



## Data Article

# Diffusion tensor imaging in patients with diabetic peripheral neuropathy: Fractional anisotropy and apparent diffusion coefficient dataset of posterior tibial nerve

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## ABSTRACT

The data in this article described quantitative values of fractional anisotropy (FA) and apparent diffusion coefficient (ADC) for 23 (46 extremities) normal healthy males and females, for 46 patients with bilateral diabetic peripheral neuropathy. 1.5 Tesla (T) MR System Multiva – Philips magnets (Baltimore, Netherland, Holland) imaging with axial T1WSE, sagittal T2WSE and STIR sequences by means of diffusion weighted neurography  $b$  values of 0 and 800 s/mm<sup>2</sup>. The data obtained as FA and ADC values in healthy adults and patient population can be referred by researchers, clinicians for early diagnosis, to determine intervention effectiveness and patient management.

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## Specifications Table

Subject	Endocrinology, Diabetes and Metabolism
Specific subject area	Diabetic Sensory - Motor Peripheral Neuropathy affected population fractional anisotropy (FA) and apparent diffusion coefficient (ADC) measurements
Type of Data	Table, Figure
How data were acquired	1.5 Tesla (T) MR System Multiva - Philips magnets (Baltimore, Netherland, Holland)
Data format	Raw
Description of data collection	1.5 Tesla MRI was used to determine diffusion of the tibial nerve. ROI was outlined on axial TIWSE, sagittal T2WSE, STIR sequences to delineate FA and ADC.
Data source location	Maharishi Markandeshwar Superspeciality Hospital, Mullana – Ambala, Haryana, India with geographical location details as latitude 30.2494 and longitude 77.0427.
Data accessibility	Repository name: Mendeley Data Data identification number: <a href="https://doi.org/10.17632/7jrp4v2vmn/2">10.17632/7jrp4v2vmn/2</a> Direct URL to data: <a href="https://data.mendeley.com/datasets/7jrp4v2vmn.2">https://data.mendeley.com/datasets/7jrp4v2vmn.2</a>
Related research article	Goyal et al. Effect of massage, passive neural mobilization and transcutaneous electrical nerve stimulation on magnetic resonance diffusion tensor imaging (MR-DTI) of the tibial nerve in a patient with type 2 diabetes mellitus induced neuropathy: a case report. <i>Physiotherapy Theory and Practice</i> . 2021 Nov; DOI: <a href="https://doi.org/10.1080/09593985.2021.1994070">10.1080/09593985.2021.1994070</a>

## Value of the Data

- We determined FA/ADC values using a reliable method of diffusion tensor imaging by means of magnetic resonance single – shot echo planar  $b =$  values 0 and 800 s/mm<sup>2</sup>.
- We present FA and ADC values for age – matched healthy controls and patients with type 2 diabetes mellitus induced diabetic peripheral neuropathy involving tibial nerve.
- The current data is useful for researchers, clinicians and radiologists caring for patients with type 2 diabetes mellitus induced neuropathy.
- This data can be referred for further research to determine the effect of interventions other than passive nerve mobilization on FA/ADC of the tibial nerve.
- We provide data as the normative reference FA/ADC values of tibial nerve in both the lower extremities; from pre and post nerve mobilization of tibial nerve effect on FA/ADC in patients with diabetic peripheral neuropathy.
- The utility of FA/ADC values in tibial nerve in patients with type 2 diabetes mellitus in identifying subclinical neuropathy at an early stage.

## 1. Data Description

Arrangement of data in Mendeley set repository is explained in this section. FA and ADC ( $\times 10^{-3}$  mm<sup>2</sup>/s) values in both healthy (Data code C1 to C23) males who were labeled as 1 and females were labeled as 2 and in patients (Data code A1 to A23 and B1 to B23) with diabetic peripheral neuropathy of tibial nerve between age group 36 and 70 years were described.

