CHAPTER 5
5.0   METHODS

5.1   PARTICIPANTS

The sample consisted of all children with ASD attending four special schools in Bangalore. The sample consisted of both male and female participants. All participants had a formal diagnosis of autism. The children with ASD were diagnosed with autism under the International Classification of Diseases (ICD-10) for assessing children under the Autism Spectrum Disorder.

5.1.1   SAMPLE SIZE & SAMPLING TECHNIQUE

A total of 43 children with ASD between the age of 5-15 years participated in the study. The sample is a convenient sample due to less availability of special children with ASD. G-power was used for the calculation of the sample size. The sample size was estimated using the (effect size = .68, α = .05, power =.8) of a previous study (Chan et al., 2013), with the sample requirement in each group as 19. The sample size for this study was, n= 43 (35 boys and 8 girls), with the *yoga* group, n= 23 (M: F = 19:4) and control group, n= 20 (M: F = 16:4).

5.1.2   SELECTION AND SOURCE OF PARTCIPANTS

Eight special schools in Bengaluru were contacted for the study, with four schools expressing different participation constraints. Four special schools agreed to participate in the study. The sample was a convenient sample depending on the availability of children with ASD across the four special schools. Each of the special schools consisted of a) School 1 (n= 20), b) School 2 (n= 8), c) School 3 (n= 8) and d) School 4 (n= 7). The children were divided into *Yoga* and control group in each school and matched equally based on the autism severity. This ensured that the results were comparable with the children in both *yoga* and control groups in each school exposed to the same socioenvironmental factors. A total of 43 children participated in the study across four special schools. All the children with ASD received special education services during school hours in special schools based on their individual needs and requirements and were not assigned to specific grades**.**

5.1.3 INCLUSION CRITERIA

The participants included in the study if they were – (a) between 5-15 years, (b) referred by school principals, (c) had a regular attendance, (d) had a formal clinical diagnosis of autism. Both male and female children with ASD participated in the study.

5.1.4 EXCLUSION CRITERIA

The participants were excluded from the study if they had – (a) significant physical and motor impairments preventing participation in *yoga*, (b) not meeting the requisite age criterion specified.

