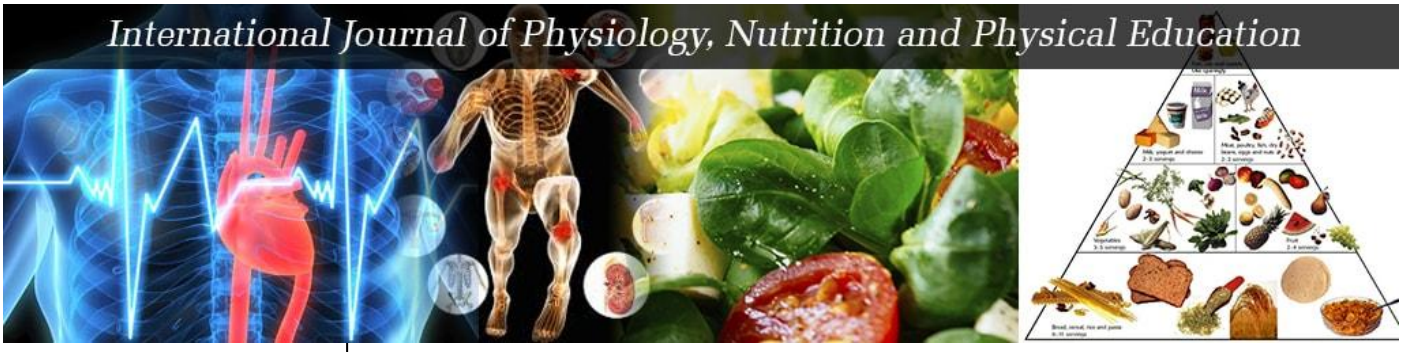

ISSN: 2456-0057
IJPNPE 2018; 3(1): 1126-1128

www.journalofsports.com
Received: 09-11-2017
Accepted: 12-12-2017

Dhiman Midday
HOD, Department of Physical Education, Adamas University, Kolkata, West Bengal, India

Correspondence
Dhiman Midday
HOD, Department of Physical Education, Adamas University, Kolkata, West Bengal, India

Differentiation of gait pattern between normal and hearing impaired males

Dhiman Midday

Abstract
The purpose of the study was to compare gait pattern of normal and deaf subjects. Four students were selected as subjects; among which two were normal and two more than 90% deaf. Gait action of the subjects was recorded using a high speed video camera. For comparison of gait pattern selected anthropometric and kinematic parameters were (i) walking speed (ii) cadence (iii) stride length (iv) stride width (v) arm velocity; (vi) duration of stride cycle (vii) stance phase (viii) swing phase (ix) double support phase and (x) single support phase. The recorded movements were analyzed using motion analysis software and the obtained data were statistically analyzed using data analysis software. The results indicated that walking speed was lower for deaf than normal subjects but the cycle duration and arm velocity were higher for deaf.

Keywords: gait pattern, hearing impaired, kinematics

Introduction
Gait may be defined as the style of walking, the most fundamental human activity that serves as the most basic means for functionality. Depending on the speed, walking can be classified into three categories – slow, medium and fast (Klopsteg and Wilson, 1968). Walking is accomplished by the alternating action of the two lower extremities.

Walking results from successive loss of balance of the two alternating feet. Each balance loss is followed by a newly established base of support and a regaining of balance. Forward progress in walking results from a combination of three forces – (1) muscular force causing pressure of the foot against the surface, (2) force of gravity which tends to pull the body forward and downward once it is off- balance and (3) force of momentum which tends to keep the body moving in the same direction and at a constant speed. While analyzing walking biomechanically, leg movement should be considered primarily. The leg movement is divided into two phases – (a) support phase and (b) swing phase. The support phase is further sub-divided into restraining phase and propulsion phase. Walking cycle is consists of support phase and swing phase. In ordinary walking support phase occupies 60% and swing phase 40% of total time of a single walking cycle.