## 2. Experimental Design, Materials and Methods

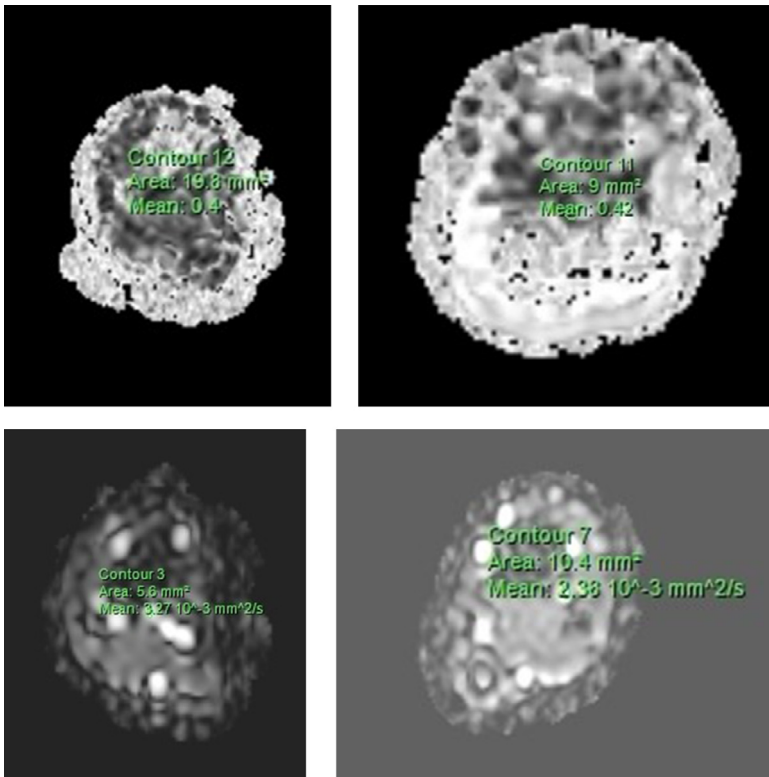
Participants (healthy and patients) were included in the study according pre-defined selection criteria. The study was approved by Institutional Ethics Committee (IEC–1360) of Maharishi Markandeshwar (Deemed to be University) and was registered in Clinical Trials Registry of India (CTRI/2019/06/019552). Informed consent was obtained from all the participants and their guardians wherever necessary.

**Table 1**

Imaging parameters of 1.5 Tesla MR sequences.

Imaging Parameters	Axial T1WSE	Sagittal T2WSE	STIR
TR (ms)	577	2513 - 2932	5000
TE (ms)	8	90	70
NEX	3	3	4
FOV (cm)	20 - 33	15 - 33	-
Matrix size	-	256 × 256	256 × 192
Voxel size (mm)	0.99\1.22\3.66	0.99\1.26\3.66	1.42\2.06\13
Slice thickness/gap (mm)	1.5 - 4\0.1 - 0.8	1.5 - 4\ 0.1 - 0.8	1.5 - 4\ 0.1 - 0.8

Note: TR = Repetition time, TE = Time to echo, FOV = Field of view, NEX = Number of excitations.



**Fig. 1.** Fig. 1Ai and Fig. 1Aii: Displayed the diffusion tensor imaging FA mean value and cross sectional area of posterior tibial nerve in a healthy participants traced with ROI. Fig. 1Bi and Fig. 1Bii: Displayed the diffusion tensor imaging ADC mean value and cross sectional area of posterior tibial nerve in healthy participants traced using ROI.

FA and ADC measurements were obtained using 1.5 Tesla MR System Multiva – Philips magnets (Baltimore, Netherland, Holland) by means of axial T1WSE, sagittal T2WSE and STIR sequences. Participants (both healthy and patients) were positioned in supine lying and a typical spine and knee range coils were placed over the ankle joint with an extremity in neutral position [1]. The imaging parameters of various sequences are presented in Table 1.

Diffusion weighted images (DWI) neurography on two b – values of 0 and 800 s/mm<sup>2</sup> were used to determine FA and ADC values of tibial nerve [1]. Region of interest (ROI) was traced manually to delineate FA value and ADC value, respectively in healthy subjects (Fig. 1Ai and

**Table 2**

FA and ADC values of tibial nerve in healthy males and females.