5.1.5 ETHICAL CONSIDERATION

Consent from parents and teachers of children with ASD participating in the study was obtained through written informed consent. All the special schools were assured of complete anonymity and confidentiality of data collected for the study on the school premises.
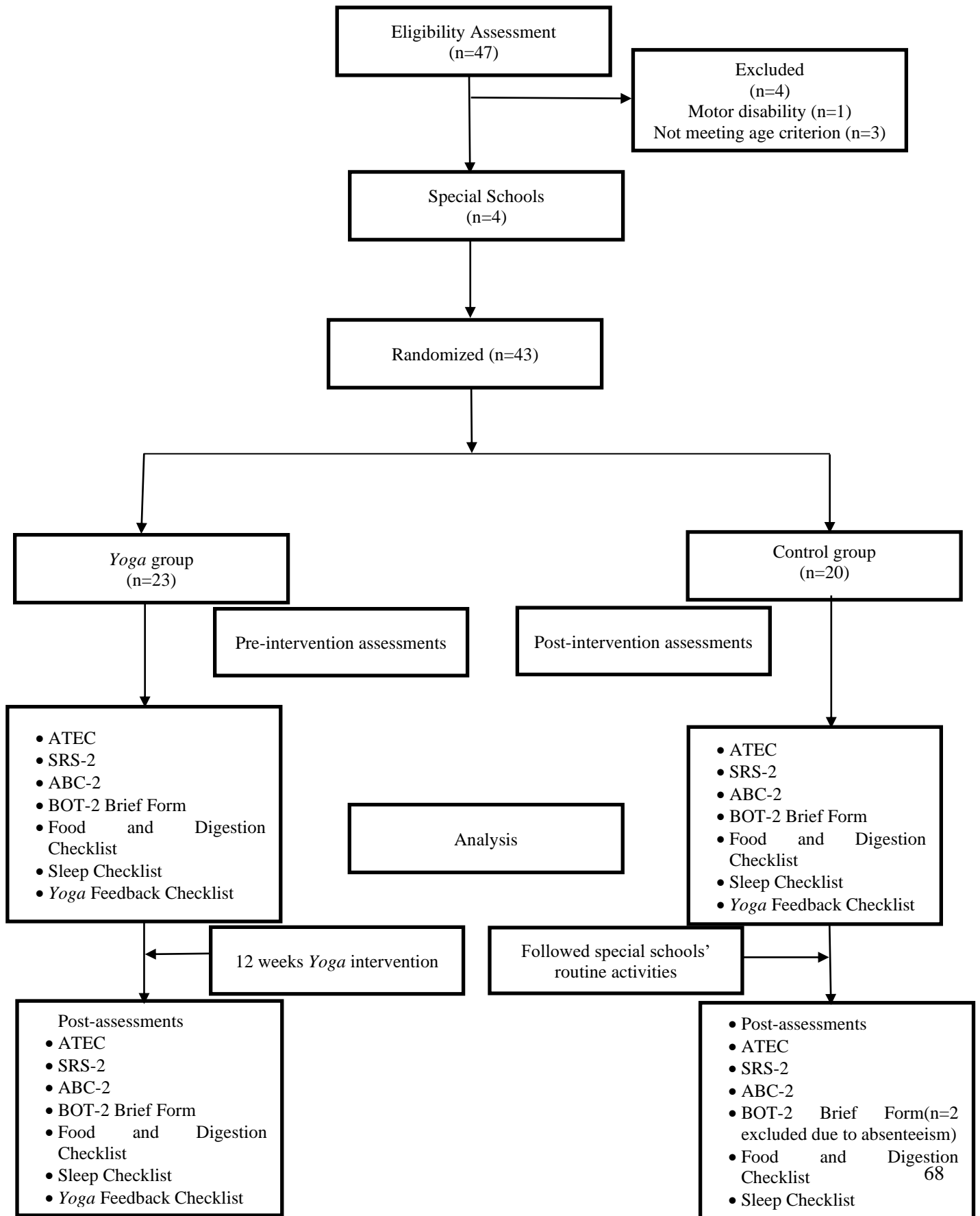
5.2 DESIGN OF THE STUDY

A randomized controlled open-label trial was employed for the study in four special schools to explore the effect of the *yoga* intervention as a daily school program for children with ASD. Forty-three children with ASD from 4 special schools participated in the study. The children with ASD from 4 special schools were divided into two groups – the *yoga* group and the waitlist control group. The *yoga* group participated in the 3-month *yoga* intervention as the experimental group. The control group did not participate in the *yoga* intervention and continued with other school activities designated in the special schools for children.

5.2.1 RANDOMIZATION

The Autism Treatment Evaluation Checklist (ATEC) was completed by the parents of children to assess the severity in autism. A total of 43 children with ASD from 4 special schools were then randomly assigned to two groups- the *yoga* group and the control group based on the severity in autism as evaluated by the total ATEC score. In each school, the nearest two ATEC scores were then paired and assigned to either group by following a simple randomization process of the coin

toss. Both groups were thus matched equally on the total ATEC scores taken as baseline characteristic for randomization with no significant differences between groups y*oga* group M= 65. 13, SD= 17.82 and control group M= 64.85, SD = 22.41; p = .96). Data were collected pre and post the *yoga* intervention. The trial profile is as shown in Fig 1.

