

To Study the Autism Spectrum Disorder Market : Pipeline Review, Developer Landscape, and Competitive Insights

By

Purnendu Dubey

*Dissertation submitted for the partial fulfillment of the
MBA Pharmaceutical Management*

Academic year, 2018-2020



The IIHMR University, Jaipur

1, Prabhu Dayal Marg, Sanganer, Airport
Jaipur 302029, Rajasthan
Ph: 0141 3924700, Fax: 3924738
Website: www.iihmr.edu.in

To Study the Autism Spectrum Disorder Market : Pipeline Review, Developer Landscape, and Competitive Insights

By

Purnendu Dubey

*Dissertation submitted for the partial fulfillment of the
MBA Pharmaceutical Management*

Academic year, 2018-2020

VEFA ILAC



The IIHMR University, Jaipur

1, Prabhu Dayal Marg, Sanganer, Airport
Jaipur 302029, Rajasthan
Ph: 0141 3924700, Fax: 3924738
Website: www.iihmr.edu.in

Website: www.iihmr.edu.in

TO WHOMSOEVER MAY CONCERN

This is to certify that Purnendu Dubey student of MBA Pharmaceutical Management from The IIHMR University, Jaipur has undergone internship training at Vefa Ilac from 3rd of Feb 2020 to 3rd of May 2020.

The Candidate has successfully carried out the study designated to him during internship training and his approach to the study has been sincere, scientific and analytical. The Internship is in fulfillment of the course requirements.

I wish him all success in all his future endeavors.

Dean, Academics and Student Affairs

The IIHMR University, Jaipur

Professor

The IIHMR University, Jaipur

ACKNOWLEDGEMENTS

The project report defines and signifies the sheer mannerism in which numerous interacted tasks are performed.

I owe the completion of dissertation to the almighty and my family whose love and blessing will be with me in every moment and every condition of life.

The day which marked the beginning of my project report bears a special status to all of us; I begin with the proceedings and support of Mr. Diptiman Tripathi for providing me opportunity to learn and develop professionally. I would like to also thank Mr. Ajinkya Dalal at VEFA ILAC LLP for constant guide and support in every step which helped me to understand the pharma market easily.

I would like to express my deep gratitude for my mentor and internship coordinator DR. ASHOK PEEPLIWAL, associate professor, the IIHMR university, Jaipur, Rajasthan, for his valuable support in the preparation of the project report. I also like to thank my academic mentor Dr. Saurabh Kumar for his valuable advices.

Last but not the least, I wish to remember with the deep sense of gratitude the encouragement provided to me by all involved directly or indirectly.

DATE:

PLACE: JAIPUR

PURNENDU DUBEY

MBA PM 10

IIHMR-U/02/2018-20/0146

List of abbreviations

WHO - WorldHealth Organization

GMP - Good Manufacturing Practices

ADHD -Attention-Deficit/Hyperactivity Disorder

DCD- Development Co-Ordination

DSM-5- Mental Disorders Version 5

PDD-NOS- Pervasive Developmental Disorder Not Otherwise Specified

ASD -Autism Spectrum Disorder

RRB - Restricted And Repetitive Behavior

ABA- Applied Behavioral Analysis

FSSAI- Food Safety And Standard Authority Of India

IFOS- International Fish Oil Standard

DC- Dyscalculia

CDC- Centers For Disease Control And Prevention

ALA - Alpha-Linolenic Acid

DHA- Docosahexaenoic Acid

EPA-Eicosapentaenoic Acid

PUFA- Polyunsaturated Fatty Acids

CHD- CoronaryHeart Disease

CVD- Cardiovascular Disease

List of figures

<u>Figure: 1</u>	Classification of ASD
<u>Figure: 2</u>	Chemical structure of eicosapentaenoic acid (EPA)
<u>Figure: 3</u>	Chemical structure of docosahexaenoic acid (DHA)

List of graphs

Graph: 1	<u>ASD market share by type</u>
Graph: 2	<u>COMPARATIVE VIEW OF VARIOUS MARKETS</u>
Graph: 3	<u>Market prediction</u>

List of tables

Table:1	<u>Marketed omega3 syrup supplements</u>
Table: 2	<u>Attribute analysis</u>
Table: 3	<u>Phase- 1</u>
Table: 4	<u>Phase- 2</u>
Table: 5	<u>Phase- 3</u>
Table: 6	<u>Phase- 4</u>
Table: 7	<u>Attribute analysis of high impact pipeline assets</u>
Table: 8	<u>Line of therapy</u>
Table: 9	<u>common omega-3 fatty acids found in nature</u>
Table: 10	<u>Food Sources of α-Linolenic Acid</u>
Table: 11	<u>Food Sources of EPA and DHA</u>

Table of contents

1	Company overview –.....	9
1.1	Vefa (turkey).....	9
1.2	Vefa ilac India	9
2	Literature Review	10
3	Research objective	12
4	Research Methodology	12
5	Research tools and techniques-	12
6	Part:a.....	13
6.1	Disease profile.....	13
6.2	Classification	13
6.3	Sign and symptoms-	14
6.4	Treatment approaches-.....	15
6.5	Epidemiology-.....	16
6.6	Unmet needs	16
6.7	Marketed omega3 syrup supplements.....	16
6.8	Attribute analysis of products used as supplement for ASD in Delhi in comparison to cogni3 17	17
6.9	Competitive landscape of pipeline products	18
6.9.1	Phase-1	18
6.9.2	Phase -2	21
6.9.3	Phase -3	23
6.9.4	Phase- 4	25
6.10	Attribute analysis of high impact pipeline assets	26
6.11	Line of therapy	27
7	Part: b	28
7.1	Omega 3	28
7.2	Chemistry	29
7.3	List of omega–3 fatty acids.....	29
7.4	Food sources containing Omega-3 fatty acids	30
7.4.1	α -Linolenic acid (ALA):	30
7.4.2	Eicosapentaenoic acid and docosahexaenoic acid	31
7.5	Forms	32
7.6	Biochemistry	32
7.6.1	Transporters	32

7.7	Omega-3 index.....	32
7.8	MARKET OVERVIEW	33
7.8.1	Global ASD market share by type.....	33
7.8.2	COMPARATIVE VIEW OF VARIOUS MARKETS IN COMPARISION TO DIETARY SUPPLEMENT MARKET	33
7.8.3	Market scenario of omega 3	34
7.9	USE OF OMEGA 3 IN WELLNESS THERAPIES	34
8.	Conclusion	37

1 Company overview –

1.1 Vefa (turkey)

Vefa Ilac is all about excellence in manufacturing, research and development of Pharmaceuticals, Nutraceuticals and Personal Care product. It has one of the best in class WHO GMP certified manufacturing capabilities in Eurasia, the facility conforms to the toughest international regulatory norms. Vefa Ilac's is a vision come true and is the result of 20 years of dedication of Mr. Khaladdin Guliyev's in the healthcare industry which today has resulted in the setting up of the most modern manufacturing facility in Istanbul, Vefa Ilac. Vefa Ilac is head quartered in one of the most geostrategic country in Eurasia , Turkey and has a great advantage of uniting business across continents. The company can invariably offer its services across all the countries in Europe, Asia and CIS. It has an expansive manufacturing base, latest Equipments & Laboratories with highly skilled manpower and a strong pool of technical professionals supporting the R&D efforts. Vefa Ilac is the first Turkish pharmaceutical company to have achieved the WHO GMP certification in shortest time frame as our compliance for the certification was found to be very good and also accredited by Turkey's ministry of Agriculture for production of Dietary Supplements. The water used for manufacturing is the best as it's complained to USP approved which ensure the finest quality of end product. We at Vefa Ilac work towards a mission of being the "Most Preferred Manufacturing Destination in Eurasia" and value each and every customer of ours as an integral part of Vefa Ilac. You can get the products manufactured at Vefa Ilac and enjoy the geostrategic advantage as it will significantly improve the profitability, reduce the logistic hassles thereby directly improving execution time of production and dispatch of stocks to various location directly from Vefa Ilac.

1.2 Vefa ilac India

Vefa ilac India is primarily a marketing company and working across all the main cities in India. Cogni3 is a supplement product which is offered by vefa ilac India and it is the only product launched till date in India.

