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Editorial

Brain in Stomach: Lessons for Health Management

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Our belief that stomach is solely dedicated for digesting the food stuff has turned out to be an illusion. Perhaps we are near to answering few waiting questions like why we feel excited in our stomach before a thrilling performance? How indigestion leads to nightmares? Or is it worth of prescribing antidepressants for the management of gastrointestinal ailments? The recent interesting research has unravelled the fact that besides digesting food, stomach is also involved in repertoire of a complex and highly regulated neural mechanism that links with higher brain areas, and found to be associated with physiologically central functions like reward and appetite [1]. It has been partly proved that when we experience "butterflies in the stomach", this in fact is the neurological interplay between the stomach and the brain in our head.

The neural control of the gastrointestinal tract is linked via autonomic nervous system innervating the stomach. The sympathetic (excitatory innervations: splanchnic nerves) and the parasympathetic (inhibitory innervations: vagal and pelvic nerves) are the main divisions of the nervous system establishing the neuro-link of stomach [1]. As we experience nervousness or fearful, it's a function of blood which gets diverted from gut to muscles and this is how the stomach register its protest. The emerging scientific evidence has clearly demonstrated the fact that, anxiety and depression are not only associated with deficiencies of life supporting substances, but it is also linked with functional abdominal pain in otherwise healthy people having inscrutable mild subtle gastrointestinal disorders [2].

Per say neuromediators plays key role in carrying messages from neurons to another type of cell or vice versa. The kind of research accumulating in the recent years has clearly established a link between brain processing and gastrointestinal microbiota. It has been clearly demonstrated that the gut-brain axis especially the gut bacteria has interactive network with the enteric nervous system and the CNS [3]. Plethora of studies have described the significance of gut microbiota in concert with its interactions with CNS and the enteric nervous systems. These bidirectional brain-gut interactions are thought to be carried out by means of neural, endocrine, immune, and humoral signals. Although the majority of experimental data has been acquired using rodents and pigs model studies, however the studies focusing the microbiota-mental health interactions originating from association of intestinal dysbiosis with CNS disorders especially anxiety-depressive behaviours and functional gastrointestinal disorders comprising of irritable bowel syndrome in relation to mental health comorbidities also reiterates the significance of gastrointestinal microbiota in brain processing [4,5].

Looking towards the influence of gut microbiota in brain processing, a research window of developing probiotics is expanding in logarithmic fashion and people are interested to know how gut microbiome interactions with brain function can be casted as a novel paradigm for health management. It is so frequent to observe that physicians have started prescribing probiotics gastrointestinal and stomach disorders. Although the role of probiotics is known, however, its understanding in relation to brain functions is evolving and the topic is still in its infancy. A provocative discourse on how a high-fibre diet can be employed in prevention of neurodegeneration by subsequent increasing the butyrate concentration in the colon is in queue [6].

Over the past four decades, advances in neurotransmitter research has added significantly towards understanding the role of serotonin in the regulating the mood, behaviour and the etiology of psychopathology etc. The molecular mechanisms controlling the metabolism of gut-derived serotonin is one of the evolving research area in neurobiology. The evolving experimental evidences links the plausible

involvement of serotonin in mood, irritations, aggression and behaviour. In general, it has been observed that lower levels of serotonin are attributed with more negative mood and behavioural patterns while elevated levels have counter effects [7]. Interestingly, over 90% of the body's serotonin is synthesized in the gut, nevertheless gut synthesized serotonin activates over 14 different serotonin receptor subtypes located on enterocytes, enteric neurons and immune cells [8]. The above circumstantial literature strengthens the gut-brain associations in concert with human mood and behaviour.

Till date, digestion and emotion have not been coupled together in the mainstream medicine and science. We commonly use a phrase of "gut feeling" which implicitly links the belly with the brain, in fact there is need to establish a link of gut physiology-microbes-mind, which currently are studied independently [9]. Perhaps, this is the reason why physicians prescribe two separate medicines for constipation and (constipation induced) depressions. Therefore, the take to home message for individuals and health management systems is to integrate and link the stomach disorders, digestion, gut microbiota in concert with brain functioning, and develop such integrative therapeutic modalities which perhaps will stabilize the functioning of our brain in head and brain in stomach.

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