

CERTIFICATE

This is to certify that this is an authentic copy of the thesis titled '**THE EFFECT OF YOGA ON CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD) IN SPECIAL SCHOOL ENVIRONMENTS**' submitted by Sindhu Shanker (Registration No. Ph.D./RES/03/AUG14) in partial fulfillment of the requirement of the Doctor of Philosophy (Ph.D.) in yoga. She has successfully completed the required 'course of research' to submit this thesis to the Division of Yoga and Humanities under *Swami Vivekananda Yoga Anusandhana Samasthana* as per the regulations of the university. We also declare that the subject matter of this thesis has not been previously formed as the basis of the award of any degree, diploma, associateship, fellowship, or similar titles.

Dr. Balaram Pradhan,PhD
Associate Professor,
S-VYASA Yoga University
Bengaluru
(Guide)

DECLARATION

I hereby declare that this study was conducted by me at *Swami Vivekananda Yoga Anusandhana Samasthana* (S-VYASA), Yoga University, Bengaluru, under the guidance and supervision of **Dr. Balaram Pradhan**, Associate Professor, S-VYASA, University, Bengaluru.

I also declare that the subject matter of the Thesis titled '**EFFECT OF YOGA ON CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD) IN SPECIAL SCHOOL ENVIRONMENTS**' has not been previously formed the basis of any degree, diploma, associateship, fellowship or similar titles

Dated, the 22nd September, 2022.

Place: Bengaluru

Sindhu Shanker

Regd.No.PhD/RES/03/AUG14

ACKNOWLEDGEMENTS

I feel immense pleasure to express my deep sense of gratitude and thanks to Dr. Balaram Pradhan, Associate Professor, Swami Vivekananda Yoga Anusandhana Samasthana University, Bengaluru, for his continued guidance, strict supervision and valuable instructions throughout the course of my research work. It would have been a difficult task for me to complete the research work without his constant encouragement and suggestions during the study period.

My special thanks and gratitude to Dr. HR Nagendra, Chancellor of S-VYASA, Yoga University for providing the facilities for me to conduct the research work. My heartiest thanks to all the Yoga teachers who took the full responsibility for conducting yoga classes during the period of yoga intervention for children with ASD. I express my profound gratitude and thanks to all the principals of the special schools for giving permission to carryout the yoga intervention programme in their premises. Above all, I thank the encouragement and support extended by my family while pursuing the research study.

Lastly, I bow down to the Almighty God for showering his blessings on me and guiding me on the right path.

Sindhu Shanker

Regd.No.PhD/RES/03/AUG14

**STANDARD INTERNATIONAL TRANSLITERATION CODE USED TO
TRANSLITERATE SANSKRIT WORDS**

a	=	अ	ña	=	ञ	pa	=	प
ā	=	आ	ca	=	च	pha	=	फ
i	=	इ	cha	=	छ	ba	=	ब
ī	=	ई	ja	=	ज	bha	=	भ
u	=	उ	jha	=	झ	ma	=	म
ū	=	ऊ	ñ	=	ञ	ya	=	य
ṛ	=	ऋ	ṭa	=	ट	ra	=	र
ṝ	=	ॠ	ṭha	=	ठ	la	=	ल
e	=	ए	ḍa	=	ड	va	=	व
ai	=	ऐ	ḍha	=	ढ	śa	=	श
o	=	ओ	ṇa	=	ण	ṣa	=	ष
au	=	औ	ta	=	त	sa	=	स
m̐	=	अं	tha	=	थ	ha	=	ह
ḥ	=	अः	da	=	द	kṣa	=	क्ष
ka	=	क	dha	=	ध	tra	=	त्र
kha	=	ख	na	=	न	jña	=	ज्ञ
ga	=	ग						
gha	=	घ						

ABSTRACT

BACKGROUND

Autism spectrum disorder (ASD), the most common neurodevelopmental disorder, refers to a group of disorders distinctly characterized by core symptoms of deficits in social communication and interaction and restrictive, repetitive behaviors. Other psychological and physiological comorbidities frequently accompany this disorder. As a heterogeneous condition, ASD ranges from mild to severe across a continuum with varying degrees of impairments in functioning involving communication, cognition, language, behavior, and other health conditions. Autism severity defines the level of support needed by the children for their day-to-day functioning. This disorder is increasingly reported amongst school-age children in India, where many children with ASD attend special schools to receive support for learning basic functional and academic skills. Most of the major challenges associated with children in school environments include social skills deficits and problem behaviors. Other common physiological conditions prevalent in children with ASD are poor motor proficiency, food and digestion problems, and sleep disorders. Such challenges usually manifest in the form of various behavioral issues and chronic stress, significantly affecting learning in school environments. *Yoga* is recognized as a mind-body intervention that promotes physical, physiological, and psychological well-being in children with ASD and aids in the reduction of many autism-related symptoms. *Yoga* classes as group intervention for the children with ASD within the familiar and conducive school environment benefit all children by providing a consistent opportunity for participation to all students. Evidence-based studies suggest that *yoga* can be an effective alternative mind-body intervention that positively impacts various aspects of autism.

