A COMPARATIVE STUDY OF ANTHROPOMETRIC PARAMETERS IN AUTISTIC AND HEALTHY CHILDREN

Submitted to the Integral Institute of Medical Sciences and Research, Integral University
In partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE
IN
MEDICAL ANATOMY

DEPARTMENT OF ANATOMY
INTEGRAL INSTITUTE OF MEDICAL SCIENCES AND RESEARCH, INTEGRAL UNIVERSITY, LUCKNOW

Submitted By

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M.Sc. Medical Anatomy

Session 2022-23

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DEPARTMENT OF ANATOMY

CERTIFICATE

This is to certify that the dissertation "**A COMPARATIVE STUDY OF ANTHROPOMETRIC PARAMETERS IN AUTISTIC AND HEALTHY CHILDREN**" is a bonafide and genuine research work of **Ashok kumar** necessary for award of degree of Master of Science in Medical Anatomy, Session: 2022-23, under the supervision and guidance of **Dr. Kamil khan** in the Department of Anatomy, IIMS&R, Integral University, Lucknow.

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DECLARATION

I hereby declare that this dissertation **A COMPARATIVE STUDY OF ANTHROPOMETRIC PARAMETERS IN AUTISTIC AND HEALTHY CHILDREN** is a bonafide and genuine research work carried out by me as per the Research Committee and Ethical Committee guidelines of IIMS&R, under the guidance of **Dr Stuti Tandon** Department of Anatomy, Integral Institute of Medical Sciences & Research, Integral University, Lucknow U.P.

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M.Sc. Medical Anatomy

Session 2022-23

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Ashok kumar

TABLE OF ABBREVIATION

ADI-R	**Autism Diagnostic Interview Revised**
ASD	**Autism Spectrum Disorder**
BMI	**Body Mass Index**
Cm	**Centimetre**
CPEA	**Collaborative Programs Of Excellence Autism**
DSM-V	**Diagnostic Statistically Manual 5th Edition**
GFCF	**Gluten Free Casein Free Diets**
IQ	**Intelligence Quotient**
Kg	**Kilogram**
Mm	**Millimetre**
P-VALUE	**Prevalence Value**
T- VALUE	**Tabulated Value**
USA	**United State America**

TABLE OF CONTENTS

INTRODUCTION

Autism is a rapidly increasing developmental disorder. Rising autism cases are expanding nearly 12% each year as per centers for disease control.[1]

The National Institute of Mental Health describes autism spectrum disorder to serve as a developing disease that affects a child's behavior and social interaction.[2]

It is also one of the most rising illnesses in development, with a 12% annual rise. The etiopathology, an increased rate of incidence and deficiency of effective therapy makes this condition more challenging. It induces a huge weight on the family as well as the society. Combinations of genetic and environmental factors are determinants of the etiopathology of this disorder.[3]

Children with Autism Spectrum Disorder (ASD) have different kind of difficulty in social communication, language and repeated behavior.[4]

The estimated prevalence of ASD is 14.6 per 1000 children aged 8 years in the United States whereas the pooled estimate of autism is 14 per 10,000 in rural population and 12 per 10,000 in urban population in India, which is much lower than those reported from the United States.[5]

The food habits of these children are affected by the behaviour. Their eating behaviour may be governed by loss of appetite or refusal or preferences for some types of food which may lead to selection of some types of food over others. Dysfunction in sensory – Motor evaluating, mental impairment, and

a variety of linked problems all have an impact on the behaviour that governs food selection. This behaviour change can lead to decrease in anthropometric measurements as compared with normal children.[6]

The aforementioned food selection, as well as the adopting of specific diets (Gluten free casein free diets, GFCF), shows an impact on the quality of the diet. This poor diet may result in the onset of various related ailments such as diabetes, cardiovascular disease, osteoporosis, and psychosocial issues during adult life.[4] The sedentary lifestyle of individuals with ASD due to restricted social interaction also adds to the problem. This could result in changes in anthropometric measurements, which reflects the imbalance between energy level. Furthermore, these parameters might be used as indirect measures of these children's eating habits.[7]

The term “anthropometry” is taken up from the word “anthropo” which means “human” and the word “metron” meaning “measure” (Ulajaszek, 1994).” It is the study of the measurement of the human dimensions of bone, muscle, and fat tissue”. The anthropometry measurements include weight, skinfold thicknesses, head and arm circumferences, limb lengths and breadths. It plays a key role in assessing the nutrition status in such individuals.[8]

There is a decreased clarity in etiology and the genetic basis of this disorder due to the difference in the behavioural and clinical presentation. Anthropometric measurements can serve as effective tool for the evaluation of the clinical presentation which reflects the impact of genetics and environment.[3]A relationship between increased body weight and psychiatric disorders like ASD and hyperactive disorders has been found in many studies.[9]

Hence, the present study aims to identify variations in significant anthropometric measurements between autistic children and healthy children."

