© AUG 2026 | IRE Journals | Volume 10 Issue 2 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV10I2-1722614

Comparison of Macular Thickness Among Myopes and Emmetropes in Port Harcourt, Rivers State, Using Spectral Domain Optical Coherence Tomography.

OZURUMBA O. A.[1], AZUAMAH Y. C.[2], DANIEL-NWOSU E. I.[3], MEGWAS A. U.[4], IKORO N. C.[5], SAM-DURU P. A.[6], NWANESINDU U. E.[7], ERONINI Y. R.[8]

[1,2,3,4,5,7]*Department of Optometry, School of Health Technology, Federal University of Technology, Owerri, Imo State.*

[6]*Depatment of Dispensing Opticianry, Federal Polytechnic Nekede Owerri, Imo State.*

[8]*Department of Optometry, Madonna University, Elele Campus, Rivers State*

Abstract- ***Myopia is a leading cause of visual impairment worldwide and is associated with structural alterations of the retina particularly the macula. Spectral Domain Optical Coherence Tomography (SD-OCT) provides accurate and reproducible measurements of macular thickness, but data among Nigerian adults remain limited. This study comparted macular thickness among myopic and emmetropic adults in Port Harcourt, Rivers State, using SD-OCT. A comparative cross-sectional study was conducted among adults aged 18-40 years attending an eye specialist hospital. Participants were classified into myopic and emmetropic groups according to spherical equivalent refractive error. Central, inner, outer, and average ocular thicknesses were measured using a Topcon SD-OCT system based on the Early Treatment Diabetic Retinopathy Study (ETDRS) protocol. Data were analyzed using SPSS version 23, with statistical significance set at p<0.05. Myopic eyes had significantly lower macular thickness than emmetropic eyes. Central macular thickness was 188.11 ± 24.83 µm in myopes versus 200.30 ± 16.81 µm in emmetropes (p = 0.046). Inner macular thickness was 281.75 ± 14.44 µm versus 295.92 ± 44.76 µm (p = 0.039), outer macular thickness was 257.80 ± 13.90 µm versus 280.07 ± 9.30 µm (p < 0.001), while average macular thickness was 266.99 ± 12.78 µm versus 291.66 ± 19.02 µm (p < 0.001). Myopic eyes demonstrated significantly reduced central, inner, outer, and average macular thickness compared with emmetropic eyes. These findings emphasize the importance of considering refractive status during SD-OCT interpretation and support further studies involving larger Nigerian populations.***

Keywords: Myopia; Emmetropia; Macular Thickness; Optical Coherence Tomography; SD-OCT.

I. INTRODUCTION

Introduction of Myopia, Risk and Public Health Burden:

Worldwide myopia has become one of the most common refractive errors and a rapidly developing public health issue due to increase in prevalence and development of eye complications associated with it [1,2]. Though myopia typically leads to impaired ability to see in distance, since incoming light focus in front of the retina, new evidence indicates its link with structural changes in posterior eye [3,4]. Prolonged eyeball axial elongation leads to posterior structures of the eye including the retina, the choroid and the sclera stretching and developing changes with highest concentration of changes seen in the vicinity of macular region [3,5]. These include; increase in number and types of these structure degenerative changes that predisposes its susceptible population to myopia maculopathy, retinal detachment, choroidal neovascularization and eventual irreversible visual impairment [3,6,4]. The macular is a small central area of the retina (the inner lining of the eye) specialized for high acuity, high resolution vision, colour perception, and plays crucial role in reading, driving, and facial discrimination [7]. Even minor morphological abnormality in macular causes significant vision related problems due to high demand. However, it has been ascertained that the assessment of thickness has become a routine for any competent examination of retinal patients [7,8]. Spectral-Domain Optical Coherence Tomography (SD-OCT) is a high resolution cross sectional images

providing clear, quantitative and reproducible measurement of macular retinal thickness parameters including Early Treatment Diabetic Retinopathy Study (ETDRS) macular zones from its advent which allows comparison of the same in different sets of population, unlike routine clinical examination alone and now regarded as "golden standard" tool for imaging retinal conditions like myopic-pathological alteration, retinal and choroidal pathologies [7,9,10,11]. Objectives, this study sought to compare the macular thickness of myopic and emmetropic adult using Spectral-Domain Optical Coherence Tomography and identify variances in different ETDRS macular region in Port Harcourt, Nigeria. The study would add to existing findings on the African people's retinal morphology, which would contribute to clinical management of myopic patients [12,13,14].