Vefa Ilac LLP is a Limited Liability Partnership firm incorporated on 01 June 2016. It is registered at Registrar of Companies, Delhi. Designated Partners of Vefa Ilac LLP are Diptiman Tripathy and Khaladdin Guliyev. Vefa Ilac LLP's LLP Identification Number is (LLPIN)AAG-5513. Its Email address is diptimantripathy@gmail.com and its registered address is Vatika Atrium, 1st Floor Block-B, Sector-53 Gurgaon ,HR 122002 IN ,

2 Literature Review

- **Oxford Durham study-**

Development co-ordination(DCD) affects 5% of the school children approximately. There is a core deficit in motor function, this leads to difficulty in learning, behavior and psychological adjustment that stays active in his adulthood. Omega3, Omega6 supplements are compared with placebo. It was conducted over 117 children who are associated with DCD with age group of 5-12 years. The treatment was given with dietary supplements. 3 months of treatment was given in parallel groups and followed by a 1-way crossover from placebo to active treatment. Notable Improvement was found in active treatment in comparison to placebo. Improvement was noted in reading, spelling and behavior over three months of treatment in parallel groups, no effect on motor skills was seen . It was concluded that FA supplementation offers a safe efficacious treatment option for educational and behavioral problems among children with DCD. Thus, intake of omega-3 supplements becomes a necessity to see an improvement child suffering from behavioral, learning disabilities deficits in motor function .

- **Does AD omega-3/6 fatty acids have therapeutic role in children and young adults with ADHD? E. Derbyshire -**

ADHD is a behavioral disorder that affects the daily ability to work, learn and communicate with peers. This publication assesses the role of omega 3/6 fatty acids in the treatment and management of ADHD.

Methods - Systematic review of 16 randomized controlled trials

Sample size - 1514 with children and young adults

Results- 13 reported positive benefits on ADHD symptoms including hyperactivity, impulsivity, attention, distraction, verbalization, and hard-working / short-term improvement.

Four studies used an eco-sapentanoic acid supplement in a 9: 3: 1 ratio: docosahexaenoic acid: olene linolenic acid was found to be effective in improving erythrocyte levels.

Conclusion- ADHD is a persistent and debilitating childhood condition. Due to the depressing feelings of psychostimulant drugs, omega 3/6 fatty acids hold great promise as an appropriate adjuvant therapy for ADHD.

- **Docosahexaenoic acid for reading, cognition, and behavior in children aged 7 to 9: a randomized, controlled trial (DOLAB study)**

Omega-3 fatty acid diet is essential, and in most modern developed countries the current low intake is believed to contribute to a variety of physical and mental health problems. We have investigated whether such benefits can be extended to the general child population.

Sample size - 224 children with a reading performance of 20%

result-

1. DHA has no effect on readability in the sample
2. Improvement in children's behavior and learning due to PUFA in ADHD and DCD

- **The Vitamin D and omega-3 Trial-Depression Endpoint Prevention (VITAL-DEP):**

Rationale – evaluation of vitamin D and marine omega-3 fatty acid supplements for prevention of late-life depression

Sample size- 25874

Time frame- 5 years

Methodology- randomized clinical trial, 2*2 factorial design

Conclusion- it applies all modalities of state-of-the-art prevention research – universal, selective and indicated. It will clarify the effects on mood, and use of these agents for prevention of depression in mid-life and older adults.

3 Research objective

To Study the autism spectrum disorder Market : Pipeline Review, Developer Landscape, and Competitive Insights

To Study the Role of omega3 in wellness therapies and management of cognitive disorders.

4 Research Methodology

a. Study design-

the research conducted is a descriptive research

b. Study selection-

the selection area is throughout the world, but focus is restricted to Indian market.

c. Data collection-

All data was collected from secondary source

- Company websites
- Clinical trials.gov
- Presentations
- Published association
- Journals, review articles, clinical studies
- PubMed

d. Time period-

data was collected and interpreted between 3rd feb 2020 to 3rd May 2020.

5 Research tools and techniques-

Research tool used was excel and all the analysis was done using this tool. The information used was collected through secondary sources like clinical trials.gov, company websites, journals, etc. The gathered information was entered into a presentation. All information was analyzed and after interpretation entered in final report.

6 Part: A

6.1 Disease profile

Autism spectrum disorders are neuro-developmental types of mental disorders. This includes autism and Asperger's syndrome. The person with the autistic spectrum often has difficulties and problems with social interaction and interactions and their behavior shows limitations and repetitive patterns, they may lose interest in activities. Symptoms are usually identified between one and two years. On the other hand, if we talk about long-term problems, we may see difficulties in doing daily tasks, building and keeping relationships, and managing jobs. The cause of the autism spectrum is uncertain. Older parents, family history of autism, and certain genetic conditions are risk factors for autism. It is estimated that between 64% and 91% of the risk is due to family history. Symptoms are the basis for diagnosis. In 2013, the Statistical Manual of Mental Disorders Version 5 (DSM-5) was replaced with a single word, "Autism Spectrum Disorder", of the previous autistic disorder, Asperger's syndrome, PDD-NOS and childhood dissociative disorder.

6.2 Classification

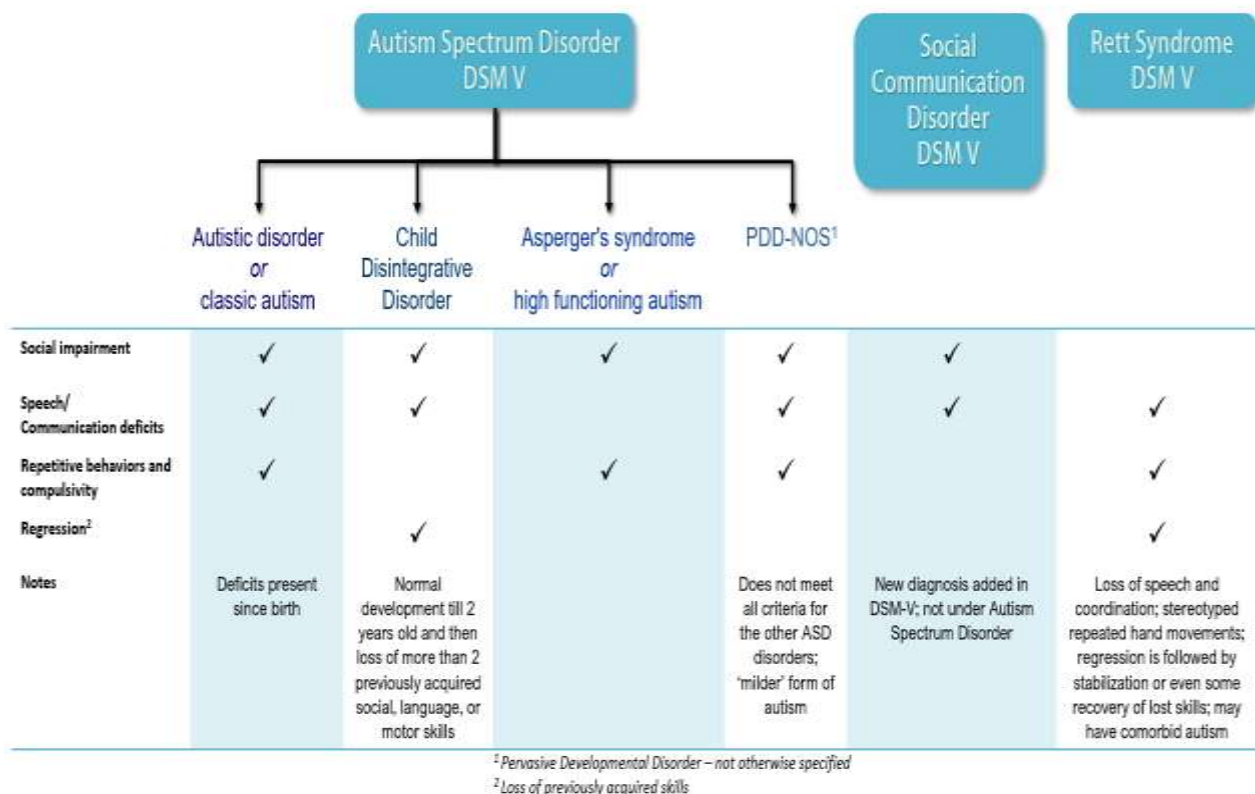


Figure:1 -By Anwer2007 - Own work, CC BY-SA 4.0,

6.3 Sign and symptoms-

ASD can be distinguished by “constant challenges with social communication and interaction, and by the presence of restricted, repetitive patterns of behavior, interests, or activities”. Symptoms of ASD arise in early childhood and have negative effect on function. Savant syndrome is also a disorder, there are high chances of co-occurrence of this disorder with autism. It is found that 1 in 10 with autism and savant syndrome can show excellent performance in art, music and mathematics. Approx. 50% of children suffering with ASD can be found indulge in some type of self-harming activities.

