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Comparison of health related physical fitness in school going children with and without visual impairment: A cross - sectional study

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Abstract
Introduction: Health related physical fitness is one of the most important measurement for overall physical status of an individual. Whilst a growing number of blind sports opportunities have been noted in community sport settings in our country, such physical fitness evaluation are necessary for additional information on visually impaired people and also enhance community rehabilitation programs for them to make them physically fit and active in their life.
Aim & Objectives: The aim of the study was to compare the health related component of the physical fitness test in normal and visually impaired school going children. The objectives were to compare the body composition, muscular strength and endurance, cardiovascular endurance and flexibility in child with and without visual impairment.
Methodology: The total of 122 samples equally divided in each group were recruited, assessed and analyzed using the health related physical fitness field tests for each component and the results were compared between the two groups.
Results: The study concluded that there is a significant difference in flexibility and the muscle endurance fitness assessment of children with and without visual impairment. It reported no differences in the body composition, muscle strength and cardiovascular endurance of the children with and without visual impairment.

Keywords: Physical fitness, visual impairment, health-related physical fitness.

1. Introduction
Physical fitness can be defined as - The ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with adequate energy to enjoy leisure-time pursuits and meet unforeseen emergencies. Physical fitness is composed of various elements that can be further grouped into health-related and skill-related components [1]. Physical activity and fitness has been put forward as a most important and modifiable factor to influencing people's health. Regular physical fitness and activity delays the onset of persistent disease and facilitates their control.
Physical activity and physical fitness levels are important factors for health and wellbeing of every child, including children with disability. Higher levels of physical fitness may be significantly related to intensity and duration of physical activity in children and adolescents [6, 7] However, it seems that many children with disability do not meet World Health Organization (WHO, 2010) recommendations of 60 min of moderate to vigorous physical activity daily [8]. It has been documented that children with disability are more likely to be sedentary [8, 11] and consequently have lower levels of Health-Related [7]. Physical Fitness such as cardiovascular fitness, muscular endurance, and higher rates of obesity [9, 10].

Physical fitness in visual impairment –
Childhood blindness is a public health concern across the world. Global estimates on childhood blindness show that there are around 1.42 million and 17.52 million children affected by blindness and severe to moderate visual impairment, respectively. It is estimated that around 200000 to 300000 children are blind in India but only around 15000 blind children are privileged to go to schools. Prevalence of childhood blindness in India is known to be

around 0.8 per 1000 children [12]. According to the Maharashtra disability census 2011, the number of visually impaired children with their age groups were – 32,197 children in age group 0-4 years, 40,075 (5-9 years), 93,353 (10-19 years) [13]. The majority of children with severe visual impairment (6/60 or worse) have additional sensory, motor, or learning impairments with or without chronic disease. Due to visual impairment, difficulties become apparent in school performance and other functions such as ability to safely participate in sports. In addition, visual impairment can affect quality of life and the effects are often life-long [14].

Dilay Acil MSN (2015) found that the prevalence of being obesity in visually impaired children is higher (17.6%). The findings suggested a correlation between the limited physical activity and inappropriate nutritional habits of visually impaired children, especially when compared with normal ones [14]. Some authors have reported that children and young adults with visual impairments tend to be less physically active, be less physically fit, and have a greater tendency to be overweight or obese than their sighted counterparts [19-22]. Lower physical activity and fitness and higher adiposity are important factors for health and well-being. Physical activity plays an important role in the promotion of children's physical and psychological health, especially for those with disabilities [19, 21, 23].

Whilst a growing number of blind sports opportunities have been noted in community sport settings in our country, such physical fitness evaluation are necessary for additional information on visually impaired people and also enhance community rehabilitation programs for them to make them physically fit and active in their life.

2. Materials & methodology

Type of Study: Cross Sectional Study

Sampling technique: Convenient Sampling

Sample population: Children with and without visual impairment.

