

## Omega-3 fatty acids supplementation and risk of atrial fibrillation: an updated meta-analysis of randomized controlled trials

Atrial fibrillation (AF) is the most prevalent sustained cardiac arrhythmia worldwide<sup>1</sup> and it is associated with high morbidity and mortality, ultimately making it a major public health burden.

Omega-3 fatty acids (O3FA) supplementation are being utilized in clinical practice to reduce cardiovascular disease (CVD) risk in patients with elevated plasma triglycerides. Safety has been, however, questioned as several cardiovascular (CV) outcomes trials of O3FA supplementation showed a potential increase of AF, when compared with placebo.<sup>2</sup>

In this meta-analysis of randomized controlled trials (RCTs), we investigated whether O3FA supplementation is associated with an increased risk for AF compared to placebo. We conducted a systematic search of RCTs of O3FA supplementation on CV outcomes, which also included data on the incidence of AF up to November 2020.

The main endpoint of the study was the onset of AF. For inferential purposes, a frequentist pairwise meta-analysis was conducted by using Poisson regression model with random

study effects. Incidence rate ratio (IRR) and 95% confidence interval (CI) were chosen over relative risk as outcome measure because of the different follow-up of the selected studies.

The pairwise meta-analysis was performed with the R statistical software (4.0.0 version) using R package 'meta'. Heterogeneity across studies was assessed with Cochran's Q method and  $I^2$  testing. A threshold of  $P < 0.10$  was used to define the presence of heterogeneity for the Q test.  $I^2$  was considered substantial when it was  $>50\%$ . The presence of publication bias for small study effect appraisal was assessed by visual examination of funnel plots and was quantified by Egger's test and Begg's test.

Detailed characteristics of the five included studies are presented in [Supplementary material online, Table S1](#).<sup>3-7</sup>

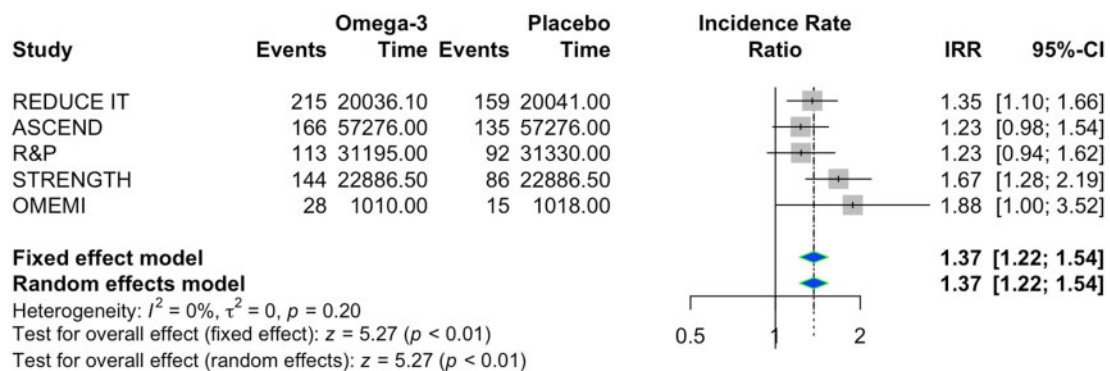
In the random effect model, O3FA supplementation was associated with an increased risk of incident AF as compared with placebo [IRR 1.37, 95% CI (1.22–1.54),  $P < 0.001$ ] (Figure 1). There were no significant statistical heterogeneity between studies and no publication bias, even if the funnel plot suggested some asymmetry. As a sensitivity analysis, we included the VITAL rhythm trial. Results confirmed a higher risk of AF in the group receiving O3FA supplementation as compared with placebo [IRR 1.29, 95% CI (1.13–1.48),  $P = 0.0002$ ] ([Supplementary material online, Figure S1](#)).

The results of this meta-analysis show that individuals at high risk for, or with established

CVD and elevated plasma triglycerides treated with O3FA supplementation have a significantly higher incidence of AF events, compared to placebo. We also found no heterogeneity and no small study publication bias.

O3FA supplementation has been utilized to reduce CVD and CVD-related mortality in patients at high CV risk and elevated plasma triglycerides. The CV benefits, however, have been inconsistent; specifically, in the REDUCE-IT trial, a high dose of O3FA supplementation with highly purified icosapent ethyl was associated with a significantly lower risk for the primary composite CV endpoint<sup>3</sup>. Contrarily, the recent STRENGTH trial, which utilized the same dose of O3FA supplementation, but containing a formulation of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), was neutral on the composite primary endpoint.<sup>6</sup> Moreover, lower doses of O3FA supplementation have not improved CV outcomes.<sup>2</sup>

Although the positive effects of O3FA supplementation on the composite CV endpoints have been inconsistent, most trials have been associated with an increased risk for AF occurrence. Patients receiving icosapent ethyl in the REDUCE-IT<sup>3</sup> trial presented a significantly greater risk for incidence AF or atrial flutter, which was further confirmed in STRENGTH. Even lower doses of O3FA supplementation has shown a potential signal for increased risk for AF,<sup>2,4,5</sup> proposing that regardless of the dose of O3FA supplementation implemented



**Figure 1** Forest plot for atrial fibrillation events. IRR, incidence rate ratio.

in the trials and potential-related benefits on CV outcomes, O3FA supplementation may increase the risk for AF. The results of our meta-analysis confirmed this finding, which is concerning given the large proportion of patients eligible for treatment with O3FA supplementation.

The conflicting results of the beneficial effects of O3FA supplementation on CV outcomes along with their potential risk for harm, highlight the need for future studies to ultimately confirm the potential beneficial effects of this class of drugs.

Moreover, the mechanisms through which O3FA supplementation may increase the risk for AF remain largely unknown, clearly highlighting the need for more mechanistic clinical trials to investigate such effects. In fact, O3FA have been previously shown to stabilize the cardiac membrane resulting in protective effects against arrhythmias, including ventricular arrhythmias.<sup>2,8</sup> Yet, some previous studies reported a higher post-operative AF in patients with elevated O3FA levels. Of note, dedicated studies investigating the effects of O3FA supplementation on ventricular arrhythmias, and in targeted high-risk populations (e.g. post-myocardial infarction patients) remain to be determined and further study encouraged.

This study has some limitations such as the lack of systematic haemorrhagic risk of the patients, the lack of a systematic search for AF events in the individual studies, and the fact that some of the studies did not include AF as a pre-specified outcome, potentially resulting in under-reporting of AF-related events. We conducted a study-level meta-analysis, with individual aspects of the participants not being accounted for. Moreover, although placebo arms were often different among the trials, we did not find heterogeneity in the results. Finally, we only included a sensitivity analysis on the VITAL rhythm results presented at the American Heart Association 2020, as the fully data have not been disclosed yet.

In conclusion, our study suggests that O3FA supplementation is associated with an increased risk of AF in patients with elevated plasma triglyceride and at elevated CV risk. This proposes that the risk of AF should be considered when prescribing O3FA supplementation in this population.

## Supplementary material

Supplementary material is available at *European Heart Journal – Cardiovascular Pharmacotherapy* online.

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**Conflict of interest:** G.B.-Z. has consulted for Cardionovum, Innovheart, Meditrial, and Replycare. The remaining authors have nothing to disclose.

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