II. MATERIALS AND METHODS

This study used a comparative cross-sectional design. Objectives were to evaluate and compare the macular thickness of myopic versus emmetropic adults with use of SD-OCT in the specialist eye hospital in Port Harcourt Rivers State. Participants Adults age 18-40 years presenting at the specialist eye hospital during the study period who meet eligibility criteria were selected for the study. Participants were grouped according to their spherical equivalent to the myopic group or emmetropic group. The inclusion criteria included adults aged 18-40 years with clear media and no ocular pathology or previous ocular surgery. Exclusion criteria Included individuals with Glaucoma, Diabetic Retinopathy, Retinal disease, Optic nerve disease, media opacity, and those with previous trauma and/or ocular surgery, people with systemic diseases that have effects on the retina. Also, poor quality SD-OCT images were excluded. After selection those fulfilling inclusion criteria were consecutively enrolled to achieve the desired sample size. A Detailed ocular history and Demographic characteristics were obtained from every participant. The participants had their visual acuity assessed and subjected to objective and subjective Refraction before examinations were performed on anterior and posterior segments of the eye prior to OCT photography. The Topcon Spectral-Domain Optical Coherence Tomography (SD-OCT) was used to acquire macular images of eyes of participants. Macular thicknesses were computed using the Early Treatment Diabetic Retinopathy Study (ETDRS) grid to measure Central macular thickness, Inner macular thickness, Outer macular thickness and Average macular thickness. Only scans showing signal strength high enough and no significant artifacts was considered acceptable to be analysed. Data generated were entered into Micro soft excel and processed using the statistical package for social science (SPSS version 23.0). Continuous variables were expressed as the mean and Standard Deviation whereas categorical variables were presented as frequency and percentages. Independent samples T test was used as statistical test for comparison between two groups, at P value<0.05 and 95% confidence interval was applied.

III. RESULTS AND DISCUSSION

A total of 152 participants recruited completed the study successfully. Participants comprised both males and females aged between 18 and 40 years. The study population included myopic and emmetropic adults who met the inclusion criteria. The descriptive findings from the data collected from 152 participants with one eye analysed per participant in Port Harcourt, Rivers State, using Spectral Domain Optical Coherence Tomography (SD-OCT).

Table 1: Age Group Distribution of Participants

Age Group (Years)	Frequency	Percentage (%)
18-20	24	15.8
21-30	60	39.5
31-40	68	44.7
Total	152	100.0

Table 1 presents the age group distribution of participants in a study involving 152 participants, conducted in Rivers State, Nigeria, using Spectral Domain Optical Coherence Tomography (SD-OCT). It divides individuals into 3 age groups, presenting both the number of eyes as Absolute Frequency and the relative Percentage. For the first age group, young adults 18-20 years old there are 24 participants/eyes, this is 15.8% of the total. In the 21–30-year-old group, there are 60 participants/eyes (39.5%), the second largest group. The 31–40-year-old group is made up of 68 participants/eyes (44.7%), the largest one. The sum is 152 participants/eyes (100%). The data shows that 84% of eyes are those from individuals between 21 and 40 years, and in particular of individuals with 31-40 years, a result which suggests that maybe the investigation is in the "working adult" age, age class in which are common certain kinds of pathologies (those investigate by Spectral Domain Optical Coherence Tomography in particular).

Table 2: Gender Distribution of Participants

Gender	Frequency	Percentage (%)
Males	40	26.3
Females	112	73.7
Males and Females	152	100.0

Table 2 shows the overall gender breakdown of the 152 participants examined in Rivers State; SD-OCT study. Males accounted for 40 eyes (26.3%), while females made up the majority with 112 eyes (73.7%). The total sums correctly to 152 (100%). The strong female predominance suggests possible selection bias, higher participation rates among women, or a higher prevalence of the studied condition (likely myopia-related macular changes) in females within this population.