Asperger syndrome was defined as different entity from autism in the DSM-IV because of lack of delay or deviance in language development in child. We can also see, individuals identified with Asperger syndrome did not have that much of notable cognitive delays. PDD-NOS was "subthreshold autism" and "atypical autism" because it shows low level of symptoms of autism or symptoms in only one specific domain. The DSM-5 combined: “Asperger Syndrome, Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS), Childhood Disintegrative Disorder, and Autistic Disorder” and grouped them under one category of diagnosis of Autism Spectrum Disorder.

Other characteristics of ASD include RRBs. These are a combination of gestures and behaviors as defined in the “Diagnostic and Statistical Manual for Mental Disorders”

- Diverse body posture
- Atypical facial expressions
- Voice is an unusual tone of voice
- very little eye contact
- Difficulty in understanding the language
- Delay in learning to speak
- Dull speech
- Improper social interaction
- Focus on one aspect
- Lack of empathy
- Inability to understand social evidence
- Difficult to learn
- Bias with specific elements
- Problems in social conversation
- Repetition of certain words or phrases
- Repetitive movements
- The nature of self-harm
- Sleep is an inappropriate sleep routine

6.4 Treatment approaches-

Research tells us that a minimum of 2 year of appropriate educational setting for these children prior to the normal start of school can significantly improve the performance of children with autism spectrum syndrome. Once autism is diagnosed, the intervention instruction should begin as soon as possible. These programs should focus on developing communication, social, and cognitive skills.

Applied Behavioral Analysis (ABA)

Applied behavioral analysis is based on principles of behavioral psychology. The learning from these principles works to systematically change the behavior.

Speech Therapy

We know that people with ASD have problems with social communication, and speech therapy plays an important role in treatment.

Occupational Therapy (OT)

Occupational therapy is a therapeutic approach that is used for sensory connectivity problems associated with ASD. It is useful for children who have fine motor skills such as dressing, using utensils, cutting with scissors and writing.

Physical Therapy (PT)

Physiotherapy consists of activities and exercises that can be used to improve gross motor skills and manage sensory connectivity issues, particularly those involving the individual's ability to feel and be aware of his body in space.

Medications

Treatment helps improve some of the behavioral symptoms of ASD, including irritability, aggressiveness, and self-destructive behavior. In addition, other treatments, including ABA, may be more effective by medically intervening or reducing disruptive behavior.

Supplements

Supplements are also used for helping the treatment. Omega 3 fatty acids , L-carnosine are some of the supplements used for this purpose.

6.5 Epidemiology-

In 2014 Baio et al., estimated that “ASD prevalence was 16.8 per 1,000 (1 in 59) children 8 years of age”. The 2016 NSCH estimated that the parent-reported ASD prevalence to be 2.5%(1 in 40) in children aged 3–17 years. Baio et al., 2018 stated that “Variance in prevalence estimate systems could be partially due to regional and policy differences in the accessibility of evaluation and diagnostic services for children.

According to data from the CDC, ASD prevalence was comparatively higher in boys (26.6 per 1,000) than in girls (6.6 per 1,000). Baio et al., 2018 also stated that the ASD prevalence rate is greater in white children(17.2/1000) in comparison to black children(16.0/1000) by 7% where as when we compare with Hispanic children (14.0/1000) we can found it is 22% lower than white children. the estimated rate of prevalence for Asian/pacific was found to be 13.5/1000.

6.6 Unmet needs

- Any treatment approach is not guaranteed to give result.
- Treatment needs to be for a very long time.

6.7 Marketed omega3 syrup supplements

Table: 1

Brands	Packing	Total Omega 3	EPA+ DHA	Vit D3	Flavor	Company	Mfg. Company	Year of Brand Launch	MRP	Cost of Therapy/ Day
Cogni3	200 ml	705 mg	376+235 mg	-	Mango & Peach	VEFA	VEFA	2019	1195	Rs. 60
Brain UP	150 ml	943/613 mg/5m	311+207 mg	200 IU + VitA 800	Pineapple	NAAV	Quixotic Solan	2017	1047	Rs.70
Brain Wise	150 ml	600 mg/ 5 ml	250+190	-	Mango	Zuventus	SPB	2010	1160	Rs.77
Cos3	200 ml	705 mg	376+235 mg	200 IU	Mix berry	Delcure	Influx	2019	1195	Rs. 60

BrainIQ	150 ml	590 mg/ 5 ml	250+185 mg	-	Mango	Nutrigold	SPB	2017	1150	Rs 76
Brain rise	150 ml	700 mg	320 mg+ 265 mg/ 5 ml (Sugar 1.7 gm)	-		Salubria	Divine PV	2019	995 Rs	Rs. 66
Brain Plus	150 ml	700 mg	320 mg+ 265 mg/ 5 ml (Sugar 1.7 gm)	200 IU	Alphanso	Daaso	Divine Nutrition	2019	1050	70
Pediawise	150 ml & 300 ml	1000 mg/ 5 ml	DHA 400 mg +EPA 100 mg+ Sucrose	-	Mango	Astrum	Influx	2019	Rs 999	66.6
Calibrain D	200 ml	200 mg	DHA 200 mg + Vitamin D3 200 IU	200 IU	Mango	Brio Bliss	Kniss Lab	2014	1170	117
Docowize	100 ml	DHA 200 mg per 5 ml + 5 mg	Veg source	-		Apex	Huntra Labs, Puducherry	-	Rs. 1200	60-120

6.8 Attribute analysis of products used as supplement for ASD in Delhi in comparison to cogni3

Unlike of Cognicare and brain wise cogni3 is verified by various labs for its safety and efficiency. Indian authorities also have given certificate to Cogni 3 for its safety and efficiency

Table: 2

attributes		CogniCare	
company	Vefa ilac	Brio bliss life sciences	zuventus
molecule	DHA/EPA	l-carnosine	DHA/EPA
ROA	Oral	oral	oral

Target population	Age:5year and above, treatment targeted to Cognition, DC,ADHD, Autism, Drug-resistant epilepsy & behavioral improvement	Age:5year and above, target majorly Autism, ADHD, Epilepsy, Learning Disorders	Age:5year and above, Cognition, DC,ADHD, Autism, Drug-resistant epilepsy & behavioral improvement
approvals	IFOS, FSSAI	FSSAI	-
GMP certified of manufacturing plant	Yes	no	no
strength	EPA 376 mg+ DHA 235 mg / 10 ml	100mg/5ml	epa250+dha190/10ml
Sugar free	Yes	no	no
moa			
flavor	Mango and peach	bubblegum	mango
price	1195/200ml	1080/200ml	1160/150ml
Cost/day	60	108	70
Frequency and dosing	10ml-20ml/od	10ml-20ml/bd	10ml/od
%concentration	86.67	-	73.33
safety	All type of allergen free. Very low chance of hypersensitivity. Not to be taken with warfarin and other anticoagulants.	In some rare cases itchiness, dry mouth, changes in appetite, feelings of tiredness, or vivid dreams.	Fishy aftertaste Nausea Very rarely Rash, Itching/swelling, And Severe dizziness can appear.

