# Telomere biology and vascular aging in patients with type 2 diabetes mellitus

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**Background**: It is known that glucose disturbances contribute to vascular aging. The length of telomere (TL) and telomerase activity (TA) are considered as biomarkers of cellular aging. It is crucial to determine the role of telomere biology in different vessels changes in diabetic patients.

**The aim** of the study was to determine the role of telomere biology in vascular aging in patients with T2DM

**Methods:** The study group included 50 patients with T2DM in mean age 58.4±7.83 years. All subjects were measured for TL and TA by quantitative polymerase chain reaction (PCR), carbohydrate metabolism assessed fasting plasma glucose (FG), glycated hemoglobin(HbA1c); oxidative stress marked by malondialdehyde (MDA); chronic inflammation marked by interleukin-6 (IL-6), C-reactive protein (CRP), fibrinogen; arterial stiffness (AS) evaluated by carotid-femoral pulse wave velocity (PWV); carotid intima-media thickness (IMT), plaque presence (PP) determined by ultrasonography in carotid arteries; endothelial dysfunction evaluated by flow-mediated endothelium-dependent vasodilation (FMV) and endothelium-independent vasodilation (NDV).

All patients were divided into 2 groups by TL. The median of telomere length was 9.75. «Short» telomeres were considered if the telomere length was <9.75. «Long» telomeres were considered if the telomere length was >9.75. Vessels changes, chronic inflammation and oxidative stress were compared in all patients depending on TL.

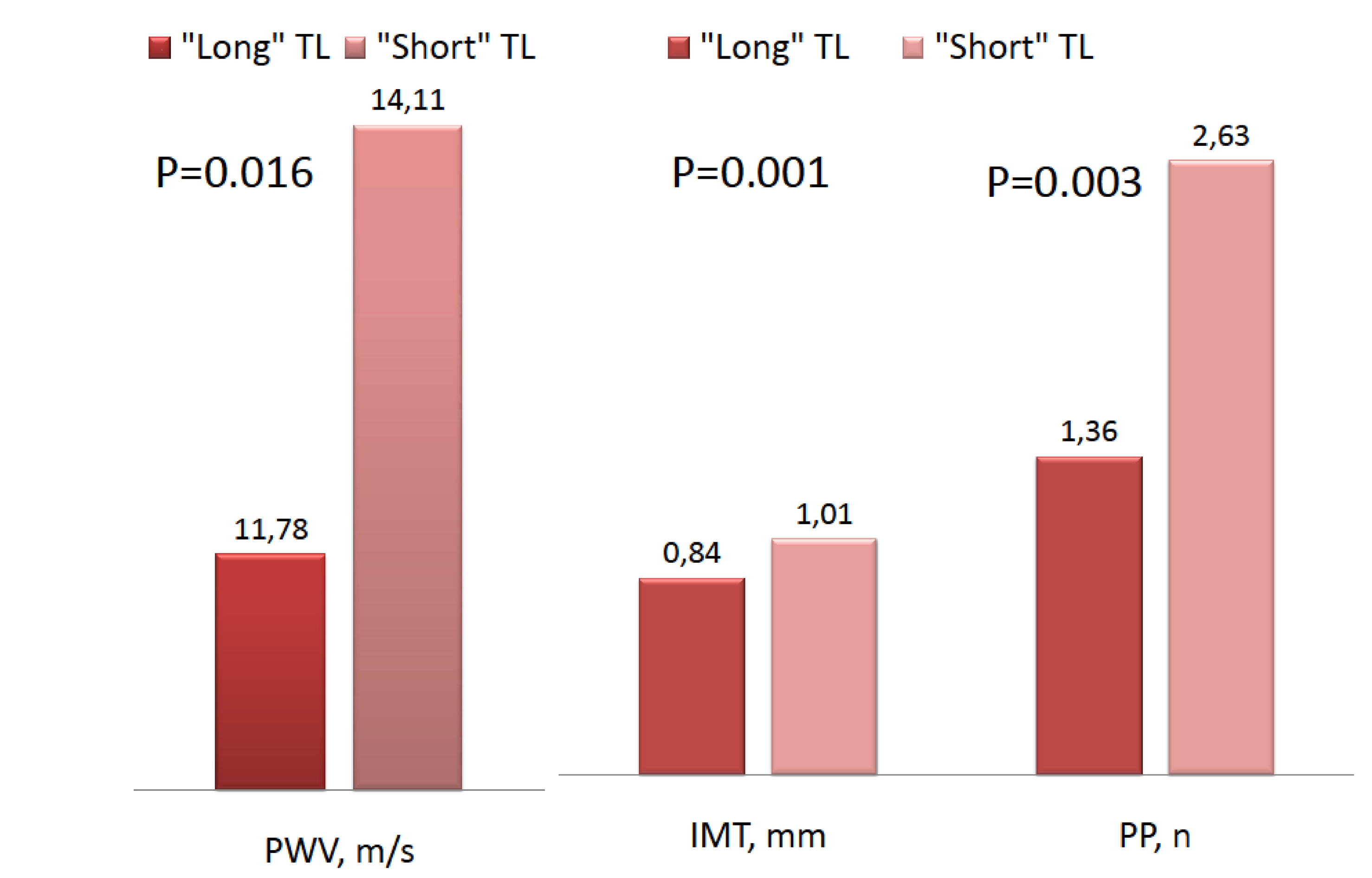
**Main clinical characteristics in patients with "short" and "long" TL**

