P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2018; 5(2): 200-204

www.kheljournal.com
Received: 05-01-2018
Accepted: 06-02-2018

Sajjad Ahmad
Assistant Students Welfare Officer, Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, Jammu and Kashmir. India

Dhananjoy Shaw
Principal, IGIPESS, University of Delhi, New Delhi, India

Correspondence
Sajjad Ahmad
Assistant Students Welfare Officer, Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, Jammu and Kashmir. India

Collateral temporal kinematic at planter aspect of foot of walking gait of female sportspersons

Sajjad Ahmad and Dhananjoy Shaw

Abstract
Natural gait analysis is the best analysis because it identifies not only our foot strike but also the way our whole body moves as we propagate. From this we can determine why our feet land as we do and select the best kind of supports for us. The appropriate support is vital to have to helps us avoid strains and sports injuries. Gait analysis is the systematic study of human walking. Over the past few years, there has been an increasing interest in the subject, particularly among practitioners and students of physical therapy, Physical education, sports sciences, bioengineering and several branches of medicine including orthopedics, rheumatology, neurology and rehabilitation. Gait analysis helps us to understand Kinematic analysis, temporal analysis, angular kinematic analysis, muscular activity, force analysis, pressure distribution analysis and joint dot analysis etc. There is negligible study on kinematic analysis on Indian sportspersons and hence a research gap was evident and a group of research scholars from Indira Gandhi Institute of Physical Education and Sports Sciences, (University of Delhi) are motivated to investigate of foot pressure dominance of contralateral aspect considering the morphological and functional asymmetricity of right and left lateral foot of female sportspersons. It was hypothesized that such findings will generate a new dimension of analogy of gait analysis and thereby their implication in the field of biomechanics and kinesiology. For this purpose twenty seven (27) female sportspersons, who has at least participated at state level competitions (age 17 to 25 years) were given a walking gait test to compare between left and right foot pressure distribution. The parameters were measured by using the portable pressure measurement system from Zebris. Inc, Germany (40x30cm), supported with WinFDM-S software, (Germany). Dynamic test for left and right foot was measured in step phases to determine the foot pressure distribution. The selected variables were Left Gait Line Length (LGLL), Right Gait Line Length (RGLL), Left Dynamic Test (LDT) and Right Dynamic Test (RDT).Collected data was computed using SPSS software for Mean, Standard deviation and t-test. The pressure distribution in regard to selected variables was found to be different between right foot and left foot. It was concluded that the collateral temporal kinematic at planter aspect of foot of walking gait of female sports persons are different in right foot and left foot in regard to variables namely Contact Time 12 (CT12), Contact Time (CT13) and Contact Time (CT14) whereas in regard to all other selected variables, the right foot and left foot are not different in walking gait of female sportspersons.

Keywords: Collateral temporal kinematic, pressure plate, walking gait, female sportspersons

Introduction
Everyone's walking style is unique, and it has been shown that both humans and computers are very good at recognizing known gait patterns. It is therefore unsurprising those dynamic foot pressure patterns, which indirectly reflect the accelerations of all body parts, are also unique. Thefeet are considered as an important part of our body. It supports not only the whole body weight but also bears several times of body weight when we are running or sprinting. Different morphological foot characteristics are associated with different functions [1]. The normal foot with twenty six (26) bones and associated muscles ensures the foot static and dynamic functions and contributes to the overall features of the foot, but the shape and morphology differs from individuals [2]. The knowledge of exact functions of different feet morphology plays a crucial role in preventing injuries and providing information about sport performance [3]. Highly competitive and recreational athletes are at risk of incurring a wide range of injuries, typically hyperkeratosis lesions like corns and calluses, or stress induced injuries. Different foot morphology has become a focus in order to reduce injury when designing shoes. When it comes to anthropometry of human feet, indexes like length, width and girth or