Fig 1 Trial Profile

Eligibility Assessment
(n=47)

Excluded
(n=4)
Motor disability (n=1)
Not meeting age criterion (n=3)

Special Schools
(n=4)

Randomized (n=43)

Yoga group
(n=23)

Control group
(n=20)

Pre-intervention assessments

Post-intervention assessments

- ATEC
- SRS-2
- ABC-2
- BOT-2 Brief Form
- Food and Digestion Checklist
- Sleep Checklist
- *Yoga* Feedback Checklist

Analysis

- ATEC
- SRS-2
- ABC-2
- BOT-2 Brief Form
- Food and Digestion Checklist
- Sleep Checklist
- *Yoga* Feedback Checklist

12 weeks *Yoga* intervention

Followed special schools' routine activities

Post-assessments
- ATEC
- SRS-2
- ABC-2
- BOT-2 Brief Form
- Food and Digestion Checklist
- Sleep Checklist
- *Yoga* Feedback Checklist

- Post-assessments
- ATEC
- SRS-2
- ABC-2
- BOT-2 Brief Form(n=2 excluded due to absenteeism)
- Food and Digestion Checklist
- Sleep Checklist

68

5.3 VARIABLES STUDIED

The feasibility of conducting *yoga* in special schools for children with ASD was evaluated in this study:

a)The feasibility of conducting group *yoga* intervention for children with ASD in special school environments in terms of participation and performance responses.

Several behavioral and physiological variables were assessed:

b) Autism Severity

c) Social Responsiveness

d) Problem Behaviors

e) Motor Proficiency

f) Food and Digestion Problems

g) Sleep Disorders

5.4 DATA EXTRACTION

The following standardized assessments were completed by parents and teachers of the children pre- and post-the *yoga* intervention. They were administered two weeks before the intervention and at the end of the 12th week of the intervention. Data were collected pre and post the *yoga* intervention of 12 weeks across the four special schools from the parents, teachers, and *yoga* teachers of children with ASD. The researcher conducted the motor proficiency test on children with ASD in the four special schools.

5.4.1 AUTISM SEVERITY

Autism Treatment Evaluation Checklist (ATEC) (Rimland & Edelson, 1999) is a standardized 77-item checklist completed by parents as a measure of autism severity and is sensitive to various treatment effects. The autism severity of the children with ASD was assessed with the Autism Treatment Evaluation Checklist (ATEC). This checklist consisted of various autism symptoms as a measure of the autism severity under four subtests (i) Speech/Language/Communication (14 items), (ii) Sociability (20 items), (iii) Sensory/ Cognitive Awareness (18 items), and (iv) Health/ Physical/Behavior (25 items). The items in the first three subscales are scored on basis of 0–2-point scale and the last subscale is scored using 0–3-point scale. The scores of all the subscales are

combined to give a total score ranging from 0 to 179. The internal consistency of ATEC was high (r =.94 for the total score). Lower scores indicated less severity in autism.

5.4.2 SOCIAL SKILLS DEFICITS

The teachers completed the standardized Social Responsiveness Scale-2 (School Age) as a measure of social skills deficits in children with ASD. The 65-item scale as a measure of social deficits in children with ASD consists of five subscales (a) Social Awareness, (b) Social Cognition, (c) Social Communication, (d) Social Motivation, (e) Restricted Interests, and Repetitive Behavior (RRB). The items are rated based on an ordinal-scaled method consisting of 1 (not true), 2(sometimes true), 3(often true), and 4 (almost always true). The SRS-2 gives a total score consisting of combined raw scores of all five subscales. The school-age form shows a strong internal consistency (a= 0.92 to 0.95). Raw scores were used for the study, with lower scores indicating more social responsiveness (Constantino & Gruber, 2012).

5.4.3 PROBLEM BEHAVIORS

The teachers completed the Aberrant Behavior Checklist -2 (Aman& Singh, 2017) as a measure of problem behaviors in children with ASD. This standardized 58-item checklist comprises five subscales(a) Irritability (15 items), (b) Social Withdrawal (16 items), (c) Stereotypic Behavior (7 items), (d) Hyperactivity/Noncompliance (16 items), and (e) Inappropriate Speech (4 items). The items in the subscales are scored using a 0–3-point scale. The ABC-2, as a revision of the original ABC, retained its content validity and showed high internal consistency (a=.86-.95). It gives five individual subscale scores with a total aberrant ABC -2 score considered inappropriate. Lower scores indicated fewer problem behaviors.