High impact	Medium impact	Low impact
-------------	---------------	------------

6.9 Competitive landscape of pipeline products

6.9.1 Phase-1

TABLE: 3

No.	Mol.Name/Intervention	Sponsor/Collaborators	Location
1	Biological: hCT-MSC infusion	Duke University The Marcus Foundation	USA
2	Device: intermittent theta burst stimulation	Chang Gung Memorial Hospital	Taiwan
3	Biological: Autologous	PerkinElmer, Inc.	USA

	Umbilical Cord Blood		
4	Drug: Ketamine Drug: Placebo	Roivant Sciences, Inc. Cures Within Reach	USA
5	Drug: Oxytocin Drug: Vasopressin	NIMH	USA
6	Drug: Citalopram	University of North Carolina (NIMH)	USA
7	Drug: intranasal oxytocin Dietary Supplement: oral probiotics	Massachusetts General Hospital	USA
8	Drug: Cariprazine	Allergan	USA
9	Drug: Minocycline	University of California	USA
10	Drug: Mitochondrial Cocktail	Drexel University	USA
11	Biological: hCT-MSC infusion	Joanne Kurtzberg, MD The Marcus Foundation Duke University	USA
12	Drug: Minocycline	Children's Hospital Medical Center	USA
13	Drug: Balovaptan Drug: Esomeprazole	Hoffmann-La Roche	USA
14	Drug: Balovaptan	Hoffmann-La Roche	USA
15	Drug: RO7017773 Other: [11C] Ro15-4513	Hoffmann-La Roche	United Kingdom
16	Drug: Oxytocin	University of North Carolina Duke University NICHD	USA
17	Drug: Trichuris Suis Ova	Montefiore Medical Center Simons Foundation	USA
18	Drug: Sulforaphane	University of Massachusetts Johns Hopkins University	USA
19	Drug: 8IU intranasal oxytocin	Opti Nose AS Oslo University Hospital	Norway
20	Drug: BB-12 with LGG	The University of Texas Health Science Center	USA
21	Biological: FMT versus placebo	Children's Hospital Los Angeles	USA
22	Drug: Intranasal oxytocin Biological: Autologous umbilical cord blood	Fundatia Bio-Forum SpitalulAngiomedica	Romania
23	Drug: Oxytocin	University of California,	USA
24	Drug: mecamlamine	Ohio State University Autism Speaks	USA
25	Biological: ASD CB-MNC infusion	INBIO, LLC	Russian Federation
26	Drug: Suramin Drug: Saline	University of California	USA
27	Drug: Transdermal nicotine	Yale University Autism Speaks	USA
28	Drug: BB-12 with LGG Drug:	The University of Texas Health	USA

	Placebo	Science Center	
29	Biological: ASD CB-MNC injection Other: Standard therapy.	State-Financed Health Facility "Samara Regional Medical Center Dinasty"	Russian Federation
30	Device: Superpower Glass	Stanford University	USA
31	Drug: oral Vancomycin Drug: MoviPrep Drug: Prilosec	Arizona State University University of Arizona University of Minnesota	USA
32	Drug: low dose naltrexone	Hadassah Medical Organization Jerusalem Institute for Child Development	Israel
33	Drug: Risperidone	Children's Hospital Medical Center	USA
34	Drug: oral zinc and vitamin C supplements	Milton S. Hershey Medical Center Thrasher Research Fund	USA
35	Device: repetitive TMS	Chang Gung Memorial Hospital	Taiwan
36	Behavioral: Neuro Modulation Technique	Neuro Modulation Technique Research Institute	USA
37	Drug: Risperidone	Children's Hospital Medical Center (NICHD)	USA
38	Other: Cholesterol	(NICHD) National Institutes of Health Clinical Center	USA
39	Biological: Umbilical cord, mesenchymal stem cells	Translational Biosciences	Panama
40	Drug: tasimelteon	Vanda Pharmaceuticals	USA
41	Procedure: Acupressure treatments and NAET treatments	Nambudripad's Allergy Research Foundation	USA
42	Drug: Lurasidone	Sunovion	USA
43	Drug: Drug: Syntocinon	Maria-de-las Mercedes Perez Rodriguez Icahn School of Medicine	USA
44	Drug: [18F]FPEB	Institute for Neurodegenerative Disorders	USA
45	Drug: Oxytocin	University of Sao Paulo General Hospital	Brazil
46	Drug: Circadin	Neurim Pharmaceuticals Ltd.	Netherlands
47	Drug: RO5028442	Hoffmann-La Roche	USA
48	Drug: DMXB-A	University of Colorado, Denver	USA
49	Procedure: Spinal Manipulative Therapy (SMT)	Southern California University of Health Sciences	USA
50	Drug: Oxytocin	Anagnostou , Evdokia, M.D.	USA
51	Drug: Donepezil hydrochloride	(NIMH)	USA
52	Biological: STEM CELL THERAPY	Chaitanya Hospital, Pune	India
53	Fat Harvesting	Ageless Regenerative Institute	USA

	Stem Cell Injection	Instituto de MedicinaRegenerativa	
54	Biological: human cord blood mononuclear cells	Shenzhen Beike Bio-Technology Co., Ltd.	China
55	Drug: Buspirone	Chugani, Diane C.	USA
56	Other: Speech Therapy	Federal University of SÃ£o Paulo	Brazil
57	Drug: supplemental liquid melatonin	Vanderbilt University (NICHD)	USA
58	Drug: DMSA - dimercaptosuccinic acid	Southwest College of Naturopathic Medicine	USA

6.9.2 Phase -2

TABLE: 4

No.	Interventions	Sponsor/Collaborators	Locations
1	Drug: ketamine and dexmedetomidine	Guangzhou Women and Children's Medical Center	china
2	Drug: IGF-1	Icahn School of Medicine Autism Science Foundation	USA
3	Drug: TTA-121	Hamamatsu University “Japan Agency for Medical Research and Development”	japan
4	Drug: GWP42006	GW Research Ltd	USA
5	Drug: Wide-spectrum nutritional supplement	Phoenix Children Hospital	USA
6	Drug: Intranasal Oxytocin	EvdokiaAnagnostou Holland Bloorview Kids Rehabilitation Hospital	Canada
7	Drug: Cannabidivarin	GW Pharmaceuticals Ltd.	USA
8	Drug: Sertraline Liquid Placebo Drug: Sertraline	(HRSA) University of California	USA
9	Drug: Bumetanide	Xinhua Hospital, Shanghai Jiao Tong University School of Medicine	china
10	Drug: JNJ-42165279	Janssen Research & Development, LLC	USA
11	Drug: Melatonin and Donepezil	Stony Brook University	USA
12	Drug: Tideglusib	EvdokiaAnagnostou Holland Bloorview Kids Rehabilitation Hospital McMaster University	Canada
13	Drug: RO5285119	Hoffmann-La Roche	USA
14	Drug: Oxytocin	Massachusetts General Hospital	USA

15	Drug: AZD7325	University of California	USA
16	Drug: N-acetylcysteine	Emory University	USA
17	Drug: RO7017773	Hoffmann-La Roche	USA
18	Drug: RG7314	Hoffmann-La Roche	USA
19	Drug: Folinic Acid	Emory University (NICHD)	USA
20	Drug: Arbaclofen	Seaside Therapeutics, Inc.	USA
21	Drug: Arbaclofen	Seaside Therapeutics, Inc.	USA
22	Drug: Buspirone	Massachusetts General Hospital	USA
23	Drug: Pioglitazone Drug: Placebo	EvdokiaAnagnostou	Canada
24	Drug: Levoleucovorin Calcium	Phoenix Children's Hospital/New York State Institute for Basic Research	USA
25	Drug: Omega-3 Fatty Acids	Hugo W. Moser Research Institute at Kennedy Krieger, Inc.	USA
26	Drug: Intranasal Oxytocin	EvdokiaAnagnostou	Canada
27	Drug: 98% pure CBD	NYU Langone Health	USA
28	Biological: Cord Blood Infusion	Joanne Kurtzberg, MD Duke University	USA
29	Drug: Arbaclofen	EvdokiaAnagnostou	Canada
30	Drug: Sertraline Behavioral: CBT/BIACA	University of California, Davis	USA
31	Dietary Supplement: Omega-3 Fatty Acids	EvdokiaAnagnostou Holland Bloorview Kids Rehabilitation Hospital	Canada
32	Drug: N-Acetylcysteine	Stanford University (NICHD)	
33	Drug: Intranasal Oxytocin (Trade name: Syntocinon)	Robert Schultz Children's Hospital of Philadelphia	USA
34	Drug: Intranasal Oxytocin	University of Minnesota	USA
35	Drug: Oxytocin Nasal Spray	Linmarie Sikich (NICHD) Duke University	USA
36	Drug: Vasopressin	Stanford University / National Institute of Mental Health (NIMH)	USA
37	Drug: Memantine	EvdokiaAnagnostou	USA
38	Biological: Essential Oil	Jill Hollway Young Living Essential Oils	USA
39	Drug: Sulforaphane	University of North Carolina	USA
40	Drug: Aripiprazole	Cambridge Health Alliance Bristol-Myers Squibb	USA
41	Drug: Pregnenolone	Stanford University Simons Foundation	USA
42	Drug: CP101	Finch Research and Development LLC.	
43	Drug: Risperidone	University of California, Los	USA