circumference of specific feet regions have been collected and utilized in footwear design since the introduction of traditional anthropometric methods [4, 5]. Many studies have been conducted to confirm the reliability and reproducibility of foot type or morphology measurement systems compared with traditional methods both under static and dynamic conditions [3-7]. Gait analysis is the systematic study of human walking. It is often helpful in the medical management of those diseases which affect the locomotor system. Over the past few years, there has been an increasing interest in the subject, particularly among practitioners and students of physical therapy, Physical education, sports sciences, bioengineering and several branches of medicine including orthopedics, rheumatology, neurology and rehabilitation. Gait analysis helps us to understand Kinematic analysis, temporal analysis, angular kinematic analysis, muscular activity, force analysis, pressure distribution analysis, joint dot analysis etc. A study involved analysis of ground reaction force and various spatial and temporal parameters associated with dynamic gait for normal individuals. It was observed that although increase in gait speed reduces the gait cycle time, the ratio of different gait phases is comparable for normal and slow speed [10]. Another recent study showed the influence of anthropometric data on kinetic and kinematic gait parameters. The comparison between univariate and multivariate showed that while univariate studies provide fits good between data, the multivariate fits generate a highly significant correlation (11). There is negligible study on kinematic analysis on Indian sportspersons, hence a research gap was evident and a group of research scholars from Indira Gandhi Institute of Physical Education and Sports Sciences, (University of Delhi) are motivated to investigate the foot pressure dominance of contralateral aspect considering the morphological and functional asymmetricity of right and left lateral foot of female sportsperson. Ideally it is hypothesized that such findings will generate a new dimension of analogy of gait analysis and thereby their implication in the field of biomechanics and kinesiology.

Methodology

The purpose of the research was explained to all the subjects and the subjects were motivated to put their best as per their consent. Based upon the literature, expert advices and feasibility following sample and collateral pressure distribution variables were selected for identifying the samples and for the purpose of the proposed study namely Age (years), Weight (Kilograms), Height (meters), Body Mass Index (BMI), Left Gait line Length(LGLL), Right Gait Line Length (RGLL),Dynamic Test Left (DTL) and Dynamic Test Right (DTR). For this purpose twenty seven (27) female sportspersons, who has at least participated at state level competition (age 17 to 25 years) were given a walking gait test to compare between left and right foot pressure distribution. Age was determined from date of birth (DOB), weight was measured using electronic weighing machine (GVC Iron Analog Weighing scale), and height was measured using anthropometry by adopting standard protocol. BMI was calculated by using the formula, BMI = weight (kg)/ height^2 (m^2). Rest of the variables was measured using the foot pressure system protocol. Data was collected using the portable pressure measurement plat from ZebrisInc; Germany (40x30 cm), supported with Win. FDM-S software (Germany). Dynamic test for left and right foot was measured in step phases to determine the foot pressure distribution. Data was computed with descriptive statistics (mean and standard deviation) and‘t’ test. Hypothesis was tested at 0.05 level of significance.

Findings

Table 1: Walking Gait Variables with Abbreviations

S. No	Name of variable	Foot	Abbreviation
1	Gait Line Length(mm)	Left	GLLL
2	Gait Line Length(mm)	Right	GLLR
3	Dynamic Test, Contact Time (1-30)*	Left	CTL
4	Dynamic Test, Contact Time (1-30)**	Right	CTR

Note: *The total contact time of right foot were divided into 30 variables or fractions with auto generation. The 30 foot contact time of right foot abbreviated as CTR1, CTR2, CTR3, CTR4, CTR5, CTR6, CTR7, CTR8, CTR9, CTR10, CTR11, CTR12, CTR13, CTR14, CTR15, CTR16, CTR17, CTR18, CTR19, CTR20, CTR21, CTR22, CTR23, CTR24, CTR25, CTR26, CTR27, CTR28, CTR29 and CTR30.

** The total contact time of left foot were divided into 30 variables or fractions with auto generation. The 30 foot contact time of left foot abbreviated as CTL1, CTL2, CTL3, CTL4, CTL5, CTL6, CTL7, CTL8, CTL9, CTL10, CTL11, CTL12, CTL13, CTL14, CTL15, CTL16, CTL17, CTL18, CTL19, CTL20, CTL21, CTL22, CTL23, CTL24, CTL25, CTL26, CTL27, CTL28, CTL29 and CTL30.