Table 3: Age And Gender Distribution of Myopes

	Males		Females		Total	
	N	%	N	%	N	%
18 – 25	6	5.36	34	30.36	40	35.72
26 – 33	12	10.71	36	32.14	48	42.85
34 – 40	8	7.14	16	14.29	24	21.43
Total	26	23.21	86	76.79	112	100.00

Table 3 details the age and gender distribution specifically among the 112 myopic eyes in the study. Females heavily dominate across all age groups: 34 in 18–25 (30.36%), 36 in 26–33 (32.14%), and 16 in 34–40 (14.29%), totaling 86 females (76.79%). Males are far fewer: 6 (5.36%), 12 (10.71%), and 8 (7.14%), totaling 26 (23.21%). The 26–33 age group has the highest overall frequency (48 eyes, 42.85%), followed by 18–25 (40 eyes, 35.72%). This indicates that myopia in this cohort is most common among younger adults, especially females.

Table 4: Descriptive Statistics of Age Values of Myopes

	N	Range	Minimum	Maximum	Mean	SD
Males	26	21	18	39	29.54	6.23
Females	86	22	18	40	28.07	6.35
Males and females	112	22	18	40	28.41	6.29

Table 4 presents age statistics for 112 myopic participants (those with nearsightedness). The sample includes 26 males and 86 females, demonstrating a strong female majority. Males have a mean age of 29.54 years with a standard deviation (SD) of 6.23 years and a range of 21 years (18–39 years). Females average slightly younger at 28.07 years, with a comparable standard deviation of 6.35 years and a range of 22 years (18–40 years). The combined group shows an overall mean age of 28.41 years, a range from 18 to 40 years, and a standard deviation of 6.29 years. Compared to emmetropes, myopes appear marginally younger on average and feature substantially more female representation. The similar variability across genders suggests consistent age dispersion within the myopic population studied.

Table 5: Age And Gender Distribution of Emmetropes

	Males		Females		Total	
	N	%	N	%	N	%
18 – 25	4	10.00	4	10.00	8	20.00
26 – 33	4	10.00	12	30.00	16	40.00
34 – 40	6	15.00	10	25.00	16	40.00
Total	14	35.00	26	65.00	40	100.00

Table 5 breaks down the 40 emmetropes by age brackets and gender. Males total 14 participants (35% of the sample), while females constitute 26 (65%), showing a clear female predominance. In the youngest bracket (18–25 years), both genders contribute equally with 4 participants each, representing 10% per gender and 20% overall. The 26–33 years group is dominated by females (12 participants, 30%) compared to males (4 participants, 10%), accounting for 40% of the total sample. Similarly, the 34–40 years category has 10 females (25%) versus 6 males (15%), also totaling 40%. The distribution reveals that emmetropes in this study cluster more heavily in the middle and upper age bands, with females consistently outnumbering males across most groups except the youngest.

Table 6: Descriptive Statistics of Age Values of Emmetropes

	N	Range	Minimum	Maximum	Mean	SD
Males	16	22	18	40	30/75	8.19
Females	24	17	20	37	30.75	5.23
Males and females	40	22	18	40	30.75	6.37

Table 6 summarizes the age characteristics of 40 individuals classified as emmetropes (those with normal vision without refractive error). The group consists of 16 males and 24 females. Both genders share an identical average age of 30.75 years, indicating balanced central tendency despite differing spreads. Males display greater inconsistency with a standard deviation (SD) of 8.19 years and a wide range of 22 years (from 18 to 40 years). Females show more consistency, with a lower standard deviation of 5.23 years and a narrower range of 17 years (ages 20 to 37). Overall, the combined sample has a mean age of 30.75 years, a full range spanning 18 to 40 years, and a standard deviation of 6.37 years. This suggests the emmetropic population in the study is predominantly young adults in their late 20s to mid-30s, with males exhibiting slightly more age diversity.

© AUG 2026 | IRE Journals | Volume 10 Issue 2 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV10I2-1722614

Table 7 Descriptive Statistics of Macular Thickness Values of Myopes

Macular zone	Mean	Std. deviation	Minimum	Maximum
Central macular thickness	188.11	24.83	142.00	289.00
Inner macular thickness	281.75	14.44	245.00	311.50
Outer macular thickness	257.8	13.85	220.00	290.00
Average macular thickness	266.99	12.78	235.00	286.50

Table 7 presents the descriptive statistics of macular thickness parameters for the 112 myopic participants studied. The mean central macular thickness was 188.11 ± 24.83 µm, ranging from 142.00 µm to 289.00 µm. The inner macular thickness recorded a mean of 281.75 ± 14.44 µm (range: 245.00 – 311.50 µm), while the outer macular thickness showed a mean of 257.8 ± 13.85 µm (range: 220.00 – 290.00 µm). The average macular thickness was 266.99 ± 12.78 µm, with values ranging from 235.00 µm to 286.50 µm. These results indicate moderate variability in central macular thickness and relatively consistent measurements in the other zones among myopic participants.