		Angeles	
44	Drug: Esomeprazole	Stanford University SPARK (Stanford University)	USA
45	Drug: lenalidomide	Sutter Medical Foundation	
46	Drug: aripiprazole	University of North Carolina, Chapel Hill Bristol-Myers Squibb	USA
47	Drug: Vasopressin (USP) Injectable Solution [Vasostriect]	Stanford University (NICHD)	USA
48	Drug: N-acetylcysteine	Indiana University School of Medicine	USA
49	Drug: Amphetamine	Duke University (NICHD)	USA
50	Drug: Levoleucovorin Calcium	Phoenix Children's Hospital Autism Speaks	USA
51	Drug: Acamprosate	Indiana University	USA
52	Combination Product: vancomycin, Miralax, intestinal microbiota	Arizona State University Finch Therapeutics	USA
53	Drug: Methylphenidate	Children's Hospital Medical Center	USA
54	Drug: Memantine Hydrochloride (HCl)	Forest Laboratories	USA
55	Drug: aripiprazole	Indiana University School of Medicine Bristol-Myers Squibb(BMS)	USA
56	Drug: Propranolol	Rutgers	USA
57	Drug: Riluzole	National Institute of Mental Health (NIMH) National Institutes of Health Clinical Center (CC)	USA
58	Drug: citalopram hydrobromide	Boston University (NIMH)	USA
59	Drug: Sulforaphane	Rutgers Rowan University	USA
60	Drug: Nuedexta	Sutter Health	USA
61	Drug: Cannabinoids	ShaareZedek Medical Center	Israel

6.9.3 Phase -3

TABLE: 5

No.	Interventions	Sponsor/Collaborators	Locations
1	Drug: Balovaptan	Hoffmann-La Roche	USA
2	Drug: Memantine	Massachusetts General Hospital	USA
3	Drug: Brexpiprazole	Otsuka Pharmaceutical	USA

4	Drug: BUMETANIDE/S95008	Institut de RecherchesInternationalesServier	USA
5	Drug: Brexpiprazole	Otsuka Pharmaceutical	USA
6	Drug: Melatonin	Neurim Pharmaceuticals Ltd.	
7	Drug: Bumetanide Oral Solution	Institut de RecherchesInternationalesServier	Australia
8	Drug: Mirtazapine	Massachusetts General Hospital Autism Speaks	USA
9	Drug: Metformin	EvdokiaAnagnostou	USA
10	Drug: Intranasal Oxytocin	Massachusetts General Hospital	USA
11	Drug: Oxytocin	KU Leuven	Belgium
12	Drug: Aripiprazole oral product	(NIMH) Bristol-Myers Squibb	USA
13	Drug: D-cycloserine	Indiana University USA Department of Defense	USA
14	Drug: Riluzole	Children's Hospital Medical Center	USA
15	Drug: folinic acid	University of California,	USA
16	Drug: NPC-15 Granules	Nobel pharma	
17	Drug: Memantine Hydrochloride	Massachusetts General Hospital	USA
18	Drug: risperidone	Janssen-Ortho Inc.	
19	Drug: Atomoxetine	Massachusetts General Hospital (NIMH)	USA
20	Drug: Methylphenidate Transdermal System	University of Oklahoma Mark L. Wolraich, M.D.	USA
21	Drug: Methyl B12	University of California	USA
22	Drug: arbaclofen	Seaside Therapeutics, Inc.	USA
23	Drug: secretin	(NICHD) (NIDCD)	USA
24	Drug: Aripiprazole Oral Solution	Otsuka Beijing Research Institute	china
25	Drug: Fluoxetine	Neuropharm Autism Speaks	USA
26	Drug: Aripiprazole	Otsuka Pharmaceutical	USA
27	Drug: Lurasidone	Sunovion	USA
28	Drug: Aripiprazole	Otsuka Pharmaceutical	USA
29	Drug: CM-AT	Curemark	USA
30	Drug: D-cycloserine	Indiana University (NIMH)	USA
31	Drug: Aripiprazole	Otsuka Pharmaceutical	USA
32	Drug: Risperidone	National Institute of Mental Health (NIMH)	USA
33	Dietary Supplement: Sulforaphane	University of California	USA
34	Drug: Aripiprazole	Indiana University National Institute of Mental Health (NIMH)	USA
35	Drug: Paliperidone ER	Indiana University Ortho-McNeil Janssen Scientific Affairs, LLC	USA
36	Drug: Risperdal	Ohio State University	USA

37	Drug: fluvoxamine	The Hospital for Sick Children	Canada
38	Drug: Galantamine	University of Medicine and Dentistry	USA
39	Drug: bumetanide	University Hospital, Brest	France
40	Drug: RG1068 (Synthetic Human Secretin)	Repligen Corporation	USA
41	Drug: Buspirone	Chugani, Diane C. (NINDS)	USA
42	Drug: Kuvan®	The Children's Health Council BioMarin Pharmaceutical	USA
43	Drug: Acamprosate	Children's Hospital Medical Center, Cincinnati Autism Speaks	USA
44	Drug: methylcobalamin	University of California, San Francisco	USA
45	Drug: Risperidone	University of California (NIMH)	USA
46	Drug: Olanzapine	Drexel University (NIMH)	USA
47	Drug: Aripiprazole	Otsuka Pharmaceutical Co., Ltd.	japan
48	Drug: Risperidone Drug: Placebo	Janssen Pharmaceutical K.K.	japan
49	Drug: Methylphenidate	The University of Texas Health Science Center (NIMH)	USA
50	Drug: Liquid Vitamin D	University of California	USA

6.9.4 Phase- 4

TABLE:6

No.	Interventions	Sponsor/Collaborators	Locations
1	Drug: Syntocinon (Oxytocin)	KU Leuven	
2	Drug: Buspirone	Massachusetts General Hospital	USA
3	Dietary Supplement: Omega-3 fatty acids	National Healthcare Group	Singapore
4	Drug: Memantine	Massachusetts General Hospital	USA
5	Drug: Aripiprazole	University of North Carolina (NIMH)	USA
6	Drug: Open-label Treatment with Omega-3 Fatty Acids + Inositol	Massachusetts General Hospital .Demarest Lloyd Jr. Foundation	USA
7	Drug: LisdexamfetamineDimesylate	JPM van Stralen Medicine Professional Shire	Canada
8	Drug: extended release guanfacine	Yale University Emory University (NIMH)	USA
9	Drug: extended-release Methylphenidate liquid formulation	Massachusetts General Hospital	USA
10	Drug: Atomoxetine	Eli Lilly and Company	Netherlands

11	Drug: Milnacipran	Montefiore Medical Center Forest Laboratories	USA
12	Drug: Quillivant XR	Seattle Children's Hospital Pfizer	USA
13	Drug: Metformin	Cambridge Health Alliance American Psychiatric Association	USA
14	Drug: atomoxetine	University of Rochester University of Pittsburgh	USA
15	Drug: risperidone	Washington University School of Medicine (NIMH)	USA
16	Drug: Dexmedetomidine	Rabin Medical Center	
17	Drug: Aripiprazole Drug: Risperidone	Medical University of South Carolina	USA
18	Drug: Risperidone	Johnson & Johnson Pharmaceutical Research & Development, L.L.C.	USA
19	Drug: Aripiprazole	Bristol-Myers Squibb	USA
20	Drug: Divalproex Sodium ER	Montefiore Medical Center	USA
21	Drug: Minocycline	National Institute of Mental Health (NIMH)	USA
22	Drug: Risperidone	Augusta University Ortho-McNeil Janssen Scientific Affairs, LLC	USA