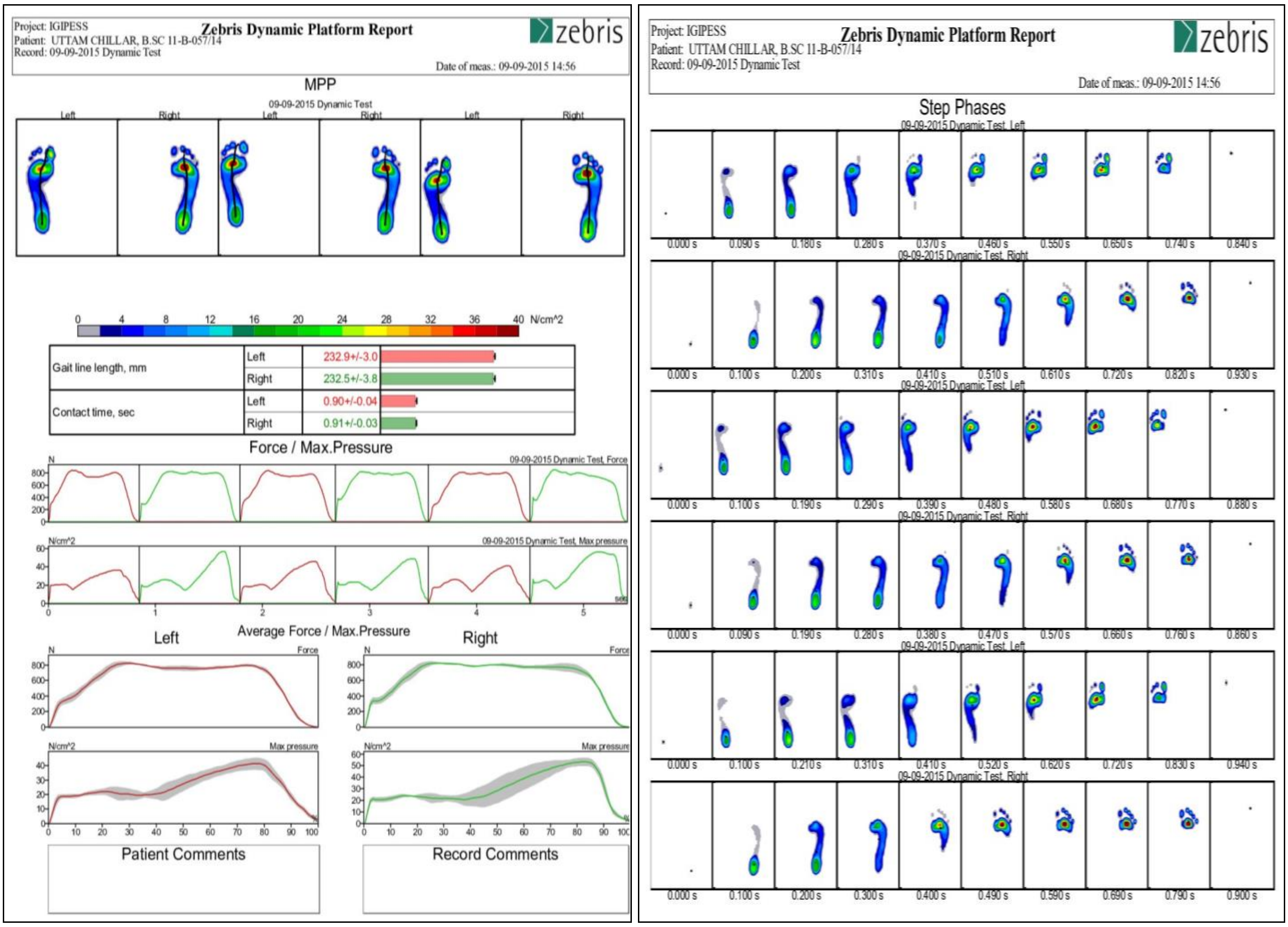

Fig 1: Sample Data

Fig 2: Picture of a Subject While Rolling Over the Pressure Plate During the Collection of Data

Table 2: Descriptive Statistics of Selected Left Collateral and Right Collateral Temporal kinematic Variables of Walking Gait of Female Sportspersons

