Research by ophthalmic specialists in Ireland has shown a statistically significant relationship between the macular pigment and a range of established risk factors for age-related maculopathy (ARM).

The leader of the research, Jack Nolan PhD, reported in the Journal Experimental Eye Research that “in the absence of retinal pathology and in advance of disease onset, the relative lack of macular pigment seen in association with increasing age, tobacco use and family history of ARM supports the hypothesis that the enhanced risk that these variables represent for ARM may be attributable, at least in part, to a parallel deficiency of macular carotenoids.”

The research findings, from the Department of Chemical and Life Sciences of the Waterford Institute of Technology in Ireland, lend support to potential benefits from the use of dietary supplements that provide the carotenoids lutein and zeaxanthin.

As the leading cause of severe visual impairment in the elderly, ARM and its advanced form, age-related macular degeneration (AMD), have been the subject of intense academic and commercial research in recent years. Several biotech and pharmaceutical companies are now conducting clinical trials to inhibit the progress of the disorder through various strategies that interfere with VEGF (vascular endothelial growth factor).

These results, however, could provide the basis for alternative strategies that focus on components of the macular pigment.

The macular pigment is composed of two hydroxycarotenoids, lutein and zeaxanthin, which together act as a blue-light filter and antioxidant. A growing body of research suggests there may be parallels between a relative lack of macular pigment and established risk factors for ARM, such as increasing age, smoking, and family history.

The recent studies conducted by Dr Nolan and colleagues were aimed at drawing firm scientific conclusions from these potential associations by using a large sample size and robust statistical analysis.

Dr Nolan’s group analysed 828 healthy volunteers between the ages of 20 and 60 years. In each of the subjects, the macular pigment was measured psychophysically by heterochromatic flicker photometry (HFP). The study reported that the optical density of the macular pigment had a mean of 0.299 and ranged from 0 to 0.868. The research team used multiple linear regression analysis, a well-established statistical methodology for mathematically interpreting the relationship between two or more factors.

In their statistical analysis, the researchers investigated the relationship between macular pigment optical density and age, sex, smoking habits, family history, alcohol consumption, and iris colour.

Analysis revealed a statistically significant finding: that macular pigment measurement decreased as age increased. In terms of a family history, the macular pigment measurement was lower in those with a family history of ARM than those without. In terms of cigarette smoking, current and past smokers tended to have lower average macular pigment measurements than those who had never smoked. Finally, females, on average, tended to have lower macular pigment measurements than males.

In summary, age, family history, smoking, and gender all appeared to be a negative predictor for macular pigment optical density. The key question, however, is what can we conclude from this?

Dr Nolan’s study, aside from showing negative predictors for macular pigment optical density, also showed that dietary levels of lutein and zeaxanthin may be a positive indicator for increased macular pigment measurements. In other words, a statistically significant relationship was observed between the levels of macular pigment and a diet providing a source of lutein. Dr Nolan comments in the report that “an age-related decline in macular pigment may be attributable to excessive depletion, or inadequate uptake, of the macular carotenoids in association with increasing age.”

If this is true, then dietary supplementation with lutein may provide a degree of protection from ARM.

Subsequent studies led by Dr Meike Treieschmann – based at the Institute of Ophthalmology at the St Franziskus Hospital in Hohenzollernring, Germany – have investigated the effects of dietary lutein supplementation on the macular pigment optical density.

Initial reports from that study referred to as the LUNA study (Lutein Nutrition Study) study. The LUNA study showed that 10mg of lutein or a lutein/antioxidant formula improved visual function in a test group of 90 individuals.

In the LUNA study, supplementation with 12mg lutein and 1mg zeaxanthin provided a significant augmentation of macular pigment optical density in a majority of subjects; however, a substantial proportion of study participants showed no augmentation of their macular pigment optical density, despite their increased serum levels of lutein and zeaxanthin.

Significantly, the LUNA study was able to show that serum levels of lutein and zeaxanthin in those that didn’t respond well were comparable with those that showed an increase in the macular pigment optical density. In other words, failure to improve the macular pigment recordings could not be explained solely by differences in absorption and transport of lutein and zeaxanthin from the intestine to the macula.

Consequently, further research will be required to tease out the mechanics of lutein and zeaxanthin capture and stabilisation within the macula.

Despite the existence of significant numbers of non-responders, the results from the studies led by Dr Nolan and Dr Treieschmann provide a valuable platform for further studies that may build on the clear statistical evidence established to date that carotenoid supplementation can have a significant impact on the macular pigment and, by extension, play an important protective role in slowing vision loss in those at risk of ARM.

The field will certainly be one to watch over the coming years not least of all by those in the pharmaceutical industry keen to gain a foothold in a growing market where novel, effective, and non-invasive treatments are in high demand.