

The impact of carotenoids on visual functions and sport performance

Submission date 03/06/2026	Recruitment status No longer recruiting	☐ Prospectively registered ☐ Protocol
Registration date 05/06/2026	Overall study status Completed	☐ Statistical analysis plan ☐ Results
Last Edited 05/06/2026	Condition category Other	☐ Individual participant data ☒ Record updated in last year

Plain English summary of protocol

Background and study aims

Macular carotenoids improve visual performance in healthy individuals. These compounds play a vital role in maintaining eye health and enhancing visual function, particularly by protecting the retina from light-induced damage and reducing photo-oxidative stress. The macula, which constitutes about 4% of the retina, mediates 90% of our vision, including most aspects of colour vision: fine color discrimination, spatial acuity, and motion detection. Therefore, enhancing the health of the macula is vital for protecting and improving overall vision. Additionally, macular carotenoids also act as a filter for short-wavelength (blue) light, thereby enhancing visual functions and sleep quality. These benefits have yet to be tested on athletes. This study examined how the macular carotenoids (lutein, zeaxanthin, and meso-zeaxanthin) with omega-3 fatty acids impact visual functions and sport performance in precision sports.

Who can participate?

Shooting, archery and Egame athletes and players aged 18 years or over with no disease

What does the study involve?

The study involved four visits to the Singapore Sport Institute Physiology laboratory for clinical assessment and to the training venue for sport performance assessment over a 9-month period. Each visit took around one and half hours. Study visits involve a non-invasive vision test along with visual performance and experience (assessed by questionnaire). Blood samples were taken to measure the carotenoid nutrients in blood before and following supplementation. Skin carotenoid measured the total carotenoid concentration in the skin. Body measurements were taken before and after supplementation. The blood sample and anthropometry measurements were taken by a trained professional. Dietary intake of lutein and zeaxanthin and sleep health were assessed via questionnaires. Sport performance tests were conducted based on the sports before and following supplementation. Study volunteers were randomly allocated to receive either an eye-related dietary supplement (containing macular carotenoids and omega-3 fatty acids) or a placebo (a capsule identical to the supplement but containing no carotenoids or other active ingredients). Neither the study organisers nor the volunteers knew which capsule each person received. The study volunteers will be provided a report on the evaluations on vision status, macular carotenoid level in blood and nutritional information at the end of the study.

What are the possible benefits and risks of participating?

This research will benefit precision sport athletes and players with respect to visual and sport performance. We foresee no risks to the study volunteers. The dietary supplement used in the study has been tested and has been deemed suitable for human consumption.

Where is the study run from?

Sport Singapore (Singapore)

When is the study starting and how long is it expected to run for?

September 2022 to February 2025

Who is funding the study?

Howard Foundation (UK)

Who is the main contact?

Prof. John Nolan, John.Nolan@setu.ie

Contact information

Type(s)

Scientific, Public, Principal investigator

Contact name

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Study information

Scientific Title

The effect of macular carotenoids and omega-3 supplementation on performance in precision sports: the Sport Nutrition Intervention in Performance Exercise (SNIPE) study

Acronym

SNIPE

Study objectives

Athletes engaged in precision sports often experience extended and varying light exposure during training and competition. Although these sports do not require responding to changing visual information, their visual demands become more pronounced in outdoor settings with varying weather conditions, significantly impacting visibility and performance. Empirical evidence shows that the human eye is sensitive to exposure to short-wavelength (blue) light, which ranges from 400 and 500 nm in the visible spectrum. Visual functions can be affected by short-wavelength (blue) light causing photo-oxidative damage to retinal cells, which can compromise eye health, and the direct effects of short-wavelength (blue) light include issues around light scattering, glare disability and delayed photostress recovery, all of which can degrade or impair visual performance, including visual acuity, contrast sensitivity, and glare discomfort. These factors can significantly impact the visual skills of individuals, even those who are highly skilled athletes, in both the short- and long-term.

We propose the significant potential of macular carotenoids, specifically lutein, zeaxanthin, and meso-zeaxanthin, in the athlete population. This is based on substantial evidence supporting the positive effects of these bioactive nutrients in the general healthy population. These compounds play a vital role in maintaining eye health and enhancing visual function, particularly by protecting the retina from light-induced damage and reducing photo-oxidative stress. Additionally, macular carotenoids also act as a filter for short-wavelength (blue) light, thereby enhancing visual functions and sleep quality.