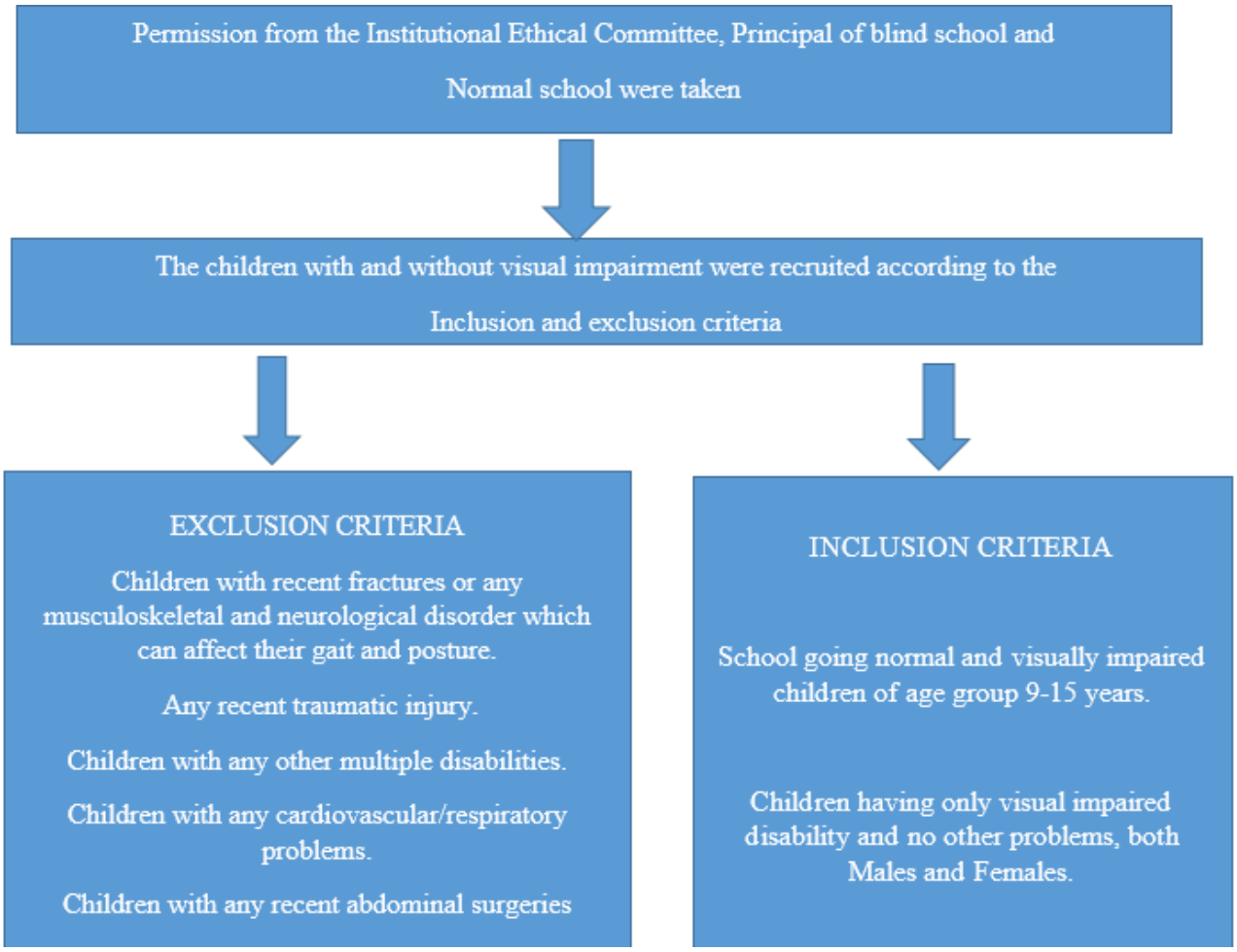
Number of Samples: 140, (70-70 in each group) [using the Open-EPI software] Population size - 15000 Anticipated % frequency (p) – 10%, Obesity in visually impaired children. Confidence limits (%) – 95% Type 1 error (a) – 0.05 (we could recruit only 61 samples each in both the groups as due to pandemic, there were strict restrictions on schools and educational institutional places, total 132 samples were recruited, assessed and analyzed for results).

