

CHAPTER 1

INTRODUCTION

Yoga affects us in ways that are more direct and substantial than just about any other stimulus. We don't know why. We can only begin to understand how. Somewhere between yoga practice and the fullness of our relationships to yoga as an art form lay the pieces of a complex neurological phenomenon. At the interaction of yoga, neurobiology, diverse cognitive processes, and Autism, is the opportunity to construct therapeutic solutions that can simultaneously leverage findings from all of these areas, and direct an experience that can be maximally therapeutic, creative, adaptable, and measurable.

In this thesis I describe a yoga module developed to provide individuals with autism spectrum disorders the opportunity to participate in yogic tasks that directly engage cognitive areas known to be dysfunctional in this population. The result is a technique that can describe cognitive changes that might occur during yoga practice, with implications for innovative treatments and cognition research.

Chapter two reviews the relevant literature according to Indian traditional scriptures and modern science and to describe the current state of autism, yoga therapy, and cognitive training.

Chapter three outlines the aims, objectives and hypothesis for the current research.

Chapter four presents' experimental data used to justify the methodology and design decisions made in the development of the current research.

Chapter five introduces results from the use of assessment tools with autism spectrum disorder children.

Chapter six describes the research results.

Lastly, Chapter seven concludes the thesis by summarizing research study, in addition to outlining strengths and limitations of the study and suggestions for future work.

1.1 Definition and characteristics of Autism Spectrum Disorders (ASD)

Autism is a debilitating condition, but easy to spot when fully manifested. Historically, Kanner L ^[1] (1943), a child psychiatrist at John Hopkins University, characterized 11 children with a previously undescribed syndrome. These children shared a fundamental inability to relate to others, failed to use language to convey meaning, and had an obsessive desire for maintenance of “sameness.” All children exhibited anxiety and fears about common things (e.g. tricycle, running water, egg beaters). Kanner felt that the children were “endowed with good cognitive potentialities, as evidenced by their astounding vocabulary, excellent memory, visual spatial skills, strong interest in numbers, letters and often, precocious literacy”. We have learnt a great deal about ASD since Kanner’s work. Soon after, Hans Asperger described similar behavioral symptomology, decoupled from abnormal intelligence (Asperger, 1944 ^[2]). Although, only in 1994 was Asperger’s syndrome distinguished from autism in a large field trial that brought Asperger’s within the context of pervasive developmental disorders, Asperger’s remains distinct from autism, but within the autism spectrum of diagnoses (Volkmar et al., 1994 ^[3]). Today, it is understood that autism is a complex series of diseases, all with distinct cognitive, etiological, and neuropathological features. In this thesis, unless otherwise specified, autism refers to the entire spectrum of the disease, including subtypes such as Asperger’s syndrome and pervasive developmental disorder-not otherwise specified. Major advances in understanding the biological basis of ASD have taken place. Research on the behavioral cognitive phenotype has expanded, leading to more refined diagnostic practices and better educational and therapeutic interventions.

Table 1 lists DSM-IV-TR criteria for autistic disorders.

Table 1: Diagnostic Criteria for Autistic Disorder

The following criteria are from the 2000 Revision of the Diagnostic and Statistical Manual, Fourth Edition, Text Revision (DSM-IV-TR). See the DSM-IV-TR manual for details and examples.

- A. A total of Six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3).
1. Qualitative impairment in social interaction, as manifested by at least two of the following:
 - a. marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
 - b. failure to develop peer relationships appropriate to development level
 - c. a lack of spontaneous seeking to share enjoyment, interest, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)
 - d. lack of social or emotional reciprocity
 2. qualitative impairments in communication as manifested by at least one of the following:
 - a. delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or maim)
 - b. in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
 - c. stereotyped and repetitive use of language or idiosyncratic language
 - d. lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level
 3. restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:
 - a. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
 - b. apparently inflexible adherence to specific, nonfunctional routines or rituals
 - c. stereotypes and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)

d. persistent preoccupation with parts of objects

- B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.
- C. The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder

Autism is defined as a spectrum of social impairments, ranging from sheer lack of awareness when Autism and Mental retardation co-exist, to the high functioning Autism or Asperger Syndrome, in which a computer specialist has no interest in social interactions outside his computer screen.

In the social domain, symptoms include impaired use of non-verbal behaviors (e.g. eye contact, facial expression, gestures) to regulate social interaction, failure to develop age appropriate peer relationships, lack of interest to share enjoyment or interests with other people and limited social emotional reciprocity.

Communication deficits include delay in development/ absence of spoken language, difficulty in initiating or sustaining conversation, repetitive language, and imitation and pretend play.