PURPOSE OF THE STUDY

There is limited literature regarding anthropometric measurement in autistic children in India. Autism is more common disorder among the other developmental disorders of the world and it is increasing. The anthropometric measurement is a good indicator for nutritional status of autistic population and is important as a screening tool. It is essential so that timely intervention for nutritional deficiency can be done.

REVIEW OF LITERATURE

REVIEW OF LITERATURE:

Komal Srivastava et al, 2016 assessed the weight of Autism Spectrum Disorder children. The weight as well as the BMI of these children was lower than that of the controls. so, it was concluded that the autistic children have higher chances of being underweight, growth stunting and muscle wasting.[7]

Sobhana Ranjan et al, 2015 in a review stated that as the disorder has an increasing incidence, a timely screening is of great importance. As the nutrition in this population highly depends on the behaviour as well as food selection, it is necessary that a detailed nutritional assessment be done so as to lead to timely and effective interventions. Anthropometry, which is the measurement of body size, is one of the components by which nutritional assessment can be done.[8]

Afaf Hafid et al, 2018 conducted a study on the autistic children & found that these children have a higher risk of malnutrition. They also found that the eating habits of these children and the parent education level have an inverse relationship. So it can be inferred that by increasing the education level of the parents we can decrease the severity of autism.[9]

Md. Ibrahim Sohel et al, 2021 assessed nutritional status with Autism spectrum disorder children. This study showed that the Bangladeshi children with autism

spectrum disorder had statistically significant lower height and weight, thicker triceps brachii and suprailiac skin fold; and were mostly underweight as compared to normal children.[10]

Dewi Setyowati et al, 2019 conducted a study on autism and normal children in Indonesia. They found that there was no difference in body weight, height and head circumference according to age between children with autism and normal children.[11]

Hart, J.S et al, 2022 conducted a study on the autism and normal healthy children. They found body mass index and mid-upper arm circumference increased because of a significant increase in subcutaneous fat thickness in female adolescents with autism. This tendency with a probable decrease in muscle mass was more evident in male or in older children, likely resulting from sedentary lifestyle and food selectivity.[12]

Janet E. Lainhart et al [2006] in their study focused on prevalence of head circumference and height in autism. Collaborative Programs of Excellence in Autism (CPEA) diagnostic criteria was used to classify the participants in four categories. It is based on the autism diagnostic interview revised (ADI-R), age, and IQ. The participants should qualify DSM-IV and ICD-10 criteria for Autism so as to meet the CPEA diagnostic criteria. [17]

Pal Suren et al [2013] stated that increased head circumference is found during initial years in children with ASD. Whereas, since there is a paucity of studies related to the length and weight, a need of more population based studies emerges. between ASD and controls in USA samples whereas prevalence of overweight in children with ASD was lower than controls in non-USA samples, which could be explained on the basis of difference in genetics and lifestyle.[18]

Arthur Kummer et al [2015] stated that whether the relationship between overweight or obesity and disorders such as ASD is characteristic or common to this group of disorders still remains unclear. Moreover, this association can also be bidirectional i.e., not only these disorders lead to increased weight but it may also be a precipitating factor of developing these disorders. Further investigations for ascertaining this association need to be done. [19]

Ms. Misbah Samir et al [2018] in their study found that the mean weight of autistic children was higher than the control group. They also concluded that several factors like lack of regular physical exercise, side effect of medications, unusual dietary patterns, cultural & environmental factors may be responsible for the presence of obesity in these children. Whereas factors like, food

selectivity, restricted eating habits may lead to nutritional deficiencies and underweight in such children.[20]

Nagwa A Meguid et al [2014] compared the anthropometric measurements in autistic Egyptian children and healthy children. They concluded that due to a notable increase in thickness of subcutaneous fat and decrease in muscle mass in these children there was an evident increase in weight and BMI. This makes it necessary to make a specialized tailored food supplementation program for these children to decrease the severity of the disorder.[21]