6.10 Attribute analysis of high impact pipeline assets

Table: 7

Sponsors and Collaborators	Hoffmann-La Roche	Massachusetts General Hospital	Massachusetts General Hospital/ Demarest Lloyd Jr. Foundation	JPM van Stralen Medicine Professional/ Shire
Molecule name	Balovaptan	buspirone	Omega-3 Fatty Acids + Inositol	Lisdexamfetamine dimethyl esylate
moa	selective small molecule antagonist of the	acts as an agonist of the serotonin 5-HT1A receptor with high	DHA in its lysophosphatidylcholine form is transported into brain by a	It is a prodrug of dextroamphetamine. It is a non-catecholamine sympathomimetic amine

	vasopressin V1A receptor	affinity	membrane transport protein, MFSD2A, which is exclusively expressed in the endothelium of the BBB	with CNS stimulant activity.
Phase	Phase 3(NCT03504917) Recruitment Status : Active, not recruiting	Phase4(NCT03538431) Recruitment Status : Recruiting	Phase4(NCT03757585) Recruitment Status : Recruiting	Phase 4 (NCT03337646) Recruitment Status : Recruiting
Patient number	322	24	60	40
ROA	Oral	oral	Oral	Oral
Dosing	10mg/od	10mg/od for 6weeks	1020mg QAM + 1020mg QPM based on weight the dose can be changed (25kgand below: 1000mg QD; 25kg or more: 2000mg QD). 6weeks	30 mg OD in morning in patients ages 6 and above. Dosage may be adjusted in increments of 10 mg or 20 mg at approximately weekly intervals up to maximum dose of 70 mg/day
Region	Canada, France, Italy, Spain, United Kingdom, USA	USA	USA	Canada

6.11 Line of therapy

Table:8

	Marketed	Pipeline
First Line of Therapy	Amphetamine, Citalopram, Paroxetine, Fluvoxamine	Cm-At (Phase3) Balovaptan (Phase4), Bupirone(Phase4)

Second Line of Therapy	Risperidone Aripiprazole	LisdexamfetamineDimesylate(Phase4)
Supplement	Omega-3 L-Carnosine	Combination of Omega-3 And Inositol Sulforaphane Liquid Vit-D Luteolin, Quercetin and Rutin Combined in A Capsule
Behavioral Therapy Approaches	Aba, Occupational Therapy , Speech Therapy	Auditory-Motor Mapping Training, Problem Solving Education, Personalized Cognitive-Behavioral Therapy
Biological	-	Stem Cell Therapy, Autologous Umbilical Cord Blood, ASD Cb-Mnc Injection
Device	Cogniable	My Screener, Superpower Glass

7 Part: b

To Study the Role of omega3 in wellness therapies and management of cognitive disorders.

7.1 Omega 3

Omega 3 fatty acids, also known as omega-3 oils, are polyunsaturated fatty acids (PUFAs) distinguished by the presence of a double bond three atoms away from the final methyl group in their chemical composition. They are widely present in nature, being important components of animal lipid metabolism, and they play an important role in human diet and human physiology.

Mammals, including humans, can synthesize some monounsaturated fatty acids from saturated fatty acids and carbon groups in carbohydrates and proteins, but they have the required delta (12) 12 and des15 dextrous to put a cis double bond on n-6 or n-3. Enzymes are deficient in a fatty acid state 3. Accordingly, omega-6 and omega-3 fatty acids are essential nutrients. The basic fatty acid of the omega-6 chain is linoleic acid, and the basic fatty acid of the omega-3 chain is ALA. Humans synthesized with long-chain (chain with 20 carbons or more) omega-6 fatty acids, such as dihomo-a-linolenic acid and arachidonic acid, LA and long-chain omega-3 fatty acids, such as eicosopentanoic acid and docosahenicoaneca acid, from ALA.

7.2 Chemistry

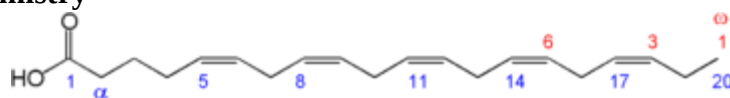


Figure:2 Chemical structure of eicosapentaenoic acid (EPA)

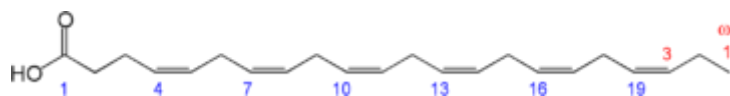


Figure:3 Chemical structure of docosahexaenoic acid (DHA)

An omega 3 fatty acid is a fatty acid consisting of several double bonds, where the first double bond is between the third and fourth carbon atoms from the end of the carbon atom chain. Short chain omega 3 fatty acids have a chain of 18 carbon atoms or less, while the "long chain" omega 3 fatty acids have a chain of 20 or more.

Omega-3 fatty acids are very important for human physiology, ALA, DHA and EPA. These three polyunsaturates have 3, 5 or 6 double bonds in a carbon chain of 18, 20 or 22 carbon atoms, respectively. As we can see with most naturally produced fatty acids, all double bonds are in the cis-configuration, in other words, two hydrogen atoms are on the same side of the double bond; And double bonds are constrained by methylene bridges (-CH₂-), leading to two single bonds between each pair of adjacent double bonds Chemistry.

7.3 List of omega-3 fatty acids

Table: 9

The table below contains some of the omega-3 fatty acids found in nature.

Name	Chemical formula
Hexadecatrienoic Acid	all-cis-7,10,13-hexadecatrienoic acid 16:3(n-3)
Docosapentaenoic Acid , Clupanodonic Acid	all-cis-7,10,13,16,19-docosapentaenoic acid 22:5(n-3)
Docosahexaenoic Acid	all-cis-4,7,10,13,16,19-docosahexaenoic acid 22:6(n-3)

Tetracosapentaenoic Acid	all-cis-9,12,15,18,21-tetracosapentaenoic acid 24:5(n-3)
Nisinic Acid	all-cis-6,9,12,15,18,21-tetracosahexaenoic acid 24:6(n-3)
Eicosatrienoic Acid	all-cis-11,14,17-eicosatrienoic acid 20:3(n-3)
alpha-Linolenic Acid	all-cis-9,12,15-octadecatrienoic acid 18:3(n-3)
Stearidonic Acid	all-cis-6,9,12,15-octadecatetraenoic acid 18:4(n-3)
Heneicosapentaenoic Acid	all-cis-6,9,12,15,18-heneicosapentaenoic acid 21:5(n-3)
Eicosatetraenoic Acid	all-cis-8,11,14,17-eicosatetraenoic acid 20:4(n-3)
Eicosapentaenoic Acid	all-cis-5,8,11,14,17-eicosapentaenoic acid 20:5(n-3)

7.4 Food sources containing Omega-3 fatty acids

7.4.1 α -Linolenic acid (ALA): .

Flax seeds, walnuts and their oils are one of the ALA's most prolific food sources. Canola oil is one of the best sources of ALA. Food surveys in the US average 1.8 to 2.0 g per day for ALA and 1.4 to 1.5 g per day for women. Below are some foods with high amounts of ALA -

table: 10- Food Sources of α -Linolenic Acid

Food	Serving	α -Linolenic acid (g)
Flaxseed oil	1.0 TS	7.3
Chia seeds(dried)	1.0 ounce	5.1
Walnuts(English)	1.0 ounce	2.6
Flaxseeds(ground)	1.0 TS	1.6
Walnut oil	1.0 TS	1.4

Canola oil	1.0 TS	1.3
Soybean oil	1.0 TS	0.9
Mustard oil	1.0 TS	0.8
Walnuts(black)	1.0 ounce	0.6
Tofu	½ cup	0.2
*TS= TABLESPOON		

7.4.2 Eicosapentaenoic acid and docosahexaenoic acid

According to a survey in the US, EPA has an average intake of 0.03 to 0.06 grams per day and DHA average 0.05 to 0.10 grams per day. Oily fish are the main food sources of EPA and DHA; eggs rich in omega-3 fatty acids are also available in the US. The following table lists some foods that are high in EPA and DHA.

Table: 11- Food Sources containing EPA and DHA

Name	Amount (ounce*)	EPA (g)	DHA (g)	Amount Providing 1 g of EPA + DHA(ounce*)
Herring(Pacific)	3	1.06	0.75	1.5
Salmon(chinook)	3	0.86	0.62	2
Sardines(Pacific)	3	0.45	0.74	2.5
Salmon(Atlantic)	3	0.28	0.95	2.5
Oysters(Pacific)	3	0.75	0.43	2.5
Salmon(sockeye)	3	0.45	0.60	3
Trout, rainbow	3	0.40	0.44	3.5

Tuna, canned, white	3	0.20	0.54	4
Crab(Dungeness)	3	0.24	0.10	9
Tuna, canned, light	3	0.04	0.19	12
* Card deck size approx. Equivalent to three ounces of fish.				