5.4.4 MOTOR PROFICIENCY

Bruininks–Oseretsky Test of Motor Proficiency, Brief Form-2 (Bruininks & Bruininks, 2010) is a short, standardized test administered to children with ASD by the first author to assess motor proficiency as a measure of functional gross and fine motor skills. It consists of 12 individual assessment subtests categorized under four motor domains giving a composite score of total motor proficiency. With a total of 12 motor tasks, all the subtests in the motor domains address various

aspects of functional motor skills. The total motor proficiency score is derived from assessing the following motor domains—fine motor proficiency on (a) fine manual control—fine motor precision and fine motor integration, and (b) manual coordination—manual dexterity, and upper-limb coordination. Gross motor proficiency on (c) body coordination—bilateral coordination and balance, (d) strength and agility, speed and agility, and strength. BOT-2 Brief showed good internal consistency of (a = 0.80–0.84, 4–21 years) with high interrater reliability of 0.98 and 0.97. Raw scores were used for the study, with higher scores reporting better motor proficiency.

5.4.5   CHECKLISTS

The Food and Digestion Checklist and Sleep Checklist are taken from a previous study on the effect of *yoga* on children with ASD. The two checklists were developed to assess the effect of *yoga* intervention on various gastrointestinal problems and sleep disorders in children with ASD (Narasingharao et al., 2017). The Food and Digestion checklist consisted of 16 items, and the Sleep checklist of 15 items, respectively. Each item offered five options to be ticked ranging from 'agree,' 'rarely,' 'sometimes,' 'disagree,' to 'strongly disagree.'

5.4.6   YOGA FEEDBACK CHECKLIST

The research team developed the *Yoga* Feedback Checklist as a measure of the participation and performance responses (PPR) and non-responses (PPNR) to the *yoga* intervention achieved by the children. Each *yoga* session consisted of twelve sections which consisted of 5 components of *yoga* – a) Chanting, b) Preparatory practices, c) *Asanas* (*yoga* postures), d) Breathing exercises and *Pranayama*, and e) *Shavasana* (relaxation). The participation response to the intervention was defined by the ability of the child to respond to instructions and participate in the intervention with or without the help of the *yoga* teachers or the school staff. The *yoga* teachers completed the checklist for each participating child to track the daily PPR and PPNR after the *yoga* session. The simple checklist consisted of ticking either of the two options- "Response" and "Non-Response" against each *yoga* component.

5.5   INTERVENTION

5.5.1   *YOGA*

The *yoga* intervention consisted of a school-based group *yoga* program for children with ASD. Twelve structured *yoga* modules were developed for this study based on the Integrated Approach of *Yoga* Therapy (IAYT). The IAYT principle developed by *Swami Vivekananda Yoga Anusandhana Samsthana* (SVYASA) approached *Yoga* as a holistic solution to contributing effectively to the physical, mental, and emotional integration of an individual's well-being. Various studies on IAYT *yoga* practices in typically developing children and children with special needs have shown positive outcomes over various behavioral and physiological aspects such as anger, problem behaviors, attention, self-esteem, executive functions, psycho-motor abilities, and physical health (Mani et al., 2016; Narasingharao et al., 2017; Pise et al., 2018; Purohit & Pradhan, 2017; Sethi et al., 2013). The structured *yoga* modules developed for the study were customized based on the review of literature in accordance with the needs and benefits of children with ASD (Narasingharao et al., 2017; Radhakrishnan et al., 2010). The *yoga* modules consisted of various *sookshma vyayama* (loosening practices), *sithilikarana vyayama* (dynamic practices), breathing exercises, *asanas* (postures) and *pranayama* (breathing techniques), relaxation, and chanting. Each *yoga* session consisted of a few *yoga* practices to encourage children's participation and accommodate the sessions within the school timings.

