin E (400IU) should be included for 3 months and other supplements like akkermensia, Urolithin A, multi vitamins for 3 months and so on.
9. Daily exercise is powerful weapon to stay healthy and fit. We have already discussed how exercise influences our overall health in daily Life. Daily 40 min walk and 15 min meditation should be added. Everyday 7-8 hours' sleep is mandatory to reduce stress hormone cortisol and balance sleep hormone melatonin. Fixed time table should be maintained for breakfast, lunch and dinner. Frequent intermittent and weekly once complete water fasting should be encouraged to activate autophagy+mitophagy pathway.

Conclusion

We can sum up gut micro biome as hidden organ. It has control over digestion, immune function; cardio vascular health and even brain function as well. Gut micro biome is called as second brain. If we want to stay healthy, we must take care of gut micro biome. Almost all diseases are linked with gut micro biome. We can follow healthy life style and grow good bacteria to support our overall health. One simple fix in gut micro biome is the key to enjoy healthy life. So, we can leave a healthy life with proper food, exercise, hydration, taking proper antioxidants from fruits and vegetable and prepare our body to produce anti-oxidants. When we know how to figure out our health issues, why do we stay back and act carelessly? We can maintain its balance which is essential for overall health and disease prevention. A healthy and balanced gut micro biome is the door towards healthy life.

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DOI:10.31579/2690-4861/1059