| Parameter | "Long" TL (n=25) | "Short" TL (n=25) | P |
|---|---|---|---|
| Age (years) | 57.68 7.28 | 59 8.74 | 0.57 |
| Men/women | 6/8 | 17/19 | 0.68 |
| BMI (kg/m$^2$) | 30.71 5.90 | 29.75 5.06 | 0.54 |
| SBP (mm Hg) | 130.36 15.24 | 132.92 14.64 | 0.55 |
| DBP(mm Hg) | 83.28 10.55 | 82.50 12.50 | 0.81 |
| FG (mmol/l) | 7.46 1.00 | 7.44 1.98 | 0.0013 |
| Hb1Ac (%) | 7.15 0.62 | 7.40 0.77 | 0.22 |

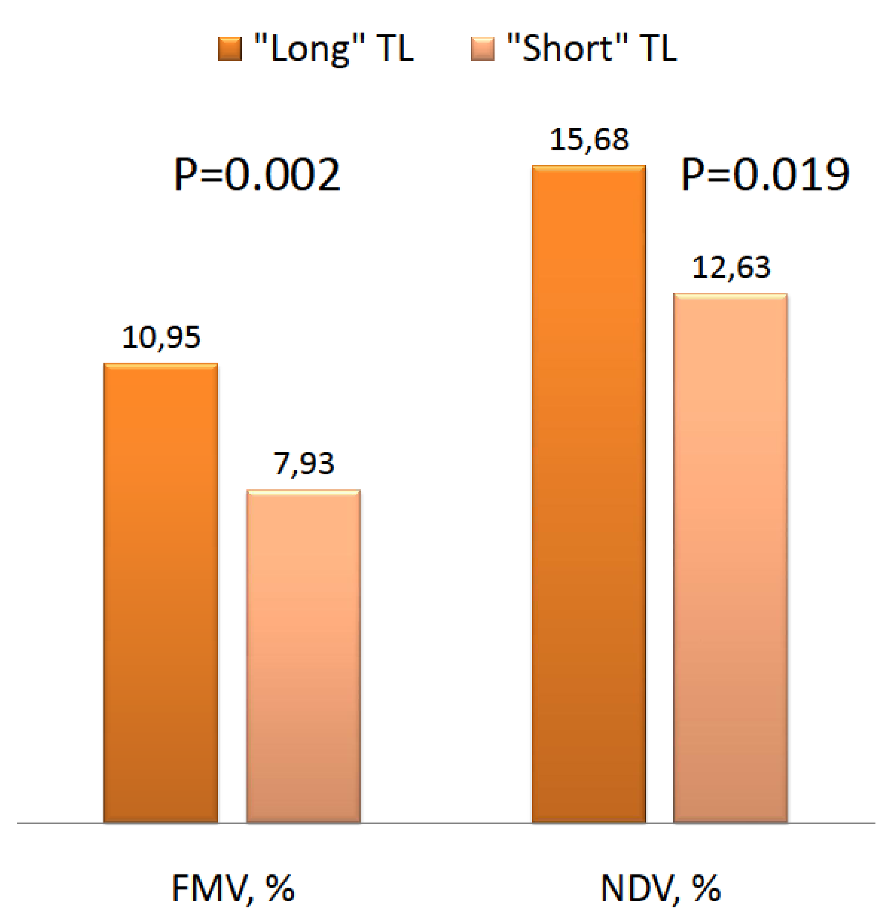
**Correlation analysis between telomere length and different variables in patients with T2DM**

| Variable | Telomere length | |
|---|---|---|
| | r | p |
| Age (years) | -0.09 | 0.52 |
| SBP (mm Hg) | -0.03 | 0.83 |
| DBP(mm Hg) | 0.12 | 0.40 |
| BMI (kg/m$^2$) | -0.02 | 0.88 |
| FG (mmol/l) | -0.42 | 0.003 |
| HbA1c (%) | -0.23 | 0.12 |
| PWV (m/s) | -0.50 | 0.0003 |
| IMT (mm) | -0.39 | 0.0059 |
| PP (number) | -0.25 | 0.08 |
| CRP (mg/l) | -0.40 | 0.004 |
| Fibrinogen | -0.18 | 0.22 |
| Interleukin-6 | -0.03 | 0.82 |
| MDA (mkmol/l) | -0.15 | 0.29 |
| FMV (%) | 0.49 | 0.0003 |
| NDV (%) | 0.41 | 0.0035 |
| Decreased TA | -0.32 | 0.035 |