Table 8 Descriptive Statistics of Macular Thickness Values of Emmetropes

Macular zone	Mean	Std. deviation	Minimum	Maximum
Central macular thickness	200.30	16.81	168.00	218.00
Inner macular thickness	295.92	44.76	110.40	323.00
Outer macular thickness	280.07	9.30	255.30	290.50
Average macular thickness	291.66	19.02	263.40	360.60

Table 8 shows the descriptive statistics of macular thickness parameters for the 40 emmetropic participants. The mean central macular thickness was 200.30 ± 16.81 µm, ranging from 168.00 µm to 218.00 µm. Inner macular thickness had a mean of 295.92 ± 44.76 xxczµm (range: 110.40 – 323.00 µm), outer macular thickness recorded 280.07 ± 9.30 µm (range: 255.30 – 290.50 µm), while the average macular thickness was 291.66 ± 19.02 µm (range: 263.40 – 360.60 µm). The emmetropic group generally showed higher mean macular thickness across all zones compared to the myopic group, with lower variability in the outer zone.

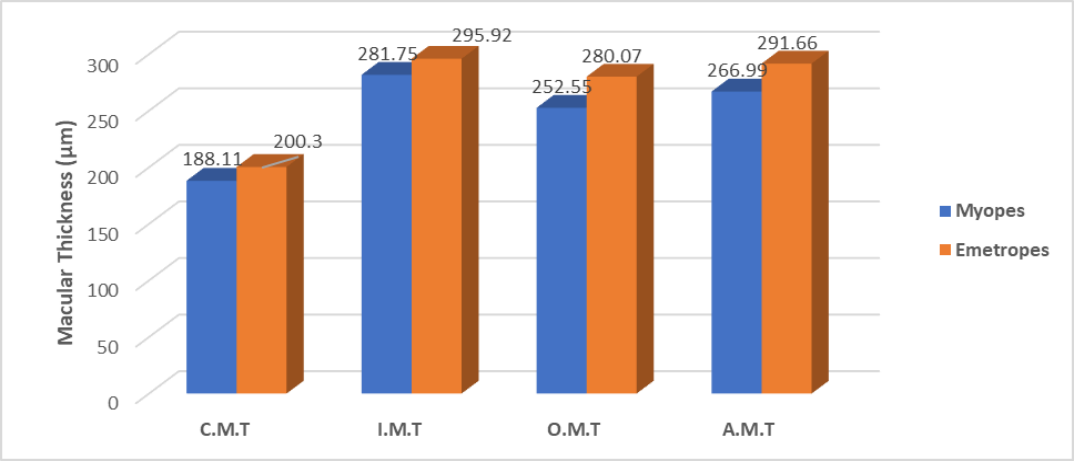

Figure 1 Comparison of mean macular thickness values between myopic and emmetropic eyes.

Figure 1 is a bar chart that compares the mean values of central macular thickness (CMT), inner macular thickness (IMT), outer macular thickness (OMT), and average macular thickness (AMT), between myopic and emmetropic participants. Emmetropic eyes consistently showed higher mean macular thickness across all zones compared to myopic eyes.

Table 9 SPSS data analysis result showing P value for testing of central macular thickness

Central Macular Thickness	P-value
Myopes – Emmetropes	0.046

Table 9 presents the comparison of central macular thickness between myopes and emmetropes using an independent samples t-test. The analysis yielded a p-value of 0.046, which was less than the 0.05 level of significance. This indicates that there was a statistically significant difference in central macular thickness between myopic and emmetropic eyes as measured using Spectral Domain Optical Coherence Tomography (SD-OCT).