S. No	Variables	Foot	Mean	SD
1	LGLL (mm)	Left	205.932	21.9162
2	RGLL (mm)	Right	211.975	15.6858
3	CT1 (sec)	Left	.0000	.00000
4	CT1 (sec)	Right	.0028	.01486
5	CT2 (sec)	Left	.0917	.01671
6	CT2 (sec)	Right	.0886	.02013
7	CT3 (sec)	Left	.1838	.03201
8	CT3 (sec)	Right	.1741	.03179
9	CT4 (sec)	Left	.2755	.04947
10	CT4 (sec)	Right	.2645	.04564
11	CT5 (sec)	Left	.3676	.06594
12	CT5 (sec)	Right	.3503	.05973
13	CT6 (sec)	Left	.4590	.07939
14	CT6 (sec)	Right	.4372	.07250
15	CT7 (sec)	Left	.5510	.09589
16	CT7 (sec)	Right	.5231	.08698
17	CT8 (sec)	Left	.6428	.11332
18	CT8 (sec)	Right	.6134	.10206
19	CT9 (sec)	Left	.7383	.12953
20	CT9 (sec)	Right	.6993	.11646
21	CT10 (sec)	Left	.8086	.21272
22	CT10 (sec)	Right	.7669	.19723
23	CT11(sec)	Left	.0028	.01486
24	CT11 (sec)	Right	.0072	.02170
25	CT12 (sec)	Left	.0979	.02993
26	CT12 (sec)	Right	.0900	.02035
27	CT13 (sec)	Left	.1862	.03530
28	CT13 (sec)	Right	.1745	.02443
29	CT14 (sec)	Left	.2734	.04624
30	CT14 (sec)	Right	.2579	.03189
31	CT15 (sec)	Left	.3617	.05850
32	CT15 (sec)	Right	.3410	.04126
33	CT16 (sec)	Left	.4497	.07375
34	CT16 (sec)	Right	.4241	.05288
35	CT17 (sec)	Left	.5397	.08982
36	CT17 (sec)	Right	.5083	.06376
37	CT18 (sec)	Left	.6279	.10435
38	CT18 (sec)	Right	.5917	.07426
39	CT19 (sec)	Left	.7193	.11964
40	CT19 (sec)	Right	.6772	.08518
41	CT20 (sec)	Left	.7341	.28709
42	CT20 (sec)	Right	.6966	.25842
43	CT21 (sec)	Left	.0072	.02170
44	CT21 (sec)	Right	.0072	.02170
45	CT22 (sec)	Left	.0941	.02180
46	CT22 (sec)	Right	.0914	.01959
47	CT23 (sec)	Left	.1793	.02477
48	CT23 (sec)	Right	.1748	.02339
49	CT24 (sec)	Left	.2648	.03334
50	CT24 (sec)	Right	.2600	.02928
51	CT25 (sec)	Left	.3507	.04225
52	CT25 (sec)	Right	.3434	.03829
53	CT26 (sec)	Left	.4348	.05323
54	CT26 (sec)	Right	.4238	.04895
55	CT27 (sec)	Left	.5207	.06364
56	CT27 (sec)	Right	.5072	.05897
57	CT28 (sec)	Left	.6062	.07433
58	CT28 (sec)	Right	.5924	.06823
59	CT29 (sec)	Left	.6924	.08488
60	CT29 (sec)	Right	.6734	.07148
61	CT30 (sec)	Left	.7097	.26290
62	CT30 (sec)	Right	.7741	.08740

N=27, *= Significant at 0.05 level

The Table-2,the Mean and standard deviation (M± SD) in regard to variables namely LGLL, RGLL, CT1, CT2, CT3, CT4, CT5, CT5, CT6, CT7, CT8, CT9, CT10, CT11, CT12, CT13, CT14, CT15, CT16, CT17, CT18, CT19, CT20, CT21, CT22, CT23, CT24, CT25, CT26, CT27, CT28, CT29 and CT30 have been documented. The above findings have been graphically illustrated in figures below:

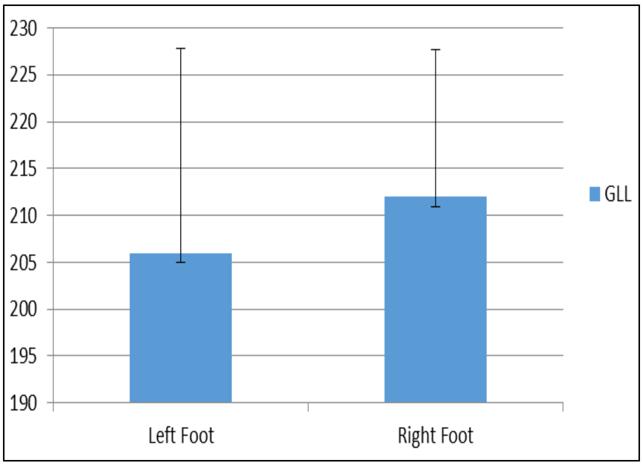

Fig 3: Difference Between Right And Left Gait Line Length

According to Figure 3, the right foot having higher means values than the left foot in regard to variable gait line length, which were statistically found to be insignificant at 0.05 levels.

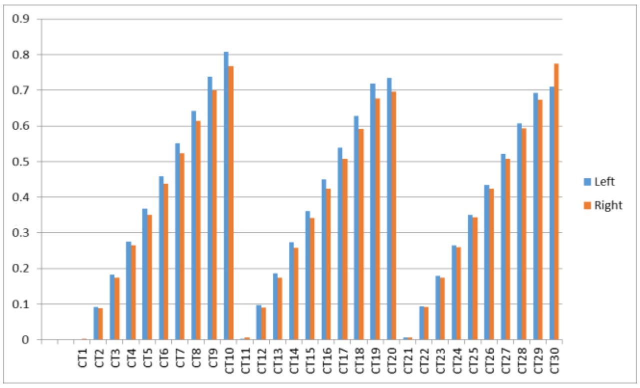

Fig 4: Difference Between Right And Left Contact Time

According to Table 4 the left foot having higher means values for CT2, CT3, CT4, CT5, CT6, CT7, CT8, CT9, CT10, CT12, CT13, CT14, CT15, CT16, CT17, CT18, CT19, CT20, CT22, CT23, CT24, CT26, CT27, CT28 and CT29 than that of right foot which were statistically found to be significant at CT12, CT13 and CT14 and insignificant at rest of the contact time variables at 0.05 level of significance whereas the right foot having higher and equal mean values for CT1, CT11, CT30 and CT21respectively than that of left foot which were statistically found insignificant at 0.05 level.

Table 3: Comparison between Right and Left collateral Temporal Kinematic Variables of Walking Gait of Female Sportspersons

S. No.	Variables	Mean Difference	Std. Error Difference	'T' Value
1	Gait Line Length	-6.0429	5.0933	0.241 (NS)
2	Contact Time 1	-0.00276	0.00276	-1.000 (NS)
3	Contact Time 2	0-00310	0.00486	0.639 (NS)
4	Contact Time 3	0.00966	0.00838	1.153 (NS)
5	Contact Time 4	0.01103	0.01250	0.883 (NS)
6	Contact Time 5	0.01724	0.01652	1.044 (NS)
7	Contact Time 6	0.02172	0.01996	1.088 (NS)
8	Contact Time 7	0.02793	0.02404	1.162(NS)
9	Contact Time 8	0.02931	0.02832	1.035 (NS)
10	Contact Time 9	0.03897	0.03235	1.205(NS)
11	Contact Time 10	0.04172	0.05387	0.775 (NS)
12	Contact Time 11	-0.0048	0.00488	-0.918 (NS)
13	Contact Time 12	0.00793	0.00672	1.180*
14	Contact Time 13	0.01172	0.00797	1.471*
15	Contact Time 14	0.01552	0.01043	1.488*
16	Contact Time 15	0.02069	0.01329	1.556 (NS)
17	Contact Time 16	0.02552	0.01685	1.514 (NS)
18	Contact Time 17	0.03138	0.02045	1.534 (NS)
19	Contact Time 18	0.03621	0.02378	1.522 (NS)
20	Contact Time 19	0.04207	0.02727	1.543 (NS)
21	Contact Time 20	0.03759	0.07173	0.524 (NS)
22	Contact Time 21	0.00000	0-00570	0.000 (NS)
23	Contact Time 22	0.00276	0.00544	0.507(NS)
24	Contact Time 23	0.00448	0.00633	0.708 (NS)
25	Contact Time 24	0.00483	0.00824	0.586 (NS)
26	Contact Time 25	0.00724	0.01059	0.684 (NS)
27	Contact Time 26	0.01103	0.01343	0.822 (NS)
28	Contact Time 27	0.01345	0.01611	0.835 (NS)
29	Contact Time 28	0.01379	0.01874	0.736 (NS)
30	Contact Time 29	0.01897	0.02061	0.920 (NS)
31	Contact Time 30	-0.06448	0.05145	-1.253 (NS)