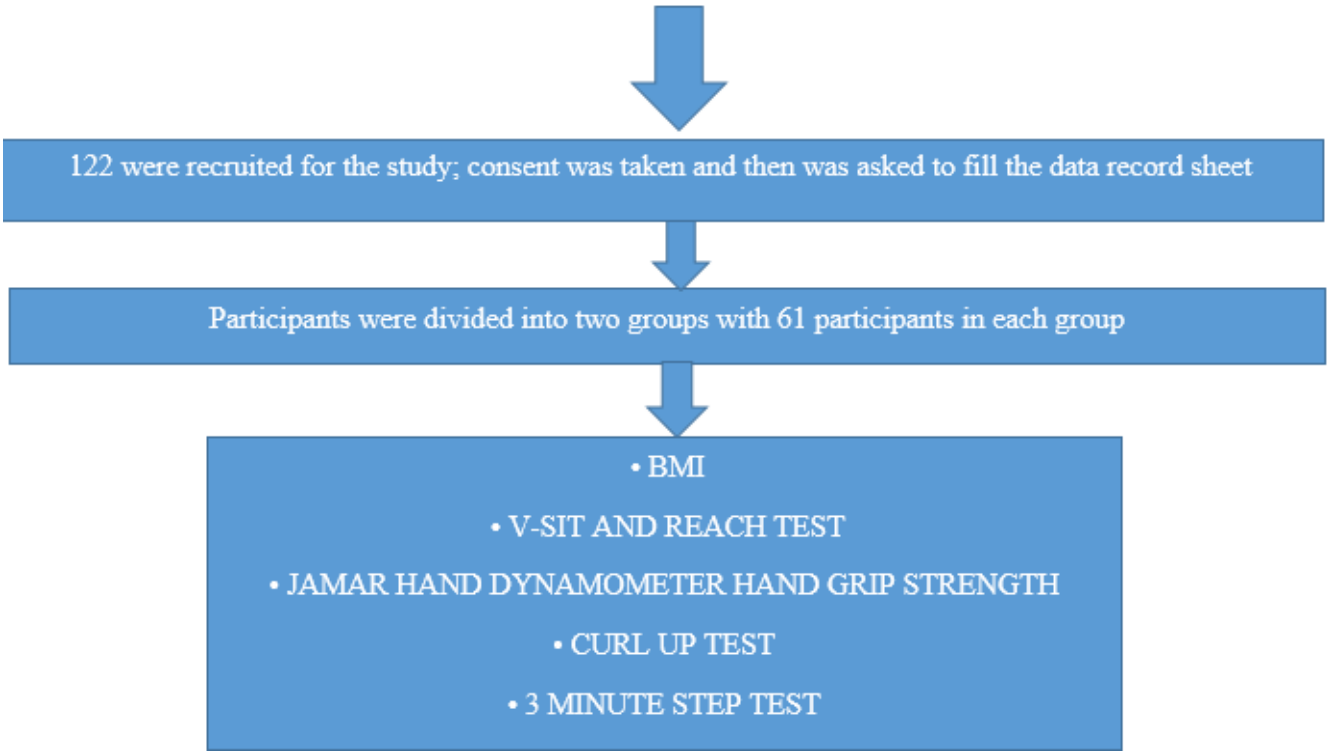
Research location: Blind schools and schools for normal children.

Operational definition: In the study the criteria for visual impairment was the child should be completely blind (presenting visual acuity <6/60-3/60 in better eye with correction) and should have the disability certificate of visual impairment by Government of India and ministry of health and family welfare.

Health related physical fitness components	Health related physical fitness field tests
Body composition	BMI body mass index
Flexibility	Sit and reach test
Muscular strength	Jamar hand dynamometer
Muscular endurance	Curl-up test
Cardiovascular endurance	3 minute step test