Participant Code	Age (years)	Weight (kg/lbs.)	Height (meters)	Gender	FA-RL	FA-LL	ADC-RL ( $\times 10^{-3}$ mm <sup>2</sup> /s)	ADC-LL ( $\times 10^{-3}$ mm <sup>2</sup> /s)
C1	45	58.5/128.99	1.68	M	0.53	0.31	2.57	2.22
C2	63	65.7/144.86	1.67	M	0.49	0.41	2.96	2.52
C3	57	68.3/150.60	1.72	M	0.29	0.28	2.07	2.06
C4	62	83.5/184.11	1.76	M	0.44	0.42	3.29	3.11
C5	43	57.8/127.44	1.68	F	0.4	0.32	3.4	2.63
C6	57	55.7/122.81	1.65	F	0.47	0.49	2.31	2.68
C7	65	66.2/145.97	1.67	F	0.56	0.38	3.11	2.89
C8	49	64.3/141.78	1.69	M	0.3	0.43	2.95	3.56
C9	41	67.2/148.17	1.66	M	0.47	0.52	2.88	2.82
C10	42	74.6/164.49	1.71	M	0.42	0.48	2.73	3.25
C11	48	82.3/181.47	1.72	M	0.38	0.42	2.23	2.29
C12	45	64.2/141.56	1.68	F	0.49	0.45	2.81	2.76
C13	40	65.3/143.98	1.66	F	0.39	0.42	3.27	2.97
C14	38	76.7/169.12	1.67	M	0.4	0.37	2.27	2.38
C15	48	77.7/171.32	1.7	M	0.39	0.43	2.84	3.17
C16	37	61.1/134.72	1.71	M	0.44	0.47	3.83	2.97
C17	58	70.2/154.79	1.68	F	0.61	0.43	3.21	2.98
C18	43	74.2/163.61	1.69	F	0.5	0.39	3.12	2.82
C19	60	79.7/175.73	1.72	M	0.41	0.46	3.19	3.01
C20	58	68.9/151.92	1.66	M	0.32	0.27	2.17	2.26
C21	47	74.3/163.83	1.69	M	0.47	0.35	2.62	2.12
C22	45	75.7/166.91	1.68	F	0.42	0.36	3.24	2.83
C23	50	76.7/169.12	1.71	M	0.24	0.39	2.92	3.36

Note: M = male, F = female, FA = fractional anisotropy, ADC = apparent diffusion coefficient, RL = right leg, LL = left leg.

1Aii & Fig. 1Bi and 1Bii). Table 2 reflected the FA and ADC value of both right and left leg in normal healthy males and females. Table 3 reflected the pre intervention and post intervention FA and ADC value of both right and left leg in patients with diabetic peripheral neuropathy who had received tibial nerve mobilization, nerve massage and transcutaneous electrical nerve stimulation (TENS) and are displayed in Fig. 2 A pre and Fig. 2A post & Fig. 2B pre and Fig. 2B post. Fig. 3A pre and Fig. 3A post, Fig. 3B pre and Fig. 3B post delineated the FA and ADC value of both right and left leg in patients with diabetic peripheral neuropathy who had received nerve massage and transcutaneous electrical nerve stimulation (TENS). The detailed information about an intervention can be obtained from our published literature [2]. Table 4 displayed the FA and ADC value of both right and left leg in patients with diabetic peripheral neuropathy; pre and post nerve massage and TENS. Our corresponding published literature [3] can be referred for the treatment details.

**Table 3**

FA and ADC values of tibial nerve in participants with DPN who received nerve mobilization, nerve massage and TENS.

