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# Evaluation of IL-6 and TNF- $\alpha$ in Tears and Serum in Age-Related Macular Degeneration

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## Abstract

**Objective:** The purpose of this study was to assess the levels of interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF- $\alpha$ ) in the tears and serum of patients with age-related macular degeneration, as well as to identify the factors associated with IL-6 and TNF- $\alpha$  levels in tears.

**Methods:** This was a comparative, cross-sectional study involving age-related macular degeneration patients and a control group. Tear samples were collected using Schirmer paper strips, while 3 mL of blood was obtained from each patient. IL-6 and TNF- $\alpha$  levels in tears and serum were measured using a commercial human enzyme-linked immunosorbent assay (ELISA) kit. The study analysed the effects of duration of age-related macular degeneration, disease stage, and smoking status on IL-6 and TNF- $\alpha$  levels in tears, aiming to determine their associations. **Results:** A total of 142 patients were recruited for this study, including 56 patients with early age-related macular degeneration, 56 patients with late neovascular age-related macular degeneration, and 30 patients in the control group. Age-related macular degeneration patients exhibited significantly higher mean levels of IL-6

in both tears and serum, as well as TNF- $\alpha$  in serum, compared to the control group, both before and after adjusting for covariates ( $21.97 \pm 10.95$  vs.  $16.06 \pm 10.00$  pg/mL,  $p = 0.008$  and  $p = 0.014$ ;  $12.00 \pm 6.04$  vs.  $8.53 \pm 4.13$  pg/mL,  $p = 0.004$  and  $p = 0.004$ ;  $18.58 \pm 7.90$  vs.  $13.61 \pm 4.86$  pg/mL,  $p = 0.001$  and  $p = 0.004$ , respectively). Within the age-related macular degeneration group, the mean IL-6 level in serum was significantly higher in patients with late neovascular age-related macular degeneration compared to those with early age-related macular degeneration ( $13.89 \pm 6.08$  vs.  $10.11 \pm 5.41$  pg/mL,  $p = 0.001$ ). The levels of IL-6 and TNF- $\alpha$  in tears were not associated with the duration of age-related macular degeneration, the stages of age-related macular degeneration, or smoking status.

**Conclusion:** There are significantly higher levels of IL-6 in both tears and serum, whereas tears and serum TNF- $\alpha$  serve as non-specific biomarkers for age-related macular degeneration. This study could serve as a basis for future research. © 2026 John Wiley & Sons Ltd.

## Author keywords

age-related macular degeneration; interleukin-6; tears; tumour necrosis factor-alpha

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