In behavior and interest domain, there are often encompassing/ unusual interests; inflexible adherence to nonfunctional routines; stereotyped body movements; and preoccupation with parts or sensory qualities of objects. To meet criteria for autistic disorders, an individual must demonstrate at least six of the twelve symptoms, with at least two coming from social domain and one each from the communicative and restricted behavior/interests categories. At least one symptom must have been present before thirty-six months of age.

1.2 Prevalence

Studies focusing on preschool children utilizing standardized diagnostic measures of established reliability and validity have given prevalence estimates of 60-70 per

10,000 or 1 in 150 across the spectrum of Autism Disorders and 1 in 500 for children with the full syndrome of Autistic disorder. (Baird G et al, 2001 ^[4])

Despite being the second most populous country in the world, there is a serious dearth of epidemiological research on ASD in India. While estimates suggest that India might have more than 2 million people with ASD, this has never been clinically tested. Using a prevalence figure of 1/250, it may be estimated that there are around 40 lakh individuals with this disorder. It is also estimated that, for every one female with this disorder there are four affected males.

It is also observed that, over the last four decades, there has been a significant increase in the number of persons diagnosed with these problems. Several reasons for this increase have been proposed, such as increased awareness among clinicians, better identification and referrals, more sensitive diagnostic tools, broader classification system etc.

1.3 Causes

A comprehensive theory of causation is still incomplete. Many still believe in the psychogenic causation, majority of experts in the field agree that neurobiological and environmental factors are important causes of autism. A review of literature on causation is somewhat disappointing as the exact cause(s) remain unclear. A variety of causes have been listed in the literature, as given in Table 2.

Table 2: Causes

Prenatal Environment	Perinatal Environment	Postnatal Environment
Teratogens		Autoimmune disease
Pesticides		Leaky gut syndrome
Folic acid		Viral infection
Stress		Excessive hygiene
Maternal antibodies		Oxidative stress
Fetal testosterone		Amygdala neurons
Ultrasound		Vitamin D
		Lead

		Mercury
		MMR vaccine
		Paracetamol
		Television watching
		Wireless devices
		Refrigerator mother
		Other psychogenic theories

1.4 Interventions

According to Schopler E (2001) ^[5], intervention claims range all the way from science to pseudo-science and anti-science. A plethora of treatment techniques often attended by anecdotal reports of dramatic improvement, receives greater publicity. Any treatment technique claiming usefulness needs to address the following questions.

Was the recovery attributable only to the use of this technique, or to one among many other influences on the child's life?

Was the recovery due to the intensity or duration of the treatment?

Was the diagnosis reliably established or were there other conditions or variations of the disorder?

Will the recovery last overtime?

1.4.1. Education and medical intervention

From a medical perspective, ASD does not yet have either specific established cause or treatment. A host of drug therapies to special diets have been tried. The medical model involves an emphasis on the etiology or underlying causal mechanism for Autism. Interventions in this category usually include various anti psychotics such as Hszsaloperidol or Fluphenazine, which have, sometimes resulted in clinically meaningful improvements in hyperactivity, aggression and peer relations.

According to Siegel B (1998)^[6] psychoactive medication treats only symptoms. There are no medications that have been found effective in the treatment of autism as a whole. Small size and heterogeneity of study samples precludes meaningful analysis.

There is no evidence that any particular pharmacologic treatment will dramatically change the core symptoms or course of Autism. However, suggestions that very early treatment with agents such as the selective serotonin reuptake inhibitors may have more profound effects are promising.

There are many therapeutic interventions based on Behavioral Intervention Models such as Pre-school Education Programs for Children with Autism (McClannahan LE and Krantz PJ, 2001 ^[7]); The Princeton Child Development Institute (Harri S and Handleman JS, 1996 ^[8]) and the Young Child Project at UCLA (Lovass IO, 1987 ^[9]). In the UCLA program, Discrete Trail Training (DTT), intensive therapy (40hours/week) and home based therapy is emphasized. The goal is to move the child ahead by main streaming him/her. All these programs derive from the behavioral framework and tradition whose roots lie in the work of B.F. Skinner and the leading theorists and researchers.

Intervention models differ from one another greatly, depending on the cultural, economic, educational philosophies and one's conceptualization of the causes of autism. US Health Care Policy and Research (AHCPR) have formulated an accepted methodology for evaluating treatments ([Jacobson JW](#) & [Mulick JA](#) (2000) ^[10]), wherein over 8000 research reports were reviewed and evaluated using objective criteria for sound research methodology. This process resulted in a group of research studies given in Table 3.