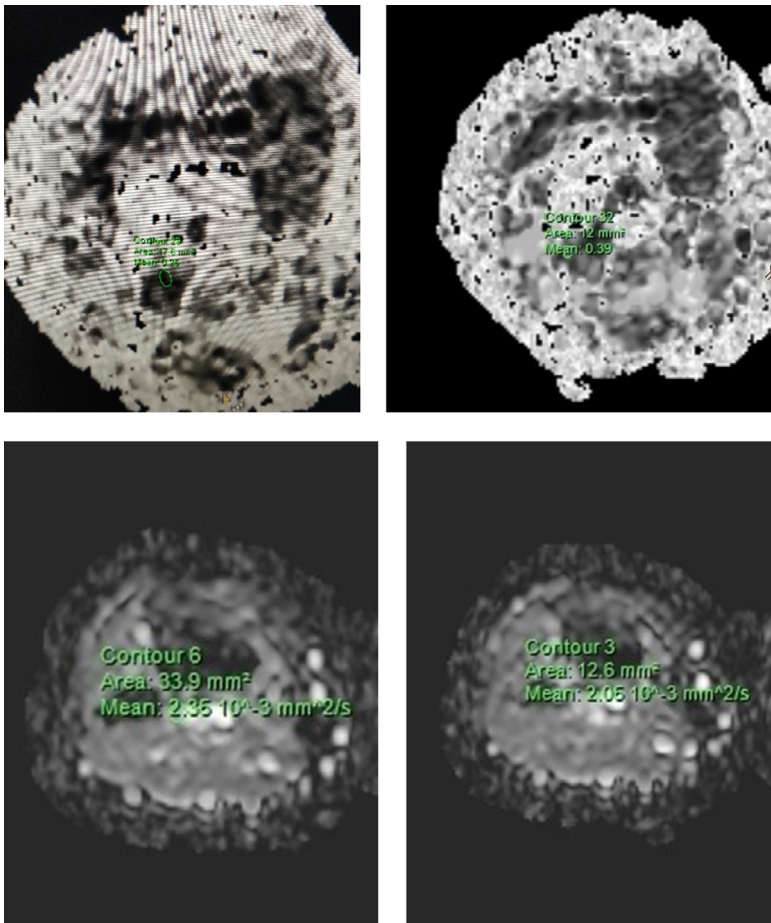
Participant Code	Age (years)	Weight (kg/lbs.)	Height (meters)	Gender	FA-RL		FA-LL		ADC-RL ( $\times 10^{-3}$ mm <sup>2</sup> /s)		ADC-LL ( $\times 10^{-3}$ mm <sup>2</sup> /s)	
					Pre	Post	Pre	Post	Pre	Post	Pre	Post
A1	62	74.4/164.05	1.77	M	0.37	0.46	0.34	0.5	3.19	3.06	3.29	2.99
A2	64	68.2/150.38	1.79	M	0.38	0.47	0.26	0.34	2.36	2.24	2.61	2.52
A3	60	72.1/158.98	1.68	M	0.26	0.39	0.45	0.68	2.35	2.05	2.99	2.31
A4	61	69.3/152.80	1.6	F	0.29	0.34	0.21	0.35	3.18	3.15	3.49	2.34
A5	50	58.2/128.33	1.6	F	0.3	0.38	0.29	0.33	3.01	2.86	2.57	2.42
A6	68	76.7/169.12	1.77	M	0.53	0.42	0.37	0.47	1.93	2.44	2.36	2.29
A7	46	71.1/156.77	1.64	M	0.47	0.58	0.38	0.43	2.82	2.59	3.16	2.94
A8	58	72.3/159.42	1.67	M	0.41	0.53	0.37	0.44	2.74	2.53	2.86	2.75
A9	50	59.2/130.53	1.65	F	0.45	0.62	0.29	0.38	2.73	2.09	2.83	2.03
A10	50	77.2/170.22	1.69	M	0.39	0.47	0.31	0.36	2.98	2.81	3.48	3.12
A11	45	62.1/136.93	1.66	M	0.41	0.48	0.36	0.44	2.68	2.52	2.7	2.54
A12	60	66.5/146.63	1.72	F	0.27	0.37	0.46	0.68	2.33	2.03	2.92	2.37
A13	48	81.4/179.48	1.77	M	0.29	0.38	0.37	0.4	3.27	3.07	2.91	2.76
A14	67	70.3/155.01	1.65	F	0.35	0.42	0.37	0.44	3.38	2.9	3.4	2.93
A15	67	68.3/150.60	1.72	M	0.36	0.38	0.27	0.35	2.01	2.13	2.19	2.03
A16	55	61.1/134.72	1.64	M	0.42	0.47	0.39	0.44	3.08	2.99	3.06	2.9
A17	52	59.7/131.63	1.71	M	0.48	0.57	0.46	0.5	2.98	2.72	2.62	2.48
A18	57	78.4/172.87	1.68	M	0.42	0.47	0.38	0.43	3.02	2.89	2.92	2.78
A19	48	62.5/137.81	1.74	M	0.41	0.45	0.39	0.43	2.78	2.62	3.12	2.9
A20	62	62.3/137.37	1.64	M	0.4	0.46	0.29	0.35	2.41	2.27	2.72	2.55
A21	64	73.7/162.50	1.76	M	0.29	0.35	0.42	0.58	2.36	2.08	2.81	2.42
A22	62	71.3/157.21	1.69	M	0.36	0.47	0.42	0.51	3.21	2.38	2.56	2.19
A23	68	67.8/149.49	1.7	M	0.34	0.49	0.48	0.59	3.25	2.3	2.46	2.29