The structured *yoga* modules were designed to address the special needs of the children with ASD keeping in mind their strengths, limitations, and contraindications. The *yoga* modules were thus created to specifically address the behavioral and physiological issues taken in the study, such as social skills deficits, problem behaviors, motor proficiency, food and digestion problems, and sleep disorders. It included both energizing and calming practices and those that fostered the development of motor skills and social skills along with alleviation of problem behaviors. A few partner postures were also incorporated into the *yoga* sessions to facilitate social interaction amongst the children. These *yoga* practices also aided in enhancing better digestion and sleep. The modules were kept short for the children to perform the *yoga* practices with better attention and ease. The *yoga* modules followed an iterative structure of simple *yoga* practices with few reinforcing repetitions maintaining predictability of tasks and new practices facilitating a gradual transition towards increasing complexity (Semple, 2019). A new *yoga* module was introduced each week with a gradual

introduction of more practices every week consisting of both repetitive and new practices to enable the children with ASD to do the *yoga* practices with better comfort and ease. Children with ASD respond effectively to a structure wherein a judicious mix of repetitive and new activities increases engagement and confidence while reducing the anxiety of new task demands (Janzen, 1996; Chrissick & Peacock, 2019). The modules started with a few *yoga* practices, which gradually increased throughout the intervention. Repetitive *yoga* practices were maintained to increase engagement and confidence in performance, while new practices facilitated a gradual transition towards performing more postures in the *yoga* sessions.

The structured *yoga* modules followed a sequence of 5 components- (a) Chanting, (b) Preparatory Practices (loosening and dynamic practices), (c) *Yoga* postures or *Asanas*, (d) Breathing practices, including Breathing exercises and *Pranayama*, and (e) Relaxation. Every *yoga* session started and ended with opening and closing chanting which included chanting of *Om* and its syllables' *A*', '*U*,' 'M,' and mantras. When chanted, mantras, as short phrases, or words, produce sound vibrations promoting calmness and focus and thus form an essential part of the *yoga* sessions (Lolla, 2017; Naidu et al., 2014). Preparatory practices such as loosening and dynamic practices performed before *yoga* postures helped warm and activated the body while facilitating the loosening of different joints (Nagendra & Nagarathna, 2011). The loosening practices also enhanced fine motor skills. A combination of slow and fast *yoga* practices triggered responses from the sympathetic and parasympathetic nervous systems fostering an inherent balance and regulation of the nervous system (Goldberg, 2013).

Breathing exercises are body movements that enable awareness of breath through body movements (Nagendra & Nagarathna, 2011). *Yoga* postures are specific body postures that involve stretching and strengthening muscles and joints with psycho-physiological benefits (Woodyard, 2011). With reference to their starting position, four types of postures were included in each session - standing, sitting, prone and supine postures. *Pranayama* or breathing practices had simple abdominal breathing and *Bhramari* (bee's breath humming) to increase breath awareness and alleviate stress response (Pellissier et al., 2019). This was followed by total relaxation with the children laying down on their backs in *Shavasana* (corpse's pose) to rejuvenate the body and mind (Bhogal et al., 2016).

5.5.2 *YOGA* TEACHERS

The *yoga* program for children with ASD was conducted by trained *yoga* teachers in all four special schools. Two *yoga* teachers were allocated to each school for the study. The *yoga* teachers were trained in IAYT *Yoga* practices having relevant teaching experience with children.