Herman D. Cortes et al [2017] found that very obese children with ASD had lower IQ and increased impairments in terms of communication and social skills. It is important to identify the comorbidities in these children to understand the biological processes that lead to this disorder. Customised treatments should be devised to target the varied genetic lesions in this group.[22]

Mirjana Jojic et al [2015] said that obesity is usually associated with these children. The comorbidities associated with being overweight may present a threat to the general health of these children.[23]

Meng-Chuan Lai et al [2015] attempted to study the relationship between gender differences and autism. They concluded that distinct and interlinked

questions about the association between differences in gender and autism still want to be addressed.[15]

Carol Curtin et al (2015) stated that there may be many factors contributing to the development of obesity in such children. These may be certain medications, disturbed sleep, genetics, typical eating behaviours, insufficient physical activity etc. Obesity and its associated consequences potentially present a threat to independent living, selfcare, quality of life and health for individuals with ASD.[23]

SylwiaTrambacz-Oleszak (2019) in the review article concluded that many factors are linked to the BMI of a person with ASD. Some of these may be symptoms of the disorder, genetics, comorbid psychological and somatic disorders, pharmacotherapy, social and family functioning.[24]

Salvador Marı´ Bauset et al(2012) stated that anthropometric measurements serve as an effective tool for assessing growth and nutritional status. Due to some factors that affect the nutrition intake, the children with ASD might have a decreased anthropometric development as seen in children with other physical and developmental disorders. Their study found that these children had the BMI percentile significantly lower than the controls.[25]

Zheng Zheng et al (2017) conducted a meta-analysis and confirmed a relationship between obesity and Autism Spectrum Disorders. but, they found

vast heterogeneity in the meta-analysis. There was no difference in the prevalence of (overweight). [26]

AIM

&

OBJECTIVES

AIM AND OBJECTIVES

AIM-To compare anthropometric parameters in Autistic and healthy children.

OBJECTIVES

- To measure body weight.
- To measure mid arm circumference and head circumference.
- To measure skin fold thickness.

OPERATIONAL DEFINITIONS

- Autism Spectrum Disorders: “It is a neurodevelopmental disability that is characterised by deficiencies in social reciprocity and language skills that are associated with repetitive behaviours and restricted interests.”
- Anthropometric measurements: “are a series of quantitative measurements of the muscle, bone and adipose tissue, used to assess the composition of the body.”

MATERIAL & METHODS

MATERIAL AND METHOD

The study was conducted on 50 subjects, 25 Autistic children (as cases group) and 25 healthy children (as control group) of same age groups after taking consent from parents. A comparison of anthropometric parameters was done in the department of Anatomy at IIMS&R (Lucknow). Samples were taken from the Integral hospital, department of pediatrics, Composite regional center Lucknow (U.P). The study was conducted after obtaining approval from the institutional research and ethical committee.

MATERIALS

- Non stretchable measuring tape
- Standard weighing scale
- Skin fold calliper
- Pen and Paper

METHODS

The following measurements were taken in the presence of a female attendant (in case of female subjects)

- The body weight was measured to the nearest 0.01 kg by a standard weighing scale, with the participant wearing light clothing and no shoes.

- Mid arm circumference was be taken at a point midway between the tip of the shoulder and tip of the elbow with a flexible non stretchable measuring tape.
- Head circumference was measured as the distance at the frontal eminence and external occipital protuberance.
- The skin fold thickness was measured to the nearest 0.1 mm using a skin fold calliper by the following methods:
- Biceps skin fold thickness was taken mid-way between the tip of the shoulder and tip of the elbow (vertical fold, mid front side of humerus).
- Suprailiac skin fold thickness was measured at oblique fold just superior to iliac crest.
- Thigh skin fold thickness was measured as vertical fold, at the mid front of thigh.

INCLUSION CRITERIA

- Individuals diagnosed with autism according to criteria defined in Diagnostic Statistical Manual 5th Edition (DSM-V)
- Children of the age 3-15 years, both autistic and healthy of same age.