Note: M = male, F = female, FA = fractional anisotropy, ADC = apparent diffusion coefficient, RL = right leg, LL = left leg.

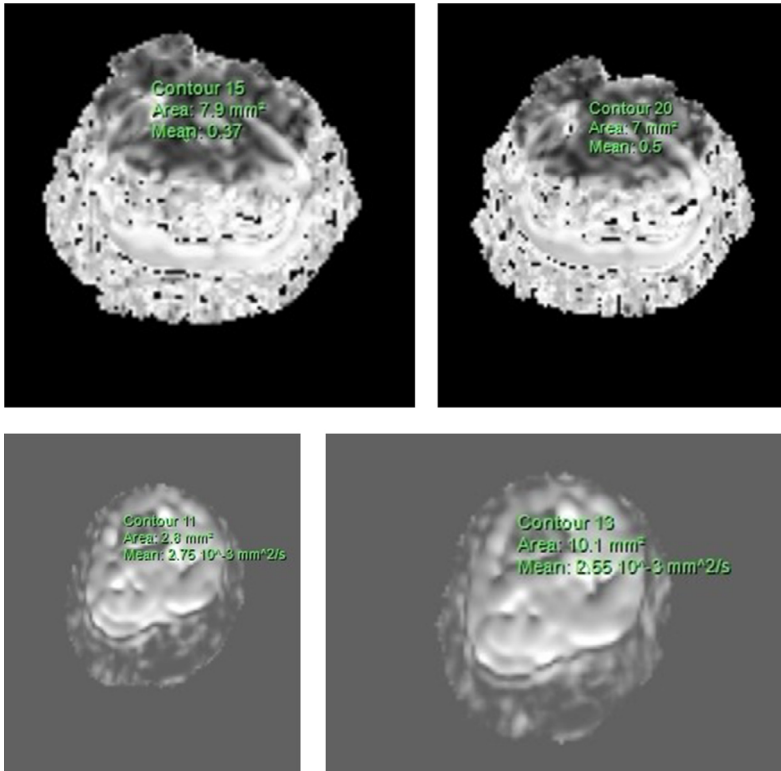
**Table 4**  
FA and ADC values of tibial nerve in participants with DPN who received nerve massage and TENS.

