The Role of Probiotics in improvement of Gastrointestinal Symptoms among children with AutismSpectrum Disorders.

Thesis

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List of Abbreviations

ASD	Autism spectrum disorder
ACTH	Adrenocorticotrophic hormone
ADHD	Attention Deficit Hyperactive Disorder
ALA	Alpha-linolenic acid
ANS	Autonomic nervous system
APA	American Psychiatric Association
atm	atmosphere
ATP	Adenosine triphosphate
B6	Vitamin *B6*
BBB	Blood brain barrier
BMI	Body mass index
CAM	Complementary and Alternative Medicine
Cfu/gm	Colony forming units per gram
CNS	Central nervous system
CNV	Copy number variants
CRH	Corticotropin-releasing hormone
DA receptors	*Dopamine receptors*

List of Abbreviations (cont….)	
DHA	Docosahexaenoic acid
DMG	Dimethylglycine
DNA	Deoxyribonucleic acid
DSM-V	Diagnostic and Statistical Manual of Mental Disorders (fifth edition)
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders (fourth edition)
e.g.	For example
ENS	Enteric nervous system
EPA	Eicosapentaenoic acid
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
GABA	Gamma-aminobutyric acid
GBA	Gut-brain axis
GFCF	Gluten-free/casein-free
GI	Gastrointestinal
GIT	Gastrointestinal tract
GSH	Glutathione
HBOT	Hyperbaric oxygen treatment

List of Abbreviations (cont….)	
HPA	Hypothalamic pituitary adrenal axis
HPHPA	3-hydroxyphenyl-3-hydroxypropionic acid
Ig	Immunoglobulin
IgA	Immunoglobulin A
IL1β	Interleukin-1 beta
IL-6	interleukin-6
IQ	Intelligence quotient
kg/m^2	Kilogram per square meters
KNOX-2	NADPH oxidases
L-carnitine	Levocarnitine
LPS	Lipopolysaccharides
MMR	Measles Mumps Rubella vaccine
MUFAs	monounsaturated fatty acids
N	Number
n-3 PUFAs	omega-3 polyunsaturated fatty acids
NADH	Nicotinamide adenine dinucleotide dehydrogenase
NADPH	Nicotinamide adenine dinucleotide phosphate
iNOS	Nitric oxide synthase

List of Abbreviations (cont.…)	
NCCAM	The National Center for Complementary and Alternative Medicine
NO	Nitric oxide
OXTRs	oxytocin receptors
PCR	Polymerase chain reaction
RD	Registered dietitian
RNA	Ribonucleic acid
ROS	Reactive oxygen species
SAM	*S*-adenosyl methionine
SCD	Specific carbohydrate diet
SCFAs	short-chain fatty acids
SD	Standard deviation
SNV	single nucleotide variants
TJ	Tight junctions
TNFα	Tumor necrosis factor alpha
WHO	World Health Organization
Wt	Weight
$\mathbf{Z_{BMI}}$	BMI z-scores for age
$\mathbf{Z_{WH}}$	Weight for height z-scores

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Abstract

Objective: This study was designed to evaluate the role of probiotics supplementation in improving the gastrointestinal symptoms, the general and mental health of the autistic children at the age of 5 to 9 years old.

Methods: Gastrointestinal flora were assessed by quantitative real time PCR of stool samples of 30 autistic children from 5 to 9 years old and 20 healthy control of similar age and sex. Gastrointestinal symptoms of autistic children were assessed with a modified six-item Gastrointestinal Severity Index(6-GSI)questionnaire, and autistic symptoms were assessed with the Autism Treatment Evaluation Checklist(ATEC)before and after 3 months of supplementation of autistic children with a probiotic nutritional supplement formula (each gram contains 100 $x10^6$ colony forming units of different probiotic strains).

Results: After probiotic supplementation, the stool PCR of autistic children showed increases in the colony counts of Bifidobacteria and Lactobacilli levels, with a significant reduction in their body weight as well as significant improvements in the severity of autism (assessed by the ATEC), and gastrointestinal symptoms (assessed by the 6-GSI) compared to the baseline evaluated at the start of the study.

Conclusions: The use of probiotics seems to be helpful in reducing the severity of autism gastrointestinal symptoms and related abnormal behaviours as well as offering new possibilities for preventive and therapeutic applications in weight management.

Keywords: Autism; Probiotics; ASD; Gastrointestinal flora; Bifidobacteria.