EXCLUSION CRITERIA

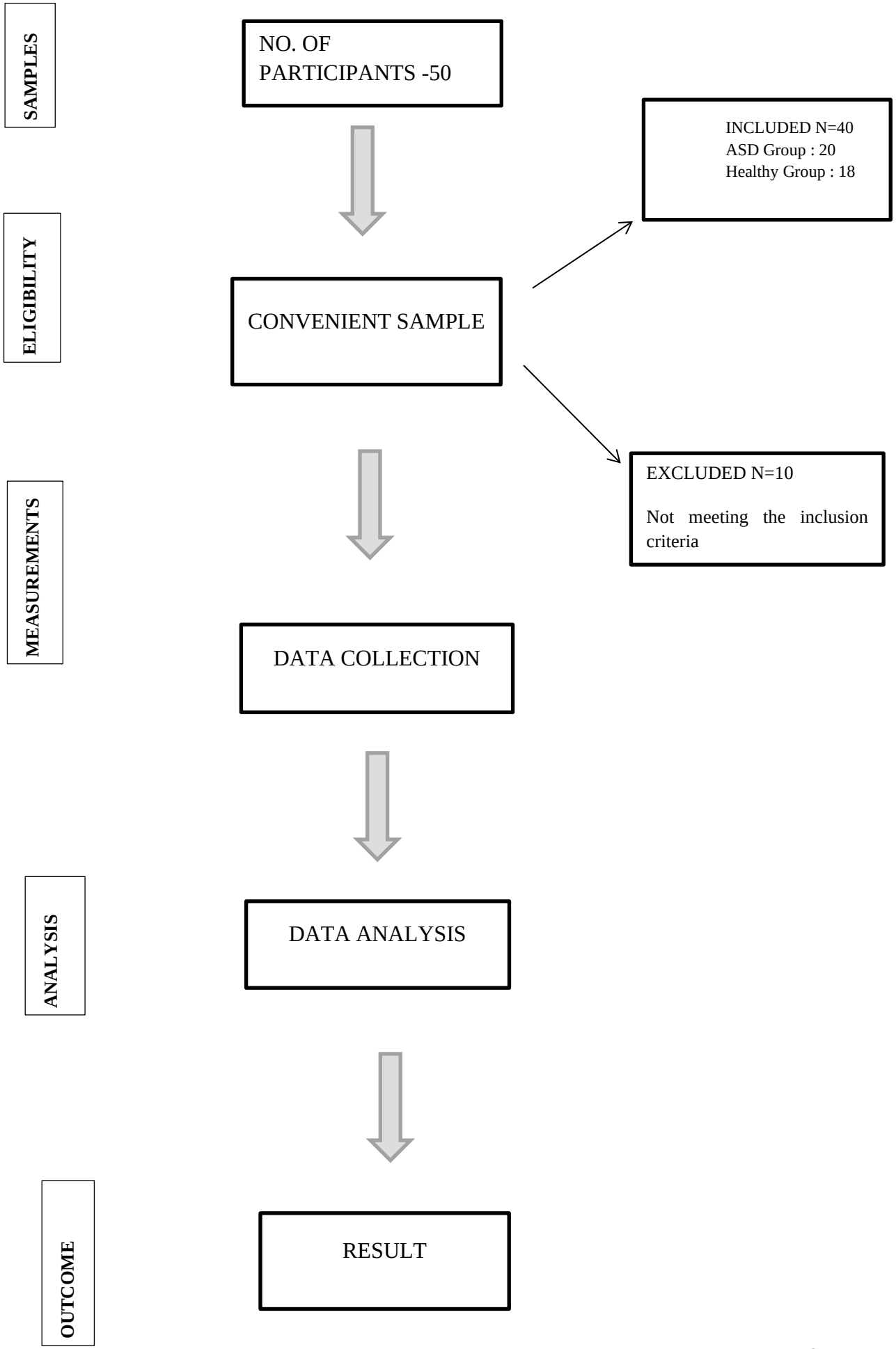
- Participants with severe visual, auditory or motor problems.

- Participants with identified other metabolic, genetic, or progressive neurological disorders.
- Individuals (or individuals parents) not willing to participate in the study.

RESULT

PROCEDURE

A total number of 50 subjects were approached for the research. Out of these 10 participants did not meet the inclusion criteria and were excluded from the study. The participants were grouped under autistic children and healthy children having 20 participants each. A written informed consent was obtained from the parents or the caregivers after explaining the purpose and procedure of the study. The control group i.e. the healthy children group was age and gender matched.