Table 10 SPSS data analysis result showing P value for testing of inner macular thickness

Inner Macular Thickness	P-value
Myopes – Emmetropes	0.039

Table 10 presents the comparison of inner macular thickness between myopes and emmetropes using an independent samples t-test. The analysis yielded a p-value of 0.039, which was less than the 0.05 level of significance. This indicates that there was a statistically significant difference in central macular thickness between myopic and emmetropic eyes as measured using Spectral Domain Optical Coherence Tomography (SD-OCT).

Table 11 SPSS data analysis result showing P value for testing of outer macular thickness

Outer Macular Thickness	P-value
Myopes – Emmetropes	0.00

Table 11 presents the comparison of outer macular thickness between myopes and emmetropes using an independent samples t-test. The analysis yielded a p-value of 0.00, which was less than the 0.05 level of significance. This indicates that there was a statistically significant difference in central macular thickness between myopic and emmetropic eyes as measured using Spectral Domain Optical Coherence Tomography (SD-OCT).

Table 12 SPSS data analysis result showing P value for testing of average macular thickness

Average Macular Thickness	P-value
Myopes – Emmetropes	0.00

Table 12 presents the comparison of average macular thickness between myopes and emmetropes using an independent samples t-test. The analysis yielded a p-value of 0.00, which was less than the 0.05 level of significance. This indicates that there was a statistically significant difference in central macular thickness between myopic and emmetropic eyes as measured using Spectral Domain Optical Coherence Tomography (SD-OCT).

IV. DISCUSSION OF FINDINGS

This study investigated the variation in macular thickness between myopic and emmetropic eyes using Spectral Domain Optical Coherence Tomography (SD-OCT). The findings showed significant differences in macular thickness between the two refractive groups, with myopic eyes generally demonstrating lower thickness values across the assessed ETDRS regions. The central macular thickness was significantly different between myopes and emmetropes (p=0.046), while the inner macular region also showed a statistically significant difference (p=0.039). The reduction in macular thickness observed in myopic eyes may be associated with structural changes resulting from ocular elongation. As myopia increases, stretching of the posterior ocular structures may contribute to changes in retinal thickness. Similar reductions in macular thickness among myopic eyes have been reported in previous OCT-based studies (Kim et al., 2023 [15]; Lee et al., 2024 [16]; Fang et al., 2025 [3]; and Song et al., 2014 [17]). However, differences between studies may be related to variations in age, ethnicity, degree of myopia, OCT devices and segmentation techniques. The findings also showed differences in macular thickness across the ETDRS regions

suggesting that the effect of myopia may not be limited to the central macular. This supports previous reports that increasing myopia may be associated with structural changes involving different regions of the macular (Xiong et al., 2018 [18]; Oderinlo et al., 2023 [14]). The findings further emphasize the importance of considering refractive status when interpreting OCT macular thickness measurements. The observed variations in this study provide useful information on macular thickness among Nigerian adults and may contribute to improved interpretation of SD-OCT findings in myopic patients. Establishing appropriate reference values for different refractive groups may also assist in distinguishing normal myopia-related variations from pathological retinal changes.

V. CONCLUSION

This study demonstrated significant variations in macular thickness between myopic and emmetropic eyes using SD-OCT. The central, inner, outer and average macular thickness measurements were generally lower in myopic eyes, with significant differences observed in the central and inner macular regions. The findings indicate that myopia is associated with measurable structural variations in the macula. These results highlight the importance of considering refractive status when interpreting macular OCT measurements, particularly in myopic patients. SD-OCT may therefore be useful in monitoring macular structural changes associated with myopia. Further studies involving larger Nigerian populations are recommended to establish comprehensive normative data for macula thickness and to further evaluate changes across different degrees of myopia.

Declaration by Authors
Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
conflict of interest: The authors declare no conflict of interest regarding the publication of this research article.

REFERENCES

[1] Baird PN, Saw SM, Lanca C, Guggenheim JA, Smith EL, Zhou X, et al. Myopia. Nature Reviews Disease Primers. 2020;6(1):99. doi:10.1038/s41572-020-00231-4.

[2] Flaxman SR, Bourne RRA, Resnikoff S, Ackland P, Braithwaite T, Cicinelli MV, et al. Global causes of blindness and distance vision impairment 1990–2020: A systematic review and meta-analysis. The Lancet Global Health, 2017;5(12):e1221–e1234. doi.10.1016/S2214-109X(17)30393-5.

