Global Prebiotic Association Young Researcher Awards - Entry #343

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Please indicate which category you're applying for:

GPA Young Researcher Award for Applied Research (115 points possible)

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https://link.springer.com/article/10.1007/s12602-023-10109-y

Please provide a summary of your research(limit 250 words)

Recent burgeoning literature unveils the importance of gut microbiota in post-stroke complications such as motor dysfunction, cognitive dysfunction, remote organ injury, sepsis, and pneumonia. Based on that finding, we hypothesized and found out the protective effect of a new synbiotic formulation containing multistrain probiotics (Lactobacillus reuteri UBLRu-87, Lactobacillus plantarum UBLP-40, Lactobacillus rhamnosus UBLR-58, Lactobacillus salivarius UBLS-22, and Bifidobacterium breve UBBr-01) and prebiotic fructooligosaccharides on post-stroke brain injury, neuroinflammation, gut dysbiosis, and intestinal integrity using a middle cerebral artery occlusion (MCAO) model of cerebral ischemia in female and male rats. These findings confer the potential benefits of our novel synbiotic preparation for MCAO-induced neurological dysfunctions by reshaping the gut-brain-axis mediators in rats.

Please provide a summary of methods (limit 250 words)

To examine the effect of a synbiotic formulation on ischemic stroke-induced brain injury, neuroinflammation, gut dysbiosis, and intestinal integrity, we used the transient middle cerebral artery occlusion (tMCAO) model. Ischemia was induced by inserting a silicone rubber-coated monofilament for 90 minutes, followed by 72 hours of reperfusion. The rotarod, foot-fault, adhesive removal, and paw whisker assays were used to assess the protective effect of the synbiotic formulation on sensorimotor and motor impairments caused by MCAO. After 72 hours of reperfusion, the rats were euthanized, the brain was isolated, and 2,3,5-triphenyltetrazolium chloride (TTC) staining was performed to evaluate the infarct volume. RT-PCR and ELISA were performed to evaluate the effect of the synbiotic formulation on IL-1β, TNF-α, IL-6, and matrix metalloproteinase-9 in MCAO rats. Furthermore, H&E and alcian blue-PAS staining of the intestine sections and cresyl violet staining of brain sections were performed to confirm the protective effect of the synbiotic formulation on the brain and intestine. To detect the effect of the synbiotic formulation on glial fibrillary acidic protein (GFAP), NeuN, occludin, and zonula occludens-1, we performed immunohistochemistry (IHC) and immunofluorescent (IF) staining of brain and intestine sections. The anti-apoptotic effect of that formulation on the intestine cell was confirmed by the TUNEL assay. Further, the effect of synbiotic formulation on gut microbiota was confirmed by 16S rRNA gene-sequencing of fecal microbiota RNA.

Please provide a summary of your results (limit 250 words)

Herein, we observed that three weeks of pre-MCAO administration of synbiotics rescinded the MCAO-induced sensorimotor and motor deficits on post-stroke days 1 and 3. We also observed decreased infarct volume and neuronal death in the ipsilateral hemisphere of synbiotic-treated MCAO rats. The synbiotic treatment also reversed the altered levels and mRNA expression of the glial fibrillary acidic protein (GFAP), NeuN, IL-1β, TNF-α, IL-6, matrix metalloproteinase-9, and caspase-3 and decreased levels of occludin and zonula occludens-1 in MCAO rats. 16S rRNA gene-sequencing data of intestinal contents indicated an increase in genus/species of Prevotella (Prevotella copri), Lactobacillus (Lactobacillus reuteri), Roseburia, Allobaculum, and Faecalibacterium prausnitzii, and decreased abundance of Helicobacter, Desulfovibrio, and Akkermansia (Akkermansia muciniphila) in synbiotic-treated rats compared to the MCAO surgery group.

Please provide a statement about what, in your opinion, makes this paper outstanding and why it fits into the grant category you selected. (limit 250 words)

The main highlights of our research are as follows:

1) We used a tMCAO model, the golden standard model for ischemic stroke, to evaluate the neuroprotective effects of novel symbiotic formulation.

2) The severity of post-stroke complications depends on the size of the infarct volume and the level of neuroinflammation, so here, we observed the neuroprotective effect of this formulation.

3) As we know, post-stroke pneumonia is one of the major causes of mortality in stroke patients that occur by altered gut microbiota. Here, for the first time, we studied the effects of this symbiotic formulation on ischemic brain injury-induced alteration of intestinal permeability and gut microbiota.

4) This primary data gives us an idea so we can further protect/treat stroke-induced pneumonia by protecting the gut integrity.

By typing your full name below and completing this application, you verify that you are the first author of this research and that this paper is original research.

Ziaur Rahman

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