SAMPLES
NO. OF PARTICIPANTS -50
INCLUDED N=40
ASD Group : 20
Healthy Group : 18
ELIGIBILITY
CONVENIENT SAMPLE
EXCLUDED N=10
Not meeting the inclusion criteria
MEASUREMENTS
DATA COLLECTION
ANALYSIS
DATA ANALYSIS
OUTCOME
RESULT

RESULTS

The data was obtained from 40 participants with 20 participants each in the Autistic group and the healthy children group. The data was analysed using SPSS 20 software. Frequencies, mean and standard deviation were calculated for the different demographic and anthropometric measurements. Independent samples 't' test was used to analyse the variation in means of anthropometric measurements between the two groups i.e. ASD group and Healthy group, all the results were marked significant at $p \leq 0.05$ (Confidence level=95%)

The results are depicted in the following tables and corresponding graphs.

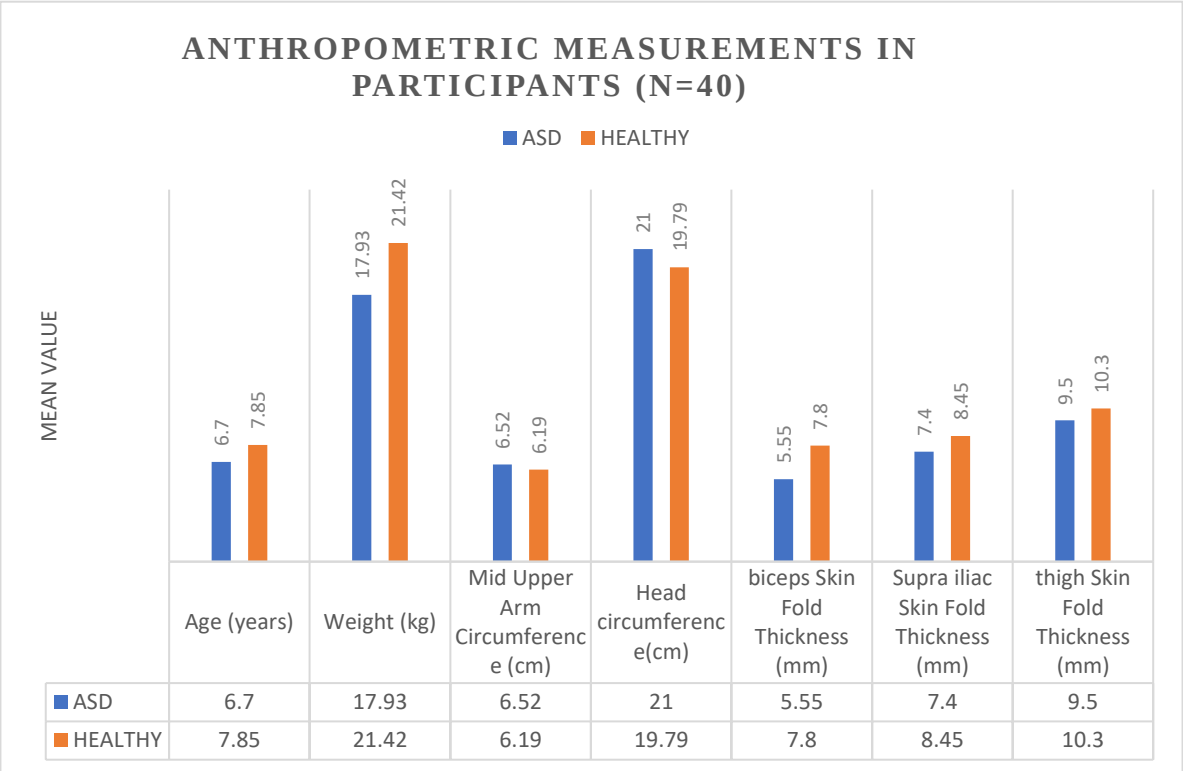
Table I shows that there were 12 males and 8 females in the autistic group whereas, 7 males and 13 females in the healthy group.