5.5.3 *YOGA* FOR CHILDREN WITH ASD TEACHER TRAINING

The *yoga* teachers underwent a two-day training program conducted by the researcher to teach *yoga* to children with ASD. A comprehensive *yoga* teacher curriculum for children with ASD was developed for the training program. The curriculum consisted of an introduction to autism spectrum disorder (ASD) and the different challenges faced by children with ASD, such as various autism-related symptoms, core diagnostic features, social skills deficits, problem behaviors, poor motor proficiency, sensory dysfunctions, and several other physiological dysfunctions. It also included the benefits of *yoga* for children with ASD, with detailed instructions for conducting *yoga* sessions compatible with children with ASD. The *yoga* teachers were also apprised of the children's different learning preferences and challenges. The *yoga* modules developed for the study were discussed, along with the benefits and modifications of the chosen *yoga* practices for children with ASD. The detailed *yoga* teacher training curriculum and the twelve structured *yoga* modules are shown in the appendices below.

5.5.4 PRE-INTERVENTION PHASE

Before the intervention commencement, the *yoga* teachers spent a week in observation in the allocated special schools. It helped the *yoga* teachers better understand the children's responses and reactions to instructions and different school activities. It also aided the children in developing a familiarity and rapport with the *yoga* teachers. A week before the intervention, the schools' authorities were informed of the assignment of children into two groups, the *yoga* group, and the control group, for the study. It allowed the special schools enough time to make necessary arrangements in the children's timetable.

5.5.5   INTERVENTION PHASE

The *yoga* group participated in the group *yoga* program conducted on all school days for 12 weeks within each special school premises. The waitlist group was on a three-month waiting period and did not participate in the *yoga* program. They continued their daily school activities like special education sessions and other school activities. The duration of the daily *yoga* session was 45 minutes during one school period. This included the children assembling for *yoga* in their respective positions, completing the *yoga* practices, and dispersing to their individual classes. The *yoga* class was conducted on the floor with the *yoga* teachers and children sitting on cotton *yoga* mats. The *yoga* practices were visually demonstrated to the children along with simple verbal prompts. Two *yoga* teachers in each *yoga* session at special schools facilitated the implementation of the *yoga* modules. They mutually maintained the class flow, providing additional support and encouragement to the children for their effective participation in *yoga*. Allotment of two *yoga* teachers to each school also ensured that the children received their daily *yoga* practice without a break in their regularity due to any teacher's absenteeism.

In addition, the *yoga* teachers received the support and supervision of the researcher during the intervention with weekly visits to the four special schools. The *yoga* teachers also filled out a *yoga* teacher's questionnaire developed by the researcher for the study to periodically evaluate their comfort and challenges in conducting the *yoga* sessions. The questionnaire was administered three times at the end of every month of the intervention

5.6   DATA ANALYSIS

The data collected from a total of 43 children with ASD were considered for analysis on various behavioral and physiological variables. The children with ASD were divided into two groups- the *yoga* group (n= 23) and the control group (n=20). The children across four special schools were randomized into two groups based on the ATEC scores. The statistical analysis was computed using JASP, Jeffrey's Amazing Statistics Program, version 0.12.2. Independent sample t-tests were applied for the pre-intervention ATEC scores, and age match at the baseline level ($p > 0.05$). The Chi-square test was used for gender match at the pre-intervention level. No attrition was seen in the sample size during the study. Repeated measures ANOVA (RM-ANOVA) followed by Bonferroni post hoc tests were conducted to compare baseline and post *yoga* intervention data on the

standardized outcome measures. The significance level of $p < .05$ was established for the study. The effect sizes (η^2) are represented as very small (< 0.01), small ($0.01 - 0.05$), medium (0.06–0.13), and large (≥ 0.14) (Cohen, 1988).

The Food and Digestion Checklist and Sleep Checklist consisted of non-parametric data that were not normally distributed. Mann-Whitney and Wilcoxon analysis test was conducted to find *z*-scoring and significance in the postintervention data. The total number of responses and non-responses under the five components of the yoga feedback checklist was counted and expressed as a percentage of (PPR) shown by children across all the *yoga* sessions of the intervention. The results are presented accordingly in the tables.