The term hearing impaired is a generic term used to identify a hearing disability and includes both hard-of-hearing and Deaf. Hearing disabilities are usually structural in origin or damage to any part of the ear - outer, middle or inner, which may result into hearing loss. Hearing loss may be classified into Conductive, Sensorineural, or Mixed.

The vestibular system is an organ that detects the sensation of physical balance and plays an important role in the relationship between body and the space it occupies. The vestibulocochlear system is located in the inner ear and has twin function. Cochlea is responsible for hearing and the vestibule is for balance. Vestibular dysfunctions are not rare in childhood. Children with vestibular dysfunction may report feeling unbalanced, may have problems with walking and other physical activity.

In the field of biomechanical research in gait analysis, there is scarce of knowledge based data among comparison between normal and deaf subjects. The present study was designed to establish a bridge between existing data and actual present scenario.

Methodology

Four students (age ranged 12-17 yrs, mean weight 27.25 ± 6.55 kg, mean height 1.41 ± 0.116 m) were selected as the subjects of the present study. Among them two were normal and two were deaf of more than 90%.

Pattern of fast walking and its influencing factors were considered as the criteria of measurement for this study. The selected biomechanical parameters were (i) walking speed (ii) cadence (iii) stride length (iv) stride width (v) arm velocity; and (vi) duration of stride cycle vii) stance phase (viii) swing phase (ix) double support phase (x) single support phase. Initially the walking actions of the subjects were recorded by a high frequency camera (420 fps) following scientific principles of filming. Then the parameters were measured by appropriate software and the data were analyzed statistically through SPSS ver. 20.

Results

The height and weight of the subjects are charted in table 1.

Table 1: Mean and S.D of Height and Weight of the subjects

Parameters	Normal	Deaf
Height (cm)	1.35 ± .049	1.46 ± .162
Weight (kg)	24.00 ± 1.41	30.50 ± 9.19

It is seen that the mean height of the normal subjects was 1.35 with standard deviation of 0.049. On the other hand the mean height of the deaf subjects was 1.46 with a standard deviation of 0.162. In case if weight the mean value for the normal subjects was 24.00 with a standard deviation of 1.41 while for the deaf subjects the value was 30.50 with a standard deviation of 9.19.

Table 2 shows the descriptive statics of selected biomechanical parameters of the gait of the subjects.

Table 2: Mean and S.D of biomechanical parameters

Parameters	Normal	Deaf
Walking speed (m/s)	3.74 ± 0.339	3.70 ± 0 .346
Cycle duration (s)	.145 ± .007	0.175 ± 0.007
Stance phase (s)	0.080 ± 0.014	0.095 ± 0.007
Swing phase (s)	0.60 ± 0.014	0.075 ± 0.007
Double support phase (s)	0.04 ± 0.042	0.02 ± 0.000
Single support phase (s)	0.06 ± 0.000	0.05 ± 0.042
Cadence (step/s)	3.50 ± 0 .007	3.23 ± 0.537
Stride width (m)	0.240 ± 0 .212	.065 ± 0 .007
Arm velocity (m/s)	20.66 ± 0.905	21.70 ± 0.395
Stride length (m)	1.63 ± 0 .035*	1.91 ± 0.127*