AIMS AND OBJECTIVES

The aims and objectives of the present study were to assess the effect of *yoga* on children with ASD across four special schools:

- Autism severity
- Social skills deficits
- Problem behaviors
- Motor proficiency
- Food and digestion problems
- Sleep disorders
- Evaluate the feasibility of conducting a regular group *yoga* intervention for children with ASD in special school environments

METHODS

A total of 43 children with ASD from 4 special schools were randomly divided into two groups: the experimental *yoga* group (n=23) and the waitlist control group (n=20) based on the Autism Treatment Evaluation Checklist (ATEC) scores taken as a measure of autism severity as evaluated by the parents of children with ASD.

Participants

Participants consisted of 43 children with ASD having a formal diagnosis of autism under the International Classification of Diseases (ICD-10) for assessing children under the Autism Spectrum Disorder. The participants consisted of male and female children (M: F=19:4) between the age group of 5-15 years across four special schools.

Design

A randomized controlled open-label trial was employed for the study across four special schools to explore the effect of the *yoga* intervention as a daily school group program for children with ASD

Assessments

Autism Evaluation Checklist (ATEC)

Social Responsiveness Scale-2 (SRS-2)

Aberrant Behavior Checklist -2 (ABC-2)

Bruininks- Oseretsky Test of Motor Proficiency, Brief Form-2 (BOT-2 Brief)

Food and Digestion Checklist

Sleep Checklist

Yoga Feedback Checklist

Intervention

The *yoga* intervention consisted of a school-based group *yoga* program for children with ASD conducted on all school days for 12 weeks. The *yoga* program consisted of twelve structured *yoga* modules consisting of simple *yoga* practices compatible with the needs and benefits of children with ASD. The structured *yoga* program of 45 minutes was delivered by two trained *yoga* teachers in each special school.

Results

As a group intervention, *yoga* was feasible to be delivered in special schools for children with ASD with high participation and performance responses. The parents reported a significant decrease in the *yoga* group compared to the control group in autism severity ($p = .001$). No significant changes were found in food and digestion problems and sleep disorders. The teachers reported improvement in the social withdrawal aspect of problem behaviors in children ($p = .005$), with no changes in social skills deficits. *Yoga* was found to positively impact the motor proficiency of children with ASD ($p = .007$).

Conclusions

The study has shown that it is feasible to conduct a regular group *yoga* intervention for children with ASD in terms of participation and performance responses. The study has demonstrated that children with ASD have benefitted in many aspects, such as autism severity, problem behaviors, and motor proficiency, with a carefully planned intervention suited for special school environments. Thus, *yoga* can be integrated into special school environments for the holistic management and well-being of children with ASD.

TABLE OF CONTENTS

CHAPTER 1	13
1.0 INTRODUCTION	13
1.1 PREVALENCE OF ASD	15
1.2 ETIOLOGY OF ASD	15
1.3 HISTORICAL PERSPECTIVE OF ASD	16
1.4 YOGA.....	19
1.4.1 YOGA FOR CHILDREN WITH ASD	20
1.5 SPECIAL SCHOOLS.....	21
1.6 NEED FOR STUDY	22
1.6.1 AUTISM SEVERITY	23
1.6.2 SOCIAL SKILLS DEFICITS	23
1.6.3 PROBLEM BEHAVIORS	24
1.6.4 MOTOR PROFICIENCY	25
1.6.5 FOOD AND DIGESTION PROBLEMS.....	26
1.6.6 SLEEP DISORDERS.....	26
CHAPTER 2	28
2.0 LITERARY RESEARCH ON AUTISM SPECTRUM DISORDER (ASD)	28
2.1 BACKGROUND AND SCOPE.....	28
2.2 SUMMARY OF EARLIER WORKS ON ASD	28
2.3 ĀYURVEDA AND ASD	30
2.3.1 UNMĀDA, ETIOPATHOLOGY, AND ASD.....	33
2.3.2 TREATMENT IN ĀYURVEDA.....	35
2.4 <i>BHAGAVAD GITA</i>	36
2.5 <i>PANCHA-KOSHA</i>	38
2.6 <i>YOGA</i>	39
CHAPTER 3	43
3.0 REVIEW OF SCIENTIFIC LITERATURE	43
3.1 BEHAVIORAL INTERVENTIONS	44
3.2 DEVELOPMENTAL INTERVENTIONS	45
3.3 SOCIAL SKILLS INTERVENTION.....	46
3.4 NUTRITIONAL AND METABOLIC INTERVENTIONS	48
3.5 PHARMACOLOGICAL INTERVENTIONS	48