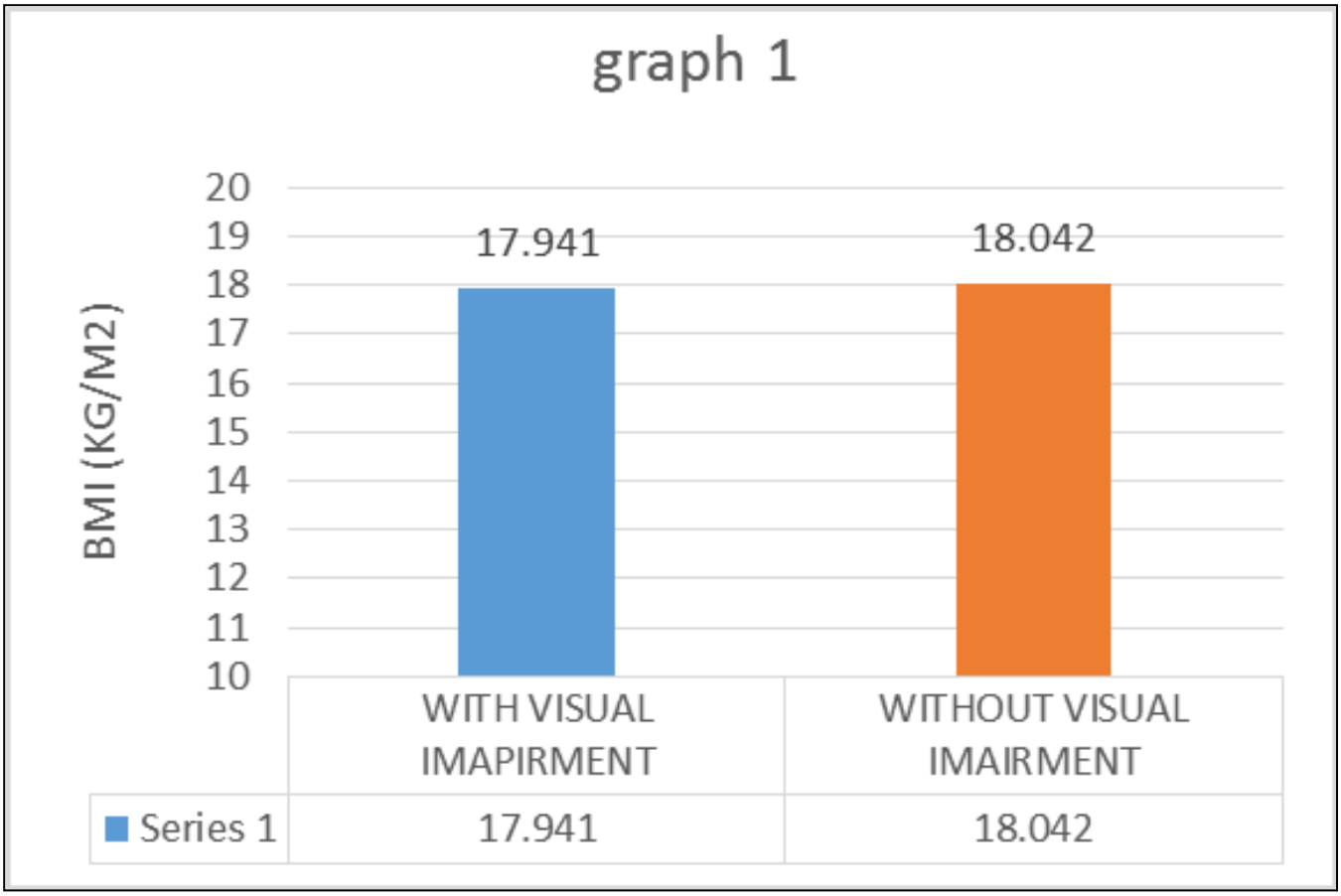
2.1 Procedure





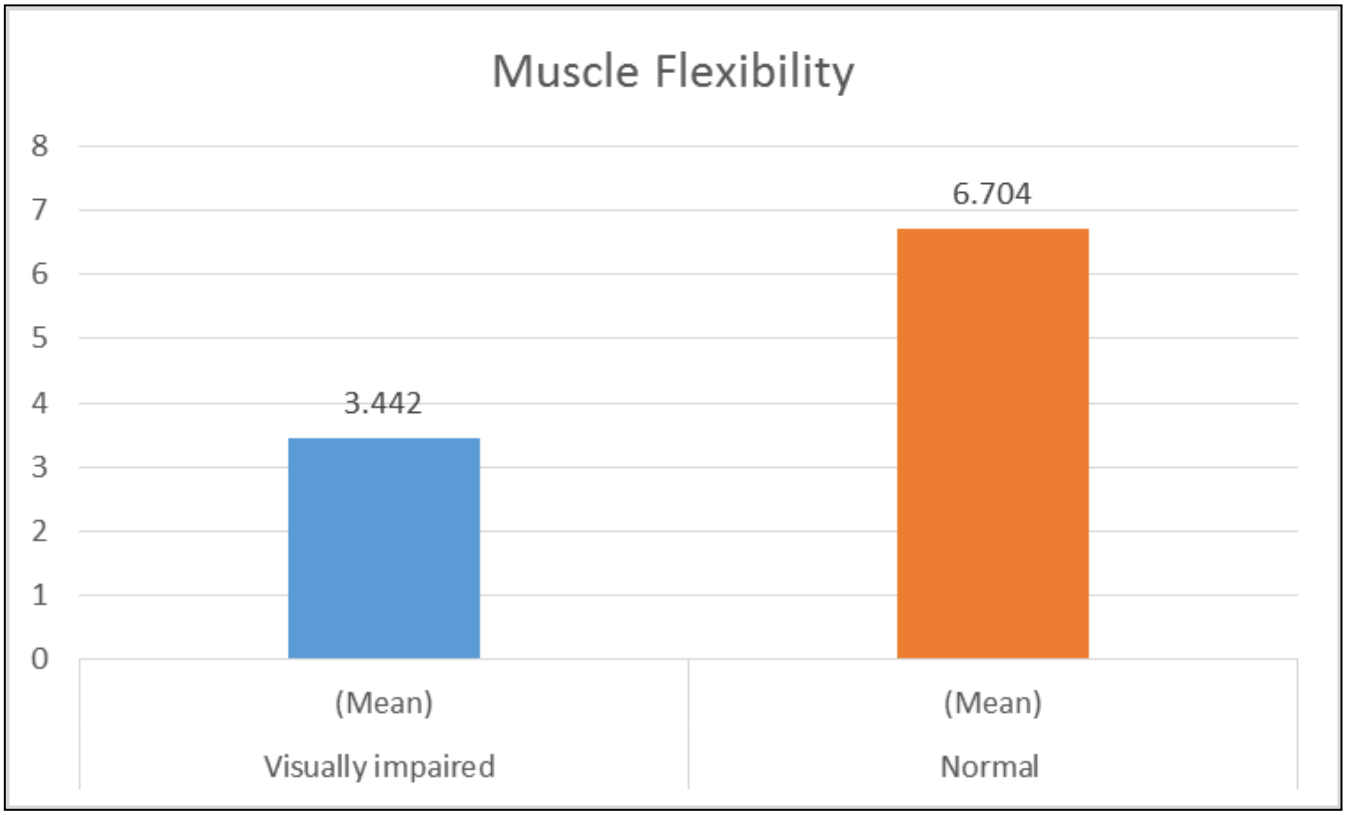
3. Results

3.1 Body Composition measurement by body mass index (BMI)