Despite this science, these benefit have yet to be tested on athletes. The SNIPE study examined how the macular carotenoids (lutein, zeaxanthin, meso-zeaxanthin) with omega-3 fatty acids impact visual functions and sport performance in precision sports. The implications of the SNIPE study are significant, as it highlights the importance of complementary bioactive nutrients, specifically carotenoids and omega-3 fatty acids, that support optimal function of the eye and brain and, subsequently, positively impacts areas of sport performance.

Ethics approval required

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Ethics approval(s)

1. Approved 06/09/2022, Singapore Sport Institute IRB Secretariat (High Performance Sport Institute Sport Singapore 3 Stadium Drive, Singapore, 397630, Singapore; +65 (0)6500 5215; chow_kin_ming@sport.gov.sg), ref: NU-FULL-021

2. Approved 20/06/2025, South East Technological University Research Ethics Committee (South East Technological University Cork Road, Waterford, K91 KOEK, Ireland; +353 (0)818121212; brian.jackson@setu.ie), ref: SETU2022REC0002 & SETU/REC/24/25/025

Primary study design

Interventional

Allocation

Randomized controlled trial

Masking

Blinded (masking used)

Control

Placebo

Assignment

Single

Purpose

Basic science

Study type(s)

Health condition(s) or problem(s) studied

Visual function and sport performance in precision sports athletes

Interventions

This study was a 1:1, placebo-controlled trial in which participants were randomly assigned to the active or placebo groups in a double-blind fashion. Participants were required to consume one capsule daily over a 9-month intervention period.

Intervention 1: a soft-gel carotenoid combination formulation containing 13.3 mg of lutein, 11.7 mg of meso-zeaxanthin, and 1.7 mg of zeaxanthin in a fish oil suspension containing 312.3 mg of docosahexaenoic acid (DHA), 53.5 mg of docosapentaenoic acid (DPA) and 78.7 mg of eicosapentaenoic acid (EPA).

Intervention 2: soft-gel placebo control containing sunflower oil.

Intervention Type

Other

Primary outcome(s)

1. Sport performance for shooting and archery measured using shooting score, total aiming time and shots grouping (Scatt system and Mantis 8X) at baseline and 9 months
2. Sport performance for Egame measured using simple reaction time, choice reaction time, focused attention and stress tolerance (Vienna Test System) at baseline and 9 months

Key secondary outcome(s)

1. Contrast and glare sensitivity measured using the M&S Smart System at baseline and 9 months
2. Visual acuity measured using the M&S Smart System at baseline and 9 months
3. Subjective visual function measured using questionnaire at baseline and 9 months
4. Sleep health measured using RU-SATED questionnaire at baseline and 9 months
5. Skin carotenoid concentrations measured using Nu Skin Pharmanex S3 scanner at baseline and 9 months
6. Serum carotenoid concentrations measured using high performance liquid chromatography analysis at baseline and 9 months
7. Dietary lutein and zeaxanthin intake measured using Dietary Questionnaire for Epidemiological Studies at baseline

Completion date

28/02/2025

Eligibility

Key inclusion criteria

1. Athletes from shooting, archery or Egame
2. Healthy individuals
3. Aged 18 years or over
4. No ocular pathology

Healthy volunteers allowed

Yes

Age group

Adult

Lower age limit

18 Years

Upper age limit

50 Years

Sex

All

Total final enrolment

67

Key exclusion criteria

1. Consumption of carotenoid supplements in the past 3 months
2. Unable to maintain their current diet throughout the studies
3. Fish and shellfish allergy
4. Presence of ocular disease, colour blindness, pancreatic disease, atrophic gastritis, insulin-requiring diabetes, or gastrointestinal bleeding disorders
5. Wheelchair bound and unable to take anthropometric measurements

Date of first enrolment

06/09/2022

Date of final enrolment

31/10/2024

Locations

Countries of recruitment

Singapore

Sponsor information

Organisation

The Howard Foundation

ROR

<https://ror.org/03ywwjy69>

Funder(s)

Funder type

Funder Name

The Howard Foundation

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary

Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet	version 2		03/06/2026	No	Yes