[3] Fang Y, Yokoi T, Ohno-Matsui K. Structural changes in the macula of highly myopic eyes. Ophthalmology. 2025;132(4): 512–520. doi.10.1016/j.ophtha.2024.10.018.

[4] Ikuno Y. Overview of the complications of high myopia. Retina, 2017;37(12), 2347–2351. https://doi.org/10.1097/IAE.0000000000001481.

[5] Liu X, Shen M, Yuan Y, Huang S, Zhu D, Ma Q, Lu F. Macular thickness profiles of high myopia using spectral-domain optical coherence tomography. Retina, 2015;35(2), 392–398. https://doi.org/10.1097/IAE.0000000000000322.

[6] Ghassibe E, Sacconi R, Corbelli E, Rabiolo A, Mercuri S, Bandello F. Visual acuity in pathological myopia. Translational Vision Science & Technology. 2019;8(2):26. doi.10.1167/tvst.8.2.26.

[7] Adhi M, Duker JS. Optical coherence tomography—Current and future applications. Current Opinion in Ophthalmology. 2013;24(3):213–221. doi: 10.1097/MCO.0b013e328361bae5.

[8] Hashemi H, Heydarian S, Hashemi A, Khabazkhoob M. Macular thickness and volume by spectral-domain optical coherence tomography and their related factors in the elderly population. J Curr Ophthalmol. 2024;35(4):362-368. doi:10.4103/joco.joco_153_23.

[9] Hwang YH, Kim YY. Macular thickness and volume of myopic eyes measured using spectral-domain optical coherence tomography. Clinical and Experimental Optometry 2012;95(5), 492–498. https://doi.org/10.1111/j.1444-0938.2012.00749.x.

[10] Patel PJ, Foster PJ, Grossi CM, Keane PA, Ko F, Lotery A, UK Biobank Eyes and Vision Consortium. Spectral-domain optical coherence tomography imaging in 67,321 adults: Associations with macular thickness in the UK Biobank study. Ophthalmology. 2016;123(4), 829–840. https://doi.org/10.1016/j.ophtha.2015.11.009.

[11] Read SA, Alonso-Caneiro D, Vincent SJ, Collins MJ. Macular retinal layer thickness in myopia: A meta-analysis. Clinical and Experimental Optometry. 2019;102(3), 247–258. https://doi.org/10.1111/cxo.12894.

[12] Eze UA, Obasuyi OC, Salihu DV, Bature M, Yeye-Agba OO, Kanmodi KK. Prevalence and causes of blindness and visual impairment among Nigerians: A systematic review. Clinical Ophthalmology. 2024; 18:289-301. doi.102147/OPTH.S440744.

[13] Ezegwui IR, Oguego NC, Okoye OI, Maduka-Okafor FC, Udeh N, Aghaji AE, et al. Prevalence of refractive errors and visual impairment in school children in Enugu, South-East Nigeria. Nigerian Journal of Clinical Practice. 2021;24(3):380-386. Doi.10.410.4103/njcp.njcp_521_19.

[14] Oderinlo O, Bogunjoki T, Hassan AO, Idris O, Dalley A, Oshunkoya L, et al. Normal central foveal thickness in a thousand eyes of healthy patients in sub-Saharan Africa using Fourier domain optical coherence tomography. Niger J Clin Pract. 2023;26(3):331-335. doi.10.4103/njcp.njcp_318_22.

[15] Kim JH., Lee SH, Park SY. Macular thickness profile in myopic eyes: An OCT-based study. BMC Ophthalmol. 2023; 23:145.

[16] Lee SS, Lingham G, Guggenheim JA. Axial length and macular thickness relationship in myopia. Investigative Ophthalmol & Vis Sci. 2024;65(2):8.

[17] Song AP, Wu XY, Wang JR, Liu W, Sun Y, Yu T. Measurement of retinal thickness in macular region of high myopic eyes using spectral domain OCT. Int J Ophthalmol. 2014;7(1):122-127.

[18] Xiong S, He X, Zhang B, Wang J, Zhu Z, Zou H, et al. Macular measurements using spectral-domain optical coherence tomography in Chinese myopic children. Exp Ther Med. 2018;16(6):5357–5362. doi:10.3892/etm.2018.6854.