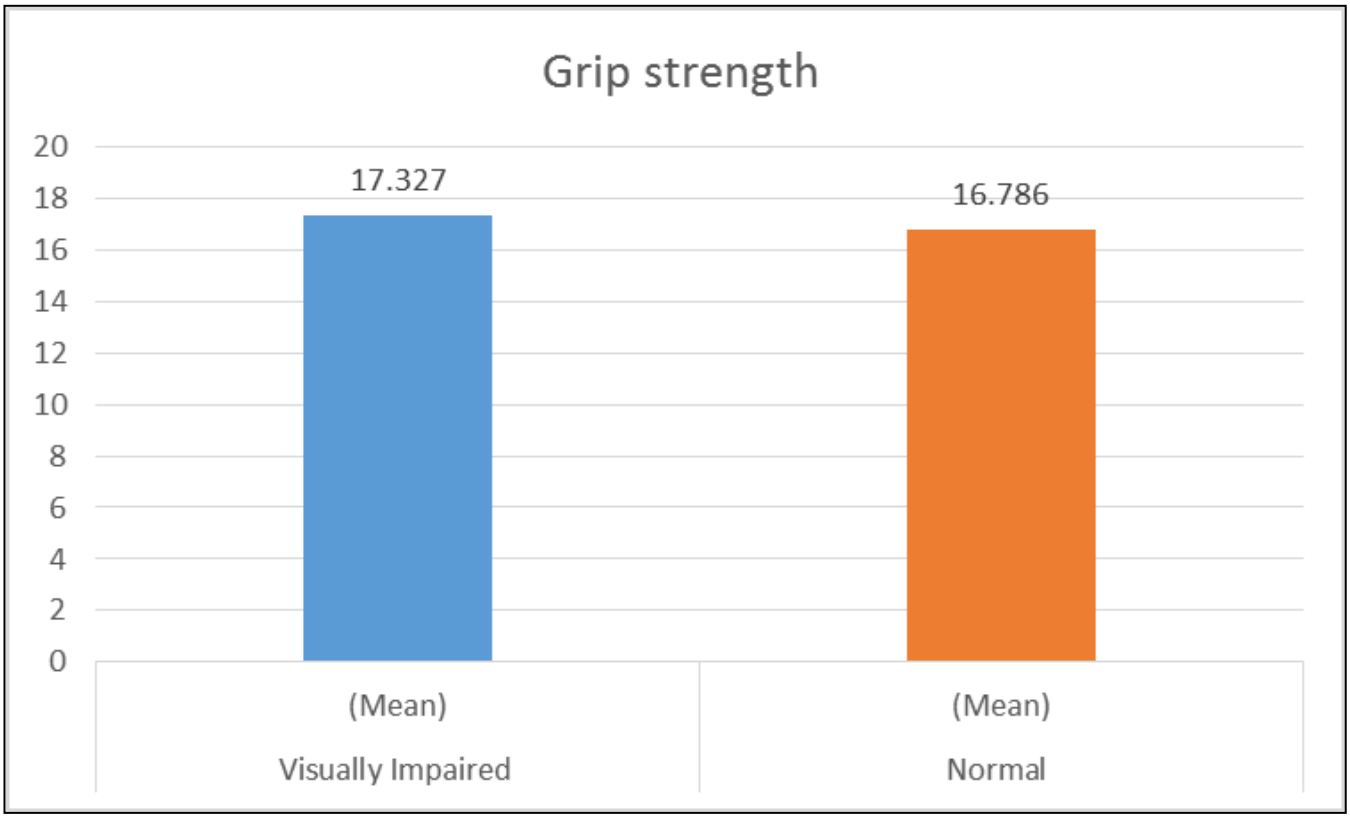
Interpretation: the graph 1 depicts that there was no significant difference in the body mass index (BMI) values between both the groups.