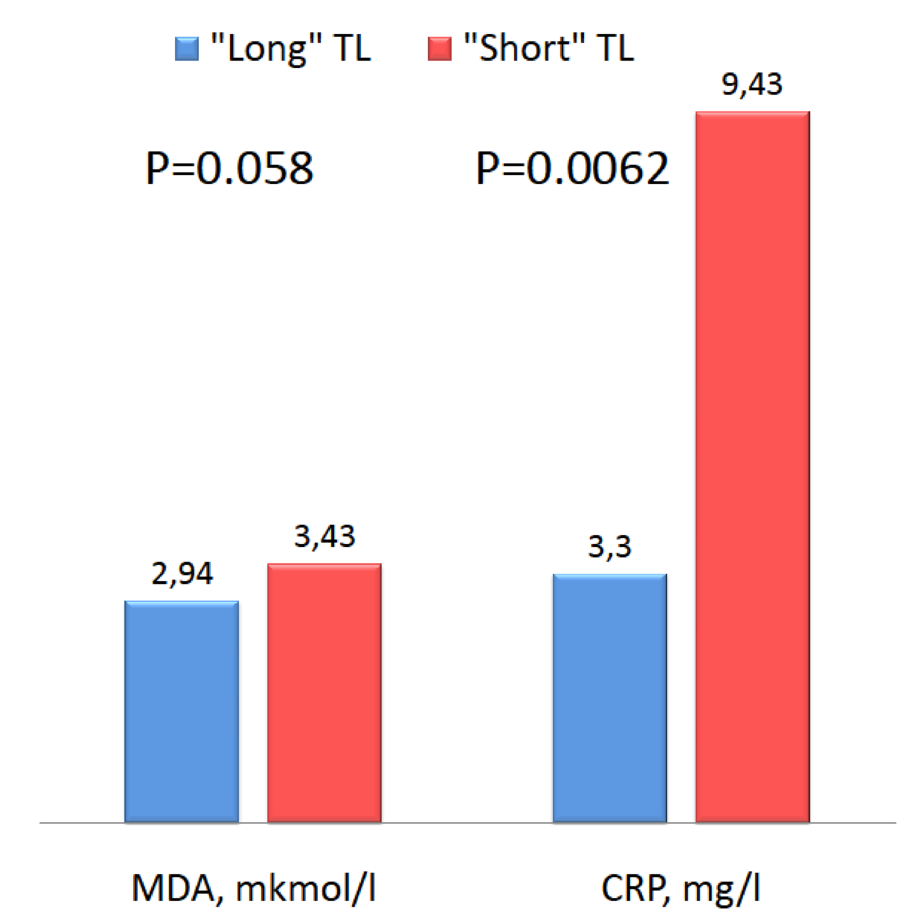
**State of the vascular wall in diabetic patients with "short" and "long" TL**




**Endothelial dysfunction in diabetic patients with "short" and "long" TL**




**Oxidative stress and chronic inflammation in diabetic patients with "short" and "long" TL**




Then patients were divided into 2 groups by the median of TA (0.33): "low" and "high" TA. There were no significant difference in vascular changes, markers of oxidative stress and chronic inflammation between the 2 groups. In diabetic patients TA was associated only with longer telomeres (r=0.40, p=0.0095).

**Conclusion:** Vascular changes, chronic inflammation and oxidative stress were more pronounced in patients with T2DM and "short" telomeres. Perhaps long telomeres protect vessels of diabetic patients from accelerated vascular aging. The role of telomerase activity in the vascular aging has not been established.

**References:** 1. Scuteri A, Najjar SS, Muller DC, Andres R, Hougaku H, Metter EJ, et al. Metabolic syndrome amplifies the age-associated increases in vascular thickness and stiffness. J Am CollCardiol.2004;43(8):1388–1395 2. Nilsson PM, Boutouyrie P, Cunha P, Kotsis V, Narkiewicz K, Parati G, et al. Early vascular ageing in translation: from laboratory investigations to clinical applications in cardiovascular prevention. JHypertens. 2013;31(8):1517–1526. 3. A. T. Ludlow, Telomere dynamics and regulation: Effects of chronic exercise, acute exercise and oxidative stress, 2011, p.195.

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