3.6	COMPLEMENTARY AND ALTERNATIVE MEDICINE	49
3.6.1	<i>YOGA</i> FOR AUTISM SYMPTOM SEVERITY	49
3.6.2	<i>YOGA</i> FOR COGNITIVE SKILLS	50
3.6.3	<i>YOGA</i> FOR PROBLEM BEHAVIORS	51
3.6.4	<i>YOGA</i> FOR SOCIAL SKILLS DEFICITS	52
3.6.5	<i>YOGA</i> FOR MOTOR PROFICIENCY	53
3.6.6	<i>YOGA</i> ON OTHER PHYSIOLOGICAL PARAMETERS IN ASD.....	53
CHAPTER 4	.....	62
AIMS & OBJECTIVES	.....	62
4.1	AIM OF THE STUDY	62
4.2	OBJECTIVES OF THE STUDY	62
4.3	JUSTIFICATION OF THE STUDY.....	62
4.3	HYPOTHESIS.....	64
4.4	NULL HYPOTHESIS	64
CHAPTER 5	.....	65
5.0 METHODS	.....	65
5.1	PARTICIPANTS.....	65
5.1.1	SAMPLE SIZE & SAMPLING TECHNIQUE	65
5.1.2	SELECTION AND SOURCE OF PARTICIPANTS.....	65
5.1.3	INCLUSION CRITERIA.....	66
5.1.4	EXCLUSION CRITERIA.....	66
5.1.5	ETHICAL CONSIDERATION	66
5.2	DESIGN OF THE STUDY	66
5.2.1	RANDOMIZATION.....	66
5.3	VARIABLES STUDIED.....	69
5.4	DATA EXTRACTION	69
5.4.1	AUTISM SEVERITY	69
5.4.2	SOCIAL RESPONSIVENESS	70
5.4.3	PROBLEM BEHAVIORS.....	70
5.4.4	MOTOR PROFICIENCY	70
5.4.5	CHECKLISTS.....	71
5.4.6	<i>YOGA</i> FEEDBACK CHECKLIST	71
5.5	INTERVENTION.....	72

5.5.1	YOGA	72
5.5.2	YOGA TEACHERS.....	74
5.5.3	YOGA FOR CHILDREN WITH ASD TEACHER TRAINING	74
5.5.4	PRE-INTERVENTION PHASE.....	74
5.5.5	INTERVENTION PHASE.....	75
5.6	DATA ANALYSIS	75
CHAPTER 6	.....	77
6.0 RESULTS	.....	77
6.3	AUTISM SEVERITY	79
6.5	PROBLEM BEHAVIORS	87
6.6	MOTOR PROFICIENCY	90
6.7	FOOD AND DIGESTION PROBLEMS	94
6.8	SLEEP DISORDERS	96
6.9	FEASIBILITY OF CONDUCTING A REGULAR GROUP YOGA PROGRAM FOR CHILDREN WITH ASD	98
CHAPTER 7	.....	99
7.0 DISCUSSION	.....	99
7.1	AUTISM SEVERITY	99
7.3	PROBLEM BEHAVIORS	100
7.4	MOTOR PROFICIENCY	101
7.4.1	TOTAL MOTOR PROFICIENCY	101
7.4.2	MANUAL COORDINATION.....	101
7.4.3	BODY COORDINATION.....	102
7.4.4	STRENGTH AND AGILITY	102
7.5	FOOD AND DIGESTION PROBLEMS	102
7.6	SLEEP DISORDERS	103
7.7	PARENTS' FEEDBACK.....	105
7.8	TEACHERS' FEEDBACK	105
7.9	FEASIBILITY OF CONDUCTING A GROUP YOGA PROGRAM FOR CHILDREN WITH ASD.....	105
7.10	CHALLENGES FACED DURING IMPLEMENTATION OF YOGA INTERVENTION	107
7.11	YOGA TEACHERS' FEEDBACK	107
7.12	YOGA IN THE SPECIAL SCHOOL ENVIRONMENTS	107
7.13	PREVIOUS STUDIES	108

7.14	COMPARISON.....	109
7.15	MECHANISM.....	111
8.0	APPRAISAL.....	114
8.1	FINDINGS SUMMARY.....	114
8.2	CONCLUSIONS.....	114
8.3	IMPLICATIONS OF THE STUDY.....	114
8.4	APPLICATIONS OF THE STUDY.....	115
8.5	STRENGTH OF THE STUDY.....	116
8.6	LIMITATIONS OF THE STUDY.....	116
8.7	SUGGESTIONS FOR FUTURE STUDIES.....	117
	REFERENCES.....	118
	APPENDICES.....	137
	PLAGIARISM CHECK.....	137
	INFORMED CONSENT FORM (SVYASA UNIVERSITY) - WHO FORMAT.....	138
	INSTITUTIONAL ETHICS COMMITTEE (IEC) LETTER.....	150
	TEACHERS' CURRICULUM FOR TEACHING <i>YOGA</i> TO CHILDREN WITH ASD.....	152
	STRUCTURED <i>YOGA</i> MODULES.....	159
	<i>YOGA</i> TEACHER QUESTIONNAIRE.....	173
	AUTISM TREATMENT EVALUATION CHECKLIST (ATEC).....	175
	SOCIAL RESPONSIVENESS SCALE (SRS-2).....	176
	ABERRANT BEHAVIOR CHECKLIST-2 (ABC-2).....	177
	BRUININKS-OSERETSKY TEST OF MOTOR PROFICIENCY (BOT-2 BRIEF FORM).....	178
	FOOD AND DIGESTION CHECKLIST.....	179
	SLEEP CHECKLIST.....	182