3.2 Flexibility measurement by v-sit and reach test



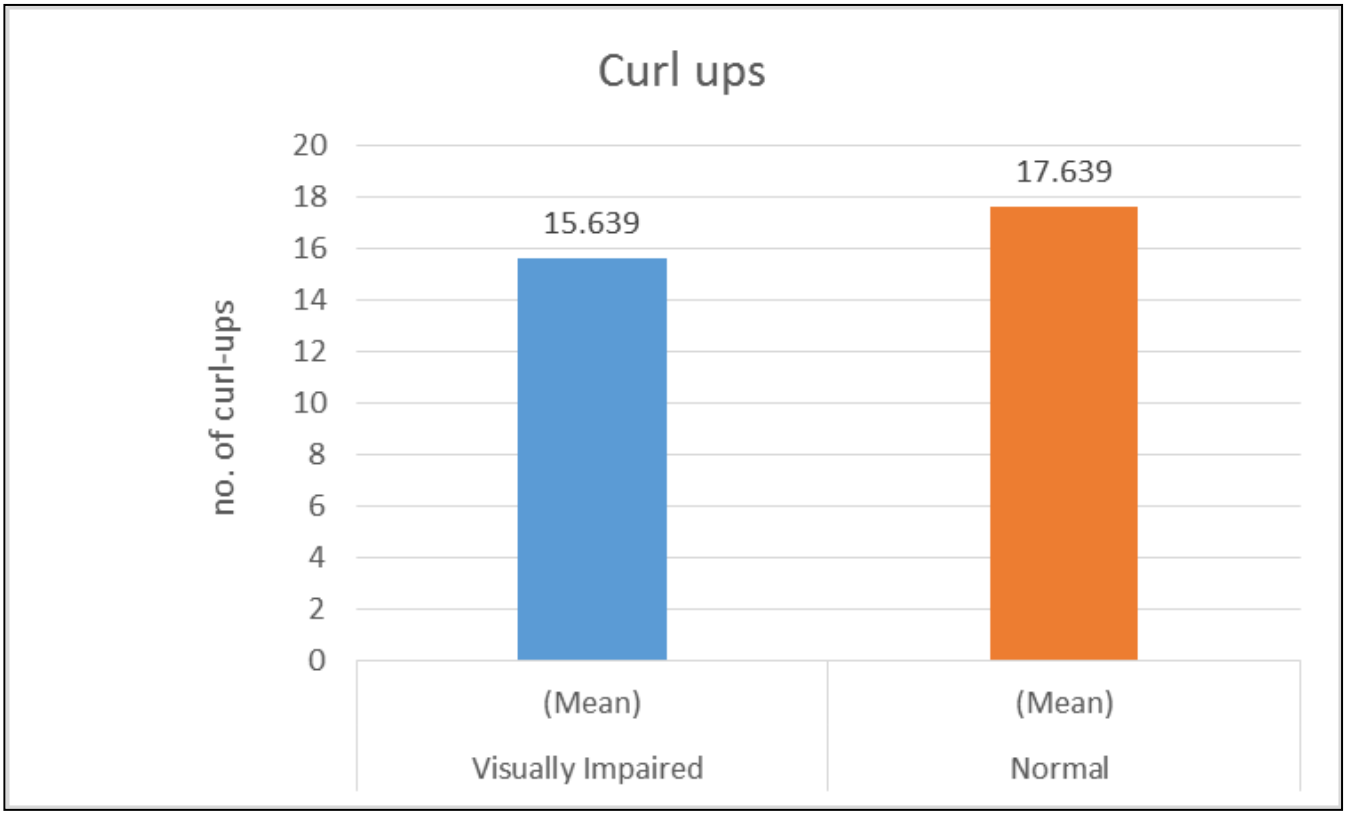
Interpretation - Graph no. 2 depicts that the children without visual impairment have more muscle flexibility on the v-sit and reach test as compared to children with visual impairment.