TABLE I GENDER DISTRIBUTION IN PARTICIPANTS

GROUP	GENDER	FREQUENCY	PERCENTAGE
AUTISTIC GROUP	MALE FEMALE	12 8	60 40
HEALTHY GROUP	MALE FEMALE	7 13	35 65

TABLE II: - DESCRIPTIVE STATISTICS OF ANTHROPOMETRIC MEASUREMENTS IN PARTICIPANT

ANTHROPOMETRIC MEASUREMENTS	AUTISTIC GROUP Mean±SD	HEALTHY GROUP Mean±SD	t value	P value
Age (years)	6.7±2.65	7.85±3.00	-1.26359	0.107037
Weight (kg)	17.93±3.77	21.42±6.31	-2.12243	.020188
Mid Upper Arm Circumference (cm)	6.52±0.91	6.19±0.65	1.31842	097628
Head circumference(cm)	21±5.09	19.79±0.91	1.05363	.149352
biceps Skin Fold Thickness (mm)	5.55±2.35	7.8±1.28	-3.75894	.000287
Supra iliac Skin Fold Thickness (mm)	7.4±2.06	8.45±3.44	-1.17057	.12453
thigh Skin Fold Thickness (mm)	9.5±1.76	10.3±3.06	-1.01257	.158835



As evident from the Table I, Mean age of autistic group of children is 6.7±2.465years, while the mean age of healthy group of children is 7.85±3.08 years.

Independent ‘t’ test was done and a statistical not insignificant difference in age was found between the two groups with t value -1.26359 at p=0.107037.

Mean weight of autistic group of children is 17.93±2.65 kg, while mean weight of healthy group of children is 21.42±6.31 kg. Independent ‘t’ test was done and a statistically significant difference was found between the two groups with t value -2.12243 at p=.020188. Mean mid upper arm circumference of autistic group of children is 6.52±0.91 in, while mean mid upper arm circumference of healthy group of children is 6.19±0.65 in. Independent ‘t’ test

was done and a statistical not insignificant difference was found between the two groups with t value 1.31842 at p=097628.Mean head circumference of autistic group children is 21±5.09 in while mean head circumference of healthy children is 19.79±0.91in. Independent 't' test was done and a statistical not insignificant difference was found between the two groups with t value 1.05363 at p= .149352

Mean biceps skin fold thickness of autistic group of children is 5.55±2.35 mm, while mean biceps skin fold thickness of healthy group of children is7.8±1.28mm. Independent 't' test was done and a statistically significant difference was found between the two groups with t-3.75894 value at p-.000287. Mean supra iliac skin fold thickness of autistic group of children is 8.45±3.44mm, while mean supra iliac skin fold thickness of healthy group of children is 24.13±0.8 mm. Independent 't' test was done and a statistical not significant difference was found between the two groups with t value -1.17057 at p=.12453. Mean thigh skin fold thickness of autistic group of children is 9.5±1.76mm, while mean thigh skin fold thickness of healthy group children is 10.3±3.06 mm. Independent 't' test was done and a statistical not insignificant difference was found between the two groups with t value -1.01257 at p =.158835

DISCUSSION

DISCUSSION

On comparing the mean age of the children, no significant difference was found between the autistic children and the healthy children. This was because the control group contained age matched children so that age wise changes in the anthropometric measurements do not interfere with the results.

The mean weight of the children in the autistic group of children (17.93±2.65) was found to be significantly lower than the mean weight of the healthy children (21.42±6.31). This is in accordance to the findings of Md. Ibrahim Sohel[10] they concluded in the review article the study showed that the Bangladeshi children with autism spectrum disorder had statistically significant lower weight, and were mostly underweight as compared to normal children.

Similar were the findings of Komal Srivastava[7] who assessed the weight of Autism Spectrum Disorder children. The weight as well as the BMI of these children was lower than that of the controls. So it was concluded that the autistic children have higher chances of being underweight, growth stunting and muscle wasting.

To our knowledge this was the first kind of study which had measured and compared the skin folds at various places in the body and mid arm circumference between the two groups. It was found that the skin folds at the level of biceps, suprailiac and thigh regions were found to be on the higher side in the group of autistic children in contrast to the controls. However, there was an insignificant increase between the measurements of biceps skin fold in the in comparison to the healthy group and autistic group.

CONCLUSION

CONCLUSION

On comparing the anthropometric measurements between the two groups it can be concluded that the weight of the autistic children was found to be lower than the healthy group of children. Also, biceps skin fold thickness of the autistic children was found to lower than the healthy group of children. Because of the tendency of the autistic children to have lower weight, associated factors should be kept in mind while approaching a case of autism and an individualized treatment plan should be formulated for gaining maximum effectiveness.