It is showed from the table that the mean value of walking speed for normal subjects with fast walking was 3.74 with a standard deviation of 0.339; for deaf subjects with fast walking it was 3.70 with a standard deviation of 0.346. The mean value of cycle duration for normal subjects with fast walking was 0.145 with a standard deviation of 0.007; for deaf subjects with fast walking it was 0.175 with a standard deviation of 0.007. The mean value of stance phase for normal subjects was 0.080 with a standard deviation of 0.014; for deaf subjects it was 0.095 with standard deviation of 0.007. The mean value of swing phase for normal and deaf subjects was 0.60 with standard deviation of 0.014 and 0.075 with standard deviation of 0.007 respectively. In double support phase the mean value for normal subjects was 0.04 with standard deviation of 0.042 while for deaf subjects it was 0.02 with standard deviation of 0.00. The mean value of single support phase for normal subject was 0.06 with a standard deviation of 0.00 and for deaf subjects it was 0.05 with standard deviation of 0.042. The mean value for cadence for general subjects with fast walking was 3.50 with a standard deviation of 0.007, for Deaf subjects with fast walking it was 3.23 with a standard deviation of 0.537. The mean value for stride width for general subjects with fast walking was 0.240 with a standard deviation of 0.212, for Deaf subjects with fast walking it was 0.065 with a standard deviation of 0.007. For arm velocity the mean and standard deviation was 20.66 and 0.905 for normal subjects while 21.70 and 0.395 for deaf subjects respectively. The mean value for stride length for general subjects with fast walking was 1.63 with a standard deviation of 0.035, for Deaf subjects with fast walking it was 1.91 with a standard deviation of 0.127. The value of mean difference for stride length was significant statistically at 95% level of confidence.

Discussion

The results of the gait speed demonstrated that the deaf group had poorer performance in walking speed than the normal group. Studies have shown that people with vestibular dysfunction walk with short steps, using a wide support base, and avoid sudden movements (12, 25) to avoid provoking undesirable symptoms such as dizziness and vertigo caused by their vestibular dysfunction. Furthermore, ability is compromised in the balance position and gait velocity is reduced in patients with vestibular dysfunction (20, 3).

It is fact that the deaf subjects had sensorineural impairment. Therefore, they found hardship to maintain stance phase as well as swing phase. The results also indicated that the value for stance phase and swing phase was much higher in deaf subjects. As a result, cycle duration was also higher in deaf subjects which were a speed barrier.

In the result it was seen that the stride length of the deaf subjects was higher than normal ones. It is a bit deviated from the regular studies. In the present case the higher subjects' height and leg length contributed to this one.

Conclusion

From the results it can be concluded that:

1. Walking speed of the deaf subjects is lower than normal subjects.
2. Cycle duration of the deaf subjects is higher than normal subjects.
3. Arm velocity of the deaf subjects is higher than normal subjects.

References

1. Gayle GW, Pohlman RL. Comparative study of the dynamic, static, and rotary balance of deaf and hearing children. Percept Mot Skills. 1990; 70:883-8.
2. Ganança MM, Caovilla HH, Munhoz MS, Ganança FF. Tonturas na criança e no adolescente. Rev Bras Med Otorrinolaringol. 1992; 2:217-42.
3. Berg KO, Maki BE, Williams JL, Holliday PJ, Wood-Dauphinee SL. Clinical and laboratory measures of postural balance in an elderly population. Arch Phys Med Rehabil. 1992; 73:1073-80.
4. Guyton AC, Hall JE. Traded de physiologic medical. 8th ed. Rio de Janeiro: Guanabara Koogan, 1992.
5. Ganança MM, Vieira RM, Caovilla HH. Princípios de Otoneurologia. São Paulo: Atheneu, 2001.
6. Formigoni FG. Avaliação vestibular na criança. In: Ganança MM, editor. Vertigem tem cura? São Paulo: Limos. 2003, 117-26.

7. Angeli S. Value of vestibular testing in young children with sensorineural hearing loss. Arch Otolaryngology Head Neck Surg. 2003; 129:478-82.
8. Gheysen F, Loots G, van Waelvelde H. Motor development of deaf children with and without cochlear implants. J Deaf Stud Deaf Educ. 2008; 13:215-24.
9. Cushing SL, Papsin BC, Rutka JA, James AL, Gordon KA. Evidence of vestibular and balance dysfunction in children with profound sensorineural hearing loss using cochlear implants. Laryngoscope. 2008; 1180:1814-23.
10. Azevedo MG, Samelli AG. Comparative study of balance on deaf and hearing children. Rev CEFAC 11. 2009; 1:85-91.