Table 3: Educational Interventions and Medical Management

<u>E</u> ducational Interventions	<u>M</u> edical Management
Applied behavior analysis	
Pivotal response therapy	<u>P</u> rescription medication
TEACCH	Supplements
<u>D</u> IR/Floor time	Diets
Communication interventions	Cannabis

Sensory integration	Craniofacial therapy
Animal-assisted therapy	Hyperbaric oxygen therapy
Neurofeedback	Prosthetics
Son-Rise	Stem cell therapy
Packing	Chelating therapy
Patterning	

1.4.2 Complementary and Alternative Medicine (CAM) therapies for ASD

Many parents appear to be using Complimentary and Alternative Medicine (CAM), as no single intervention has proved effective in alleviating the core symptoms of autism spectrum disorders (Hyman S and Levy S, 2000 ^[11]). The reasons for opting for CAM are many- Poor access to treatment, lack of agreement as to what treatment or combination of treatments is the best in terms of outcomes, unacceptable side effects with prescription medications (Roger SJ, 1998 ^[12]). Though there is no agreed cause for autism and to date, no cure, yet reports exist of significant recovery through various combinations of mainstream and alternate medicine treatments. Available drug therapies, at best, can only alleviate some of the symptoms and sometimes cause undesirable side effects. Many parents often tell us that there is no time to wait for the science to prove the efficacy of a particular treatment as they are racing against the clock to take advantage of the early childhood neuro-plasticity and are willing to try CAM treatments, especially Yoga therapy (YT), which is non-invasive and without any harmful side effects. It is widely known that, yoga can enhance our physical and emotional well being, but when yoga is practiced as a therapeutic intervention in the form of yoga therapy, it can help prevent and aid recovery from physical and mental ailments. Yoga has long been practiced with therapeutic intention as a way of transforming both the body and mind.

Yoga therapy falls under CAM therapies and these therapies are based on a wide variety of conventional and unconventional medical and philosophical belief systems. CAM has been defined by the National Centre for Complimentary and Alternate Medicine (NCCAM) as a “group of diverse health care systems, practices and products

that are not presently considered to be part of conventional medicine". It has been reported that up to 50% of children with autism use CAM in USA (Nickel R, 1996^[13]). There have been reports about YT being used with children with autism in conjunction with some conventional intervention but not in isolation. Major rehabilitation hospitals and clinics have adopted YT with various conditions, but little is written to describe these practices and their outcomes with reference to ASD.

1.4.3 Yoga for ASD

Behavior of ASD children and adolescents has a negative impact on their families, schools, and communities. Common treatments include medication, behavior management, psychosocial and family programs in various combinations. These treatments have some success, but there is need for improvement in response and relapse rates following treatment. Yoga encourages participants to be actively and independently involved in their own treatment and self-management through respiratory awareness and manipulation, postures and cognitive control. Yoga practices have a positive effect on brain wave frequencies (Banquet JP , 1973^[14]), glucose metabolism (Herzog H et al, 1990^[15]), neurotransmitter activity (Newberga AB and Iversenb J, 2003^[16]) and the autonomic nervous system (Uyterhoeven S,2006^[17]) all of which are affected in disruptive behavior. In young people, yoga and similar mind - body approaches have been shown to increase sitting tolerance, eye gaze, and imitation, improve posture and balance and reduce repetitive stereotyped self-injurious behavior. However, there are not many research studies clearly indicating the efficacy of yoga with ASD children. (Pauline S J & Kenny DT, 2009^[18])

1.5 Why this study?

Yoga may prove to be a useful tool for children with ASD because it has the potential to meet many of their needs. After observing difficulties that ASD children face, it was thought yoga could provide a sound basis for helping these children to get

in touch with their bodies. Visualizations used with most asanas may help to engage the mind and relax the body, strengthen muscles and improve flexibility (Goldberg L, 2004 ^[19]). It addresses those who are floppy and those who are rigid (Molly K, 2002 ^[20]) and helps achieve co-ordination and balance (Betts DE, 2006 ^[21]). Our observations while working with ASD children for the past ten years has pointed to many positive benefits and success at every stage. Through yoga, children were able to learn to identify tension within their bodies and breathing exercises helped them to recognize when they were experiencing agitation. By slowing down the breathing rate, hyperactivity would reduce. The language of yoga is very simple and can, in fact, be conducted without words at all. Although these techniques were used regularly and the observations were encouraging, there were no publications on the documented efficacy of yoga in ASD. Hence this study was planned to systematically document the effect of integrated yoga program in treating ASD.