7.5 Forms

Omega 3 fatty acids are naturally occurring in two forms: triglycerides and phospholipids. In triglycerides, they bind with other fatty acids to glycerol; Can be converted into acids or methyl or ethyl esters and individual esters of omega fat 3 fatty acids are available.

7.6 Biochemistry

7.6.1 Transporters

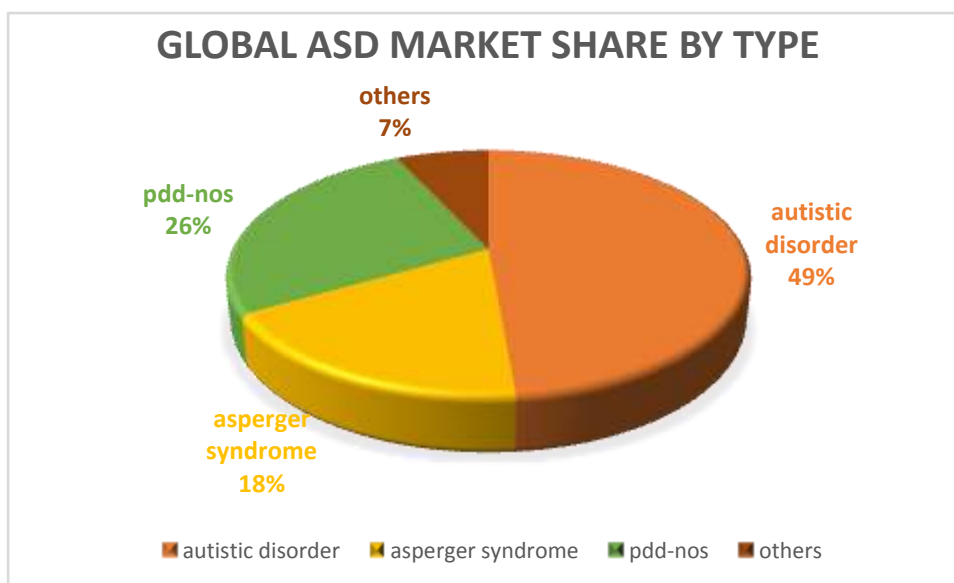
DHA is transported to the brain in the form of its lysophosphatidylcholine by the membrane transport protein, MFSD2A, which is uniquely expressed in the endothelium of the BBB.

7.7 Omega-3 index

The omega-3 index is the total amount of EPA and DHA in the components of red blood cells expressed as a percentage (%) of the red blood cell membranes in the membrane. The EPA + DHA content of red blood cell membranes corresponds to that of cardiac muscle cells, and some experimental studies show that low omega-3 index is associated with increased risk of coronary heart disease deaths. It is therefore suggested that the omega-3 index be used as a risk biomarker for cardiovascular disease, with a suggested reduction as follows: high risk, <4%; medium risk, 4% -8%; and low risk, > 8% .The addition of EPA + DHA about 5 months of dose-reliably increased the omega-3 index to 115 healthy, older adults (20 to 5 years), confirming the use of -omega-3 index as an EPA + DHA drinking biomarker. Before the omega-3 index is used in routine clinical trials, however, medical diagnostic dosages should be established in humans. In addition, fatty acid metabolism can be altered in certain pathological studies, with the possibility that the omega-3 index may be less effective in other cardiovascular conditions.

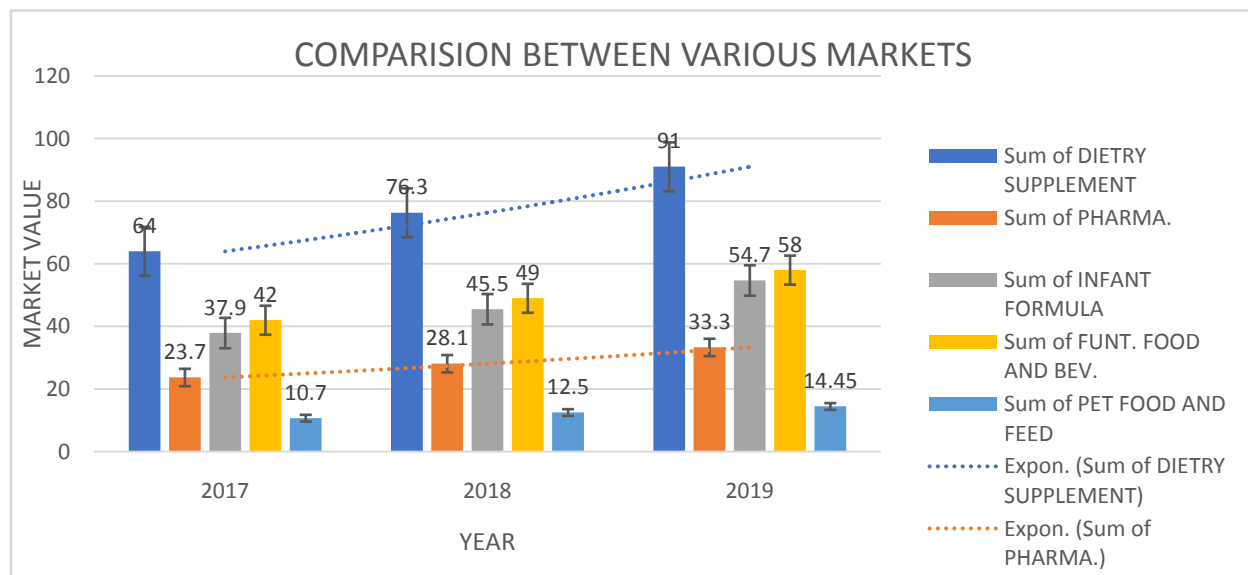
7.8 MARKET OVERVIEW

7.8.1 Global ASD market share by type



Graph: 1

7.8.2 COMPARATIVE VIEW OF VARIOUS MARKETS IN COMPARISION TO DIETARY SUPPLEMENT MARKET

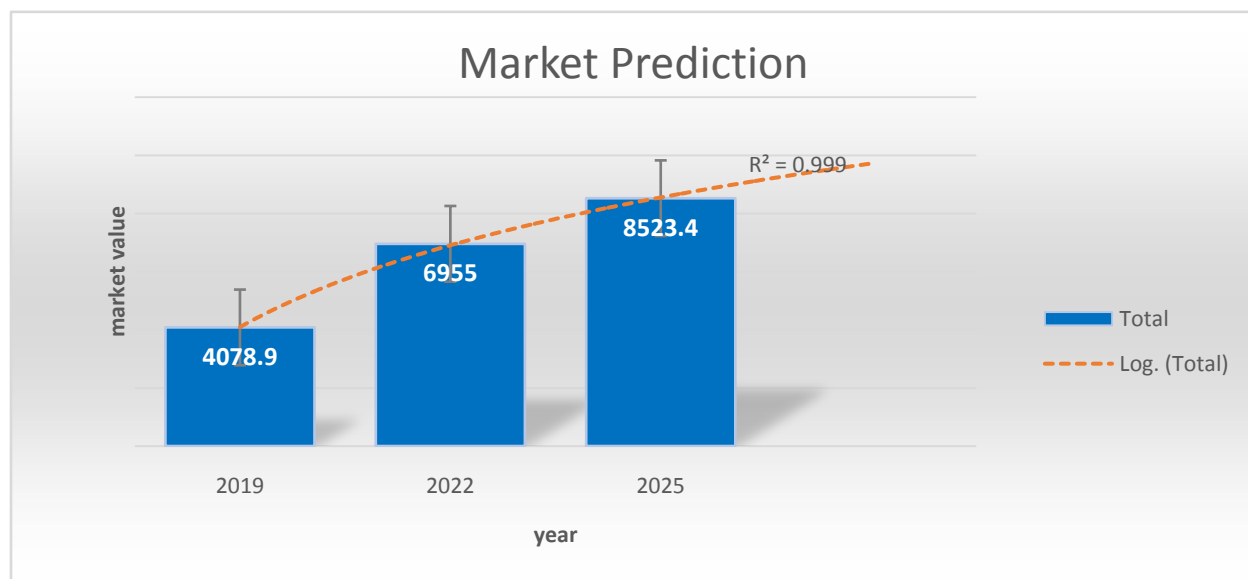


Graph: 2

7.8.3 Market scenario of omega 3

Growth rate of pharmaceutical application of dha market-18% CAGR(2016-2022)

Graph: 3 Expected market value prediction-



7.9 USE OF OMEGA 3 IN WELLNESS THERAPIES

- **Supplementation in pregnant women**

Effect on pregnancy conditions and neonatal outcomes:

The randomized control trials of omega 3 involving pregnant women shows that the effect of omega 3 supplementation is giving a significant effect in prolonging the gestation period of women with lower level of omega 3 levels. On the other hand, when we see the effect of omega 3 fatty acid on the incidence of gestational diabetes and preeclampsia it is not that significant.