Participant Code	Age (years)	Weight (kg/lbs.)	Height (meters)	Gender	FA-RL		FA-LL		ADC-RL ( $\times 10^{-3}$ mm <sup>2</sup> /s)		ADC-LL ( $\times 10^{-3}$ mm <sup>2</sup> /s)	
					Pre	Post	Pre	Post	Pre	Post	Pre	Post
B1	68	83.4/183.89	1.79	M	0.26	0.37	0.38	0.49	2.79	2.68	3.17	2.94
B2	64	62.3/137.37	1.65	F	0.3	0.39	0.27	0.36	2.71	2.53	2.95	2.68
B3	50	66.8/147.29	1.71	M	0.47	0.59	0.41	0.5	3.08	2.87	2.91	2.78
B4	48	62.3/137.37	1.67	F	0.37	0.5	0.35	0.46	2.77	2.56	2.75	2.55
B5	45	65.4/144.20	1.69	M	0.42	0.46	0.33	0.48	3.84	3.51	3.55	3.09
B6	70	67.2/148.17	1.65	F	0.45	0.53	0.42	0.49	2.39	2.26	2.47	2.33
B7	65	71.3/157.21	1.61	F	0.34	0.42	0.36	0.48	3.43	2.3	3.44	2.66
B8	43	79.6/175.51	1.71	M	0.32	0.47	0.48	0.52	2.94	2.78	3.76	2.54
B9	38	78.8/173.75	1.7	M	0.38	0.44	0.35	0.42	2.88	2.65	2.74	2.63
B10	66	72.3/159.42	1.69	M	0.27	0.39	0.23	0.35	2.92	2.78	2.56	2.69
B11	65	76.4/168.46	1.73	M	0.29	0.38	0.31	0.43	2.29	2.13	2.8	2.62
B12	54	72.3/159.42	1.68	F	0.38	0.43	0.27	0.31	2.99	2.82	3.21	3.07
B13	47	75.8/167.13	1.66	M	0.38	0.41	0.31	0.34	3.62	3.49	3.24	3.09
B14	53	68.7/151.48	1.69	M	0.39	0.43	0.42	0.45	3.25	2.98	3.06	2.89
B15	48	79.7/175.73	1.67	F	0.38	0.43	0.35	0.41	3.28	3.13	2.98	2.73
B16	55	66.8/147.29	1.67	F	0.38	0.42	0.41	0.46	3.42	3.27	3.32	3.18
B17	58	76.8/169.34	1.73	M	0.31	0.35	0.41	0.47	2.83	2.71	3.07	2.96
B18	47	72.4/159.64	1.68	F	0.27	0.34	0.27	0.38	3.08	3.05	3.46	3.42
B19	42	59.6/131.41	1.71	M	0.33	0.41	0.42	0.48	2.84	2.04	3.48	2.68
B20	52	68.4/150.82	1.69	F	0.42	0.58	0.32	0.39	2.71	2.13	2.78	2.01
B21	52	78.7/173.53	1.68	M	0.27	0.32	0.29	0.35	2.78	2.43	2.24	2.03
B22	45	71.2/156.99	1.65	F	0.35	0.41	0.41	0.46	2.81	2.68	2.78	2.69
B23	50	73.6/162.28	1.74	M	0.27	0.38	0.4	0.45	3.23	3.03	3.14	2.98

**Note:** M = male, F = female, FA = fractional anisotropy, ADC = apparent diffusion coefficient, RL = right leg, LL = left leg.



**Fig. 2.** Fig. 2A pre and Fig. 2A post: Displayed the pre and post intervention (nerve mobilization + nerve massage + TENS) diffusion tensor imaging FA mean value and cross sectional area of posterior tibial nerve in a patient with diabetic peripheral neuropathy traced using ROI. Fig. 2B pre and Fig. 2B post: Displayed the pre and post intervention (nerve mobilization + nerve massage + TENS) diffusion tensor imaging ADC mean value and cross sectional area of posterior tibial nerve in a patient with diabetic peripheral neuropathy traced using ROI.



**Fig. 3.** Fig. 3A pre and Fig. 3A post: Displayed the pre and post intervention (nerve massage + TENS) diffusion tensor imaging FA mean value and cross sectional area of posterior tibial nerve in a patient with diabetic peripheral neuropathy traced using ROI. Fig. 3B pre and Fig. 3B post: Displayed the pre and post intervention (nerve massage + TENS) diffusion tensor imaging ADC mean value and cross sectional area of posterior tibial nerve in a patient with diabetic peripheral neuropathy traced using ROI.

### Ethics Statement

The current study was approved by the Institutional Ethics Committee (IEC - 1360) of Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana – Ambala. The study was registered in Clinical Trials Registry of India (CTRI/2019/06/019552). An informed consent was procured from the participants and/or relatives.

### Funding

This work was bolstered by the Maharishi Markandeshwar (Deemed to be University), Mullana – Ambala.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.



## Data Availability

Diffusion tensor imaging values in posterior tibial nerve in healthy controls and in patients with diabetic peripheral neuropathy: pre & post nerve mobilization (Original data) (Mendeley Data).

## CRedit Author Statement

**Manu Goyal:** Conceptualization, Methodology, Writing – original draft, Formal analysis; **Asir John Samuel:** Methodology, Writing – review & editing, Formal analysis, Supervision; **Amit Mittal:** Conceptualization, Investigation, Supervision, Funding acquisition.

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