3.3 Muscle strength assessment by measuring hand grip strength



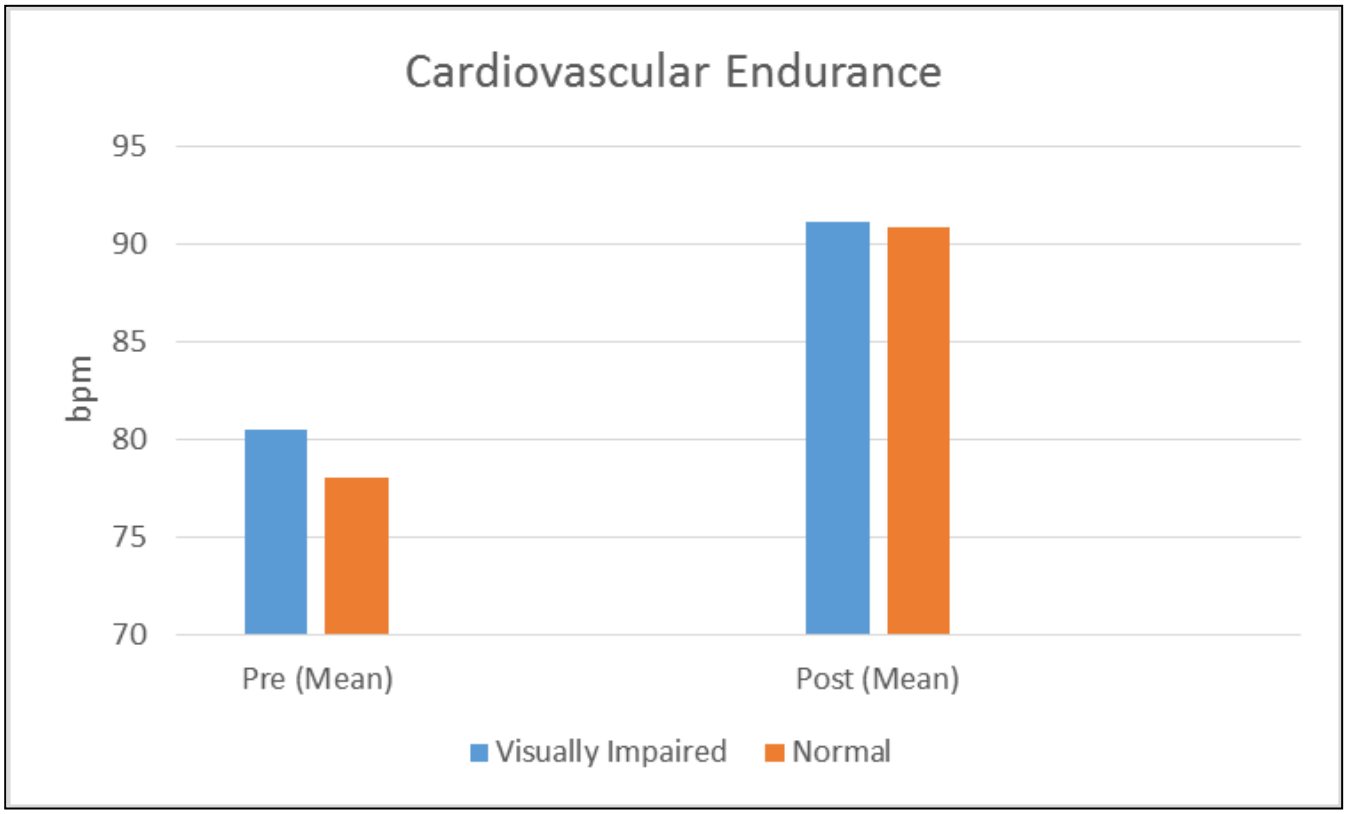
Interpretation - Graph no. 3 depicts that there is no significant difference in muscle strength measured by hand dynamometer between children with and without visual impairment.

3.4 Muscle endurance assessment by measuring curl-ups test



Interpretation:- Graph no. 4 depicts that children without visual impairment have more muscle endurance measured by the no. of curl-ups in one minute as compared to children with visual impairment.

3.5 Cardiovascular endurance measured by 3 minute step test



Interpretation - post-post p value 0.7994 is not significant. Graph no. 5 depicts that there is no significant statistical difference in cardiovascular endurance (p=0.7994) implying that the cardio vascular endurance is same between the children with and without visual impairments.

4. Discussion

All the health related physical fitness tests administered in the present study were the combination of tests taken from various physical fitness test batteries and each tests have their reliability and validity to perform it on children and visually impaired. The important consideration was to decide to

include only field tests. Indeed, although laboratory tests have more reliable results, field tests are general easier, faster, and cheaper to administer. These aspects are fundamental especially for fitness component evaluation in population based studies and in school settings [28].

There was no significant difference between the mean BMI values of both the groups stating that the mean BMI values of children with and without visual impairment are almost same. A systematic review done on physical activity, physical fitness and body composition among children and young adults with visual impairment by Liv Augestad, *et al.* 2015, reported that 23 reviewed studies had results claiming that Children with VIs were shown to have a more unhealthy body composition and higher rates of overweight and obesity than sighted. The findings revealed lower levels of participation in physical activity, poorer physical fitness, and higher prevalence of overweight and obesity among children with visual impairment compared to children with no reported Visual impairments [17]. In the current study, no significant difference were found between BMI values, supporting our results in previous studies by Lieberman, *et al.* 2010 and Montero 2005 also found no significant difference in body composition by BMI measures between visually impaired and normal sighted. However in our study the children did not live in their residential blind schools instead they were at their respective homes since past 9- 10 months due to COVID 19 pandemic and hence a proper nutritional diet would have been well taken care of at their homes. This can be one of the factor to have no significant difference in the BMI values of the both groups.

The second component of health related physical fitness is evaluation of flexibility. In present study flexibility of both the groups was measured by using v-sit and reach test. The test reported a significant difference between the mean values of flexibility v-sit and reach test. Similarly, a study by Samir Qasim, *et al.* Health-related physical fitness levels of youths with visual impairment in Jordan, in 2020 evaluated health related physical fitness and compared them between visually impaired and without visually impaired normal youths. The study had sit and reach test for flexibility evaluation and it concluded that the youths with visual impairment had low levels of flexibility measurements than the normal 52 without visual impairment ones, the mean score of VI youths was 15.39 (7.89) and that of without visual impairment was 32.32 (7.548) [10]. The present study also found significant differences in the flexibility of children with and without visual impairment. This can be because of lack of physical activity among children with visual impairment. Already previous literature have claimed reduced physical activity in visually impaired children due to several reasons like fear of fall, static and dynamic balance difficulties, reduced physical fitness levels all this can lead to reduce in physical activity that involves lower extremity eventually decreasing the extensibility of lower extremity muscles. Also due to COVID19 pandemic, all the children were forced to stay back at their home which eventually hampered their physical activity and reduced their physical fitness [33].