Supplementation in infants-

The major part of accumulation of dha in brain and retina takes place in the last trimester and first 6 months of post-natal life, so this time period is very important. We know that Human milk also contains 46% of saturated fatty acids, 41% of monounsaturated fatty acids, 12% of omega-6 fatty acid, and 1.3% of omega-3 fatty acid of its total fat content. ALA is used for supplementation in conventional infant formula from a long time but only from 2001 DHA and EPA came into limelight and got place in conventional infant formulas.

The deterioration rate of dha is high in infants due to of this reason they are not able to maintain the plasma and cellular dha concentration despite of being able to synthesize DHA from ALA. So, they need additional dietary intake to maintain the level of omega3. So, due to of this reason now-a-days the infant formulas are supplemented with dha to maintain the plasma and cellular dha concentration of formula fed infants up to the level of breast-fed infants.

- **Heart disease-**

A analysis of 17 prospective study and two retrospective studies found in 45,637 healthy participants found that circulating concentrations of α -linolenic acid and omega-3 acid (i.e., EPA, DPA, and DHA) have been associated with increased risk of coronary heart disease (CHD).

Many observational studies have examined the association between ALA diet and risk of CHD. A meta-2018 analysis of 14 prospective cohort studies in a population of 345,202 non-CVD participants evaluated the risk of developing combination CHD (including CHD events) and fatal CHD in relation to ALA diet. Overall, the risk assessment found a low risk of 9% of combined CHD effects and a low 15% risk of fatal CHD with high ALA exposure .

Cochrane's 2018 systematic review examined the evidence for the impact of ALA and omega-3 acids on low-risk or high-risk CVD individuals (103). High and high quality evidence from randomized controlled trials (at least 1 month -12) have suggested that

there is no effect of omega-3 acids (either supplemented, improved in diet, or ordered to be consumed) at risk for CHD events, CVD events, arrhythmia, stroke, CHD deaths, CVD deaths, There were no evidence of any impact on secondary outcomes, including serious physical or cardiovascular events, MI, sudden cardiac death, angina pectoris, heart failure, stroke, peripheral arterial disease, and acute coronary syndrome (103). UFA addition of PUFA to prevent the death of cardiovascular disease in patients with risk or high risk of type 2 diabetes, to prevent CHD in patients with atherosclerotic disease (e.g., premature attack, vasiperial diabetes, hypercholesterolemia), injury prevention in patients with or without a history of stroke, as well as inhibition of atrial fibrillation in patients with previous atrial fibrillation or in those with heart failure. surgery. There was some evidence to suggest that the addition of long-acting omega-3 PUFA to patients with premature-treated patients could reduce the risk of CHD death, possibly due to a reduced risk of ischemia-indos

Evidence supports the adoption of a healthy diet that includes two servings of seafood per week, a high-fat supplement of omega-3 acid is unlikely to lead to cardiovascular benefits for ordinary people with low-risk CVD or for individuals at risk or type 2 diabetes mellitus . In its recommendations on omega-3 fatty acids and cardiovascular disease (see Intake Recommendations), the American Heart Association suggests that the addition of omega-3 PUFA for “chain” can help reduce mortality in patients with CHD (e.g., those who have MI) and in those with heart failure without preservation of ventricular function.

8. Conclusion

The pipeline review shows that various new regime of treatments are nurturing and will be seen in market in near future. The behavioral therapies are also being trialed for their result and advancement.

New medications in pipeline will be helpful in near future for ASD patients , the safety of these products should have to be reviewed and taken into consideration. The new regime of supplements can be a substitute for the medication with side effect because the research show that the amount of side effect of supplements is negligible in comparison to medicines. Stem cell therapy can be a milestone and will drastically change the market scenario in the coming days.

Use of omega 3 in wellness therapies will also affect the market as well as market dynamics. We can see that the omega3 can be used as supplement for pregnant mothers , growing children and infants for better cognitive growth .

Reference

1. Mehlman M. J. (2004). Cognition-enhancing drugs. *The Milbank quarterly*, 82(3), 483–506. <https://doi.org/10.1111/j.0887-378X.2004.00319.x>
2. <http://docowize.com/product/docosa-hexaenoic-aciddha-suspension/>
3. <https://www.psychguides.com/neurological-disorders/cognitive/>
4. <https://www.fortunebusinessinsights.com/industry-reports/autism-spectrum-disorder-therapeutics-market-101207>
5. www.cogni3.com/
6. <http://briobliss.com/bb/index.php/product/cognicare-syr/>
7. <https://www.healthline.com/nutrition/omega-3-benefits>
8. <https://www.1mg.com/>
9. <https://www.webmd.com/>
10. <https://clinicaltrials.gov/>
11. <https://www.nutritioninsight.com>
12. Shahidi, F., & Ambigaipalan, P. (2018). Omega-3 Polyunsaturated Fatty Acids and Their Health Benefits. *Annual review of food science and technology*, 9, 345–381. <https://doi.org/10.1146/annurev-food-111317-095850>
13. Jeromson, S., Gallagher, I. J., Galloway, S. D., & Hamilton, D. L. (2015). Omega-3 Fatty Acids and Skeletal Muscle Health. *Marine drugs*, 13(11), 6977–7004. <https://doi.org/10.3390/md13116977>
14. Cholewski, M., Tomczykowa, M., & Tomczyk, M. (2018). A Comprehensive Review of Chemistry, Sources and Bioavailability of Omega-3 Fatty Acids. *Nutrients*, 10(11), 1662. <https://doi.org/10.3390/nu10111662>
15. Rogers, T. S., & Seehusen, D. A. (2018). Omega-3 Fatty Acids and Cardiovascular Disease. *American family physician*, 97(9), 562–564.
16. Middleton, P., Gomersall, J. C., Gould, J. F., Shepherd, E., Olsen, S. F., & Makrides, M. (2018). Omega-3 fatty acid addition during pregnancy. *The Cochrane database of systematic reviews*, 11(11), CD003402. <https://doi.org/10.1002/14651858.CD003402.pub3>

17. Judge M. P. (2018). Omega-3 Fatty Acids in Maternity and Neonatal Care. *Journal of obstetric, gynecologic, and neonatal nursing : JOGNN*, 47(3), 427–428.
<https://doi.org/10.1016/j.jogn.2017.10.007>
18. Saccone, G., Saccone, I., & Berghella, V. (2016). Omega-3 long-chain polyunsaturated fatty acids and fish oil supplementation during pregnancy: which evidence? *The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians*, 29(15), 2389–2397.
<https://doi.org/10.3109/14767058.2015.1086742>
19. Lord, C., Elsabbagh, M., Baird, G., & Veenstra-Vanderweele, J. (2018). Autism spectrum disorder. *Lancet (London, England)*, 392(10146), 508–520.
[https://doi.org/10.1016/S0140-6736\(18\)31129-2](https://doi.org/10.1016/S0140-6736(18)31129-2)
20. Masi, A., DeMayo, M. M., Glozier, N., & Guastella, A. J. (2017). An Overview of Autism Spectrum Disorder, Heterogeneity and Treatment Options. *Neuroscience bulletin*, 33(2), 183–193. <https://doi.org/10.1007/s12264-017-0100-y>
21. Reynoso, C., Rangel, M. J., & Melgar, V. (2017). El trastorno del espectroautista: aspectos etiológicos, diagnósticos y terapéuticos [Autism spectrum disorder: Etiological, diagnostic and therapeutic aspects]. *Revista medica del Instituto Mexicano del Seguro Social*, 55(2), 214–222.
<https://community.bulksupplements.com/l-carnosine>
22. <https://community.bulksupplements.com/l-carnosine>
23. <https://www.autismspeaks.org>
24. <https://omegaquant.com>