LIMITATIONS

- A small sample size.
- Only a few of the anthropometric measurements were taken.

FUTURE RECOMMENDATIONS

- A large sample size would ensure the generalizability of results.
- Other anthropometric measurements can be included.

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ANNEXURES

ANNEXURE I

CONSENT FORM

Ref No ……..…
Date: _____

CONSENT FORM

Integral Institute of Medical Sciences and Research
Department Of Anatomy
Lucknow

I …… hereby give the consent to participate in the study **"A comparative study of anthropometric parameters in autistic and healthy children."** A research study conducted by a postgraduate student from the Department of Anatomy, IIMS&R Lucknow. I have been informed about the nature and purpose of the study. The purpose of the study is to compare the anthropometric parameters in autistic and healthy children.
I duly understand the risks and benefits involved in the study, hereby referred to: Risk- **There is no risk involved with this study.**

ANTHROPOMETRIC MEASUREMENTS: The following parameters will be taken in the presence of a female attendant(In case of female subjects)

1. **Body weight:(The participant wearing light clothing and no shoes)**
2. **Mid arm circumference and head circumference: (The measurement will be taken after exposing arm)**
3. **Biceps brachii skin thickness: (The measurement will be taken after exposing arm)**
4. **Suprailiac skin thickness: (The measurement will be taken after exposing the suprailiac area)**
5. **Thigh skin thickness: (The measurement will be taken after exposing the thigh)**

Benefit- **A comparative study of anthropometric parameters may reflect impact of genetic background and environmental setup on autism.**
I understand the above information has been explained to me in the language I can understand. I have been assured that the information will be kept confidential. I am free to withdraw from this study at any time I wish to.

Name: ……

Age/Gender: …….

Signature: …….

ANNEXURE II

DATA COLLECTION SHEET

NAME: ……....

AGE/GENDER: ……...

Father's Name: ……

Mother's Name: ……...

Father's Education: …….

Mother's Education: ……

Father Occupation: …….

Mother's Occupation: …….

Family Income: ……

Diagnosis: …….

ANTHROPOMETRIC MEASUREMENTS:

1. **Body weight:**
2. **Mid arm circumference and head circumference:**
3. **Biceps brachii skin thickness:**
4. **Suprailiac skin thickness:**
5. **Thigh skin thickness:**

Ashok plag.

ORIGINALITY REPORT

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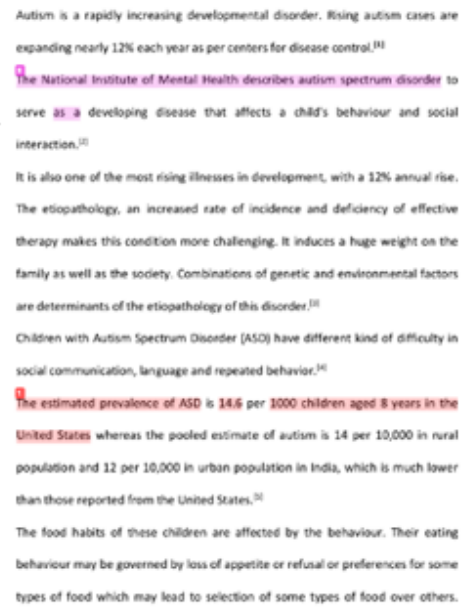

Autism is a rapidly increasing developmental disorder. Rising autism cases are expanding nearly 12% each year as per centers for disease control.[1]

The National Institute of Mental Health describes autism spectrum disorder to serve as a developing disease that affects a child's behaviour and social interaction.[2]

It is also one of the most rising illnesses in development, with a 12% annual rise. The etiopathology, an increased rate of incidence and deficiency of effective therapy makes this condition more challenging. It induces a huge weight on the family as well as the society. Combinations of genetic and environmental factors are determinants of the etiopathology of this disorder.[3]

Children with Autism Spectrum Disorder (ASD) have different kind of difficulty in social communication, language and repeated behavior.[4]

The estimated prevalence of ASD is 14.6 per 1000 children aged 8 years in the United States whereas the pooled estimate of autism is 14 per 10,000 in rural population and 12 per 10,000 in urban population in India, which is much lower than those reported from the United States.[5]

The food habits of these children are affected by the behaviour. Their eating behaviour may be governed by loss of appetite or refusal or preferences for some types of food which may lead to selection of some types of food over others.

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