The third component was to evaluate muscle endurance by observing the no. of curlups in a minute. The test produced a significant difference in the mean values of children with visual impairment 15.639 (±5.154) and children without visual impairment 17.639 (±4.906). Therefore it can be postulated that the children without visual impairment had slightly higher abdominal muscular endurance when tested on curl-ups test. Supporting evidence was found in an investigation by Short and Winnick, Meek and Maguire who reported reduced performance in abdominal strength and endurance for children with visual impairments. The author claimed that such results were observed because of lack of physical education for students with visual impairment. Contradictory findings have been reported by Hopkins, *et al* who found no correlation between level of vision and muscular endurance. Also Houwen, *et al.* [22] found the difference in muscular endurance of the abdominal muscles to be statistically insignificant between visually impaired and normal sighted individuals. Hopkins, *et al.* concluded his results with reasons that visually impaired children are less active and also that the totally blind children have an oxygen uptake that is still considerably less than that of the normal [15, 35]. The present study depicted significant difference in muscle endurance between children with and without visual impairment. This can be because the study demonstrated curlups test to check abdominal strength, visually impaired children are already known for having lower physical activity and sedentary lifestyle which directly affects the child's 55 core muscle strength and hence the study showed the significant difference with low levels of muscle endurance in visually impaired than sighted children.

The fourth component of health related physical fitness was to evaluate muscle strength which was done by performing hand grip strength testing using Jamar hand dynamometer. In the present study, the results reported that there was no significant difference between the mean values of group with visual impairment and group without visual impairment. Hopkins *et al.* and Houwen, *et al.* found no correlation between level of Visual acuity and abdominal muscular strength. Hopkins *et al.* (27 children with age group of 7-17 years) while evaluating physical fitness between normal sighted and visually impaired checked the muscular strength by partial sit-ups test. They concluded that there was no significant difference between both the groups [15, 35]. Supporting study by Houwen, *et al.* (2010) 'the relationship among motor proficiency, physical fitness and body composition in children with and without visual impairments' which consisted of 40 males and 20 females in each group and found that the difference in hand strength between persons with visual impairment and fully sighted persons to be insignificant when tested with a hand grip dynamometer. The study claimed that despite not being classified as statistically significant, the fully sighted group averaged an extra four kilograms on muscular contraction than the Visual impairment group. The author gave the reason that the motor proficiency required for the handgrip is minimal and should, therefore, not be a disadvantage for most children with visual impairment [15]. In this study, there was no significant difference found between the grip strength of both the groups. The reason for it can be, as the visually impaired individuals have sensory loss of eye sight, they rely heavily on their hand grip and tactile sensation of their hands to perform all their activities. This can eventually lead to increase in grip strength and tactile sensation of the visually impaired individuals.

The fifth component, cardiovascular endurance, the results reported that there was no significant difference between the mean post heart rate values of both the groups. However there was significant difference between the pre and post heart rate values in both the groups when compared individually, but as it wasn't the part of the study's objective, it wasn't considered in the results. Several other evidences have been researched on evaluating the cardiovascular endurance in visually impaired and compared it with the normal sighted individuals.

Hopkins, *et al.* in the study 'Physical fitness of blind and sighted children involved participants within the age group of 7-17 years, measured heart rate using the Canadian Home Fitness Stepping test (submaximal). Fully sighted individuals had significantly lower heart rates than those with blind category individuals (B1, B2 and B3), with lower submaximal heart rate indicative of greater fitness. In this study, due to time restrictions, feasibility of materials and environment and also due to COVID-19 pandemic restrictions we opted to use more readily applicable test – 3 minute step test. The advantage of administering this test was – it is less time consuming, more feasible, lesser equipment required and more over it can also be self-administered if required. This study showed no significant difference between the post-test values of the two groups. This results can be because of various reasons. Firstly, recent evidences have depicted the serious impact of COVID-19 on child's mental and physical health. Children have become more lethargic with low physical activity levels and have adapted more sedentary behavior. This can have adverse effects on physical fitness of the child. As there was no access to any sports or physical fitness activities for 61 children with and without visual impairment there have been reduction in their health related fitness levels.

5. Conclusion

There are significant differences in health related physical fitness of school going children with and without visual impairment. The present study found that there is a significant difference in flexibility and the muscle endurance fitness assessment of children with and without visual impairment. The study reported no differences in the body composition, muscle strength and cardiovascular endurance of the children with and without visual impairment.

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