N=27, *= Significant at 0.05 level

According to table 4, the selected variables namely CT12 (t=1.180), CT13 (t=1.471) and CT14 (t=1.488) have been found to be statistically significant at 0.05 level, hence accepted the drawn hypothesis. Whereas the variables namely GLL, CT 1(t=-1.000) CT2(t=0.639) CT3 (t=1.153), CT4 (t=0.883), CT5 (t=1.044), CT6 (t=1.088), CT7 (t=1.162), CT8(t=1.035), CT9(t=1.205), CT10(t=0.775), CT11(t=-0.918), CT15(t=1.556), CT16(t=1.514), CT17(t=1.534), CT18(t=1.522), CT19(t=1.543), CT20(t=0.524), CT21(t=0.000), CT22(t=0.507), CT23(t=0.708), CT24(t=0.586), CT25(t=0.684), CT26(t=0.822), CT27(t=0.835), CT28(t=0.736), CT29(t=0.920) and CT30(t= -1.253) found to be statistically insignificant hence rejected the drawn hypothesis.

Conclusion

It was concluded that the collateral temporal kinematic of planter aspect of foot of walking gait of female sports persons are different in right foot and left foot in regard to variables namely Contact Time (CT12), Contact Time (CT13) and Contact Time (CT14) whereas in regard to all other selected variables namely GLL, CT1, CT2, CT3, CT4, CT5, CT6, CT7, CT8, CT9, CT10, CT11, CT15, Ct16, CT17, CT18, CT19, CT20, CT21, CT22, CT23, CT24, CT25, CT26, CT27, CT28, CT29 and CT30 are not different in walking gait of female sportspersons.

References

1. Betts RP, Franks CI, Boulton AJM, Duckworth T, Static and Dynamic Foot Pressure Measurements in the Management of the Incentive Foot, Proceedings of the International Conference on Biomechanics and Clinical Kinesiology of Hand and Foot, IIT Madras, 1985.
2. Braz RG, Carvaiho GA. Relationship Between Quadriceps Angle (Q) and Plantar Pressure Distribution in Football Players, Rev Bras Fisioter, São Carlos. 2010; 14(4):296-302.
3. Gurney JK, Kersting UG, Rosenbaum D. Dynamic Foot Function and Morphology in Elite Rugby League Athletes of Different Ethnicity, Appi Ergon, 2009; 40:554-559.
4. Hausdorff JM, Edelberg HK, Mitchell Si, Goldberger AL, Wei JY. Increased Gait Unsteadiness in Community-Dwelling Elderly Fallers, Arch Phys Med Rehabil. 1997; 78:278-283.
5. Hossert Mi, Vyas M, Leach J, Lipsitz LA, Novak V. Foot Pressure Distribution Walking in Young and Adults, BMC, 2005, 5(8).
6. Kandil OD, Aboelazm SN, Mabroük MS. Foot Biometrics: Gender Differences in Plantar Pressure Distribution in Standing Position, American Journal of Biomedical Engineering, 2014; 4(1):1-9.
7. Lehmann JF, De lateur BJ, Price R. Biomechanics of Normal Gait, Phys Med Rehabil clin north am. 1992; 3:95-109
8. Mei Q. t3raham M, Gu Y. Biomechanical Analysis of the Plantar and Upper Pressure with Different Sports Shoes, Biomedical Engineering and Technology. 2014; 14:181-191.
9. Ratan Das, Davender Mohan, Pallabi Baruah, Neelesh Kumar. Analysis of Ground Force and Temporal Parameters During Human Gait for Design of Sensor Mechanism, Biorehab, Journals Pub, 2016, 127-32.
10. Shreeshan Jena, Gaurav Mohan Sakhare, Subrata Kumar Panda, Thirugnanam A. Determining Predictability of Human Gait Parameters Using Univariate and Multivariate Regression Studies, Biorehab, Journals Pub. 2016, 44-50.