

## Essential fatty acids

### Introduction

A supplementary, or adjunctive, treatment is administered in conjunction with a patient's ongoing antipsychotic therapy in an attempt to treat symptoms or improve functions that are not adequately improved with the antipsychotic alone. One important group of compounds that have been suggested as an adjunctive therapy are the essential fatty acids (EFAs).

The two main EFAs are omega-3 and omega-6. They are important compounds for brain function, as they have impact on membrane receptors, ion channels and synapse function, as well as neuronal development. However, they are not made in the body and must be sourced from the diet. People with schizophrenia have shown to have lower levels of these essential compounds and their products, including omega-3 products docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA), its ester, ethyl-eicosapentaenoic acid (E-EPA), omega-6 product arachidonic acid (AA), and their metabolites including prostaglandins (PGE).

It has been suggested that supplementing essential fatty acid levels may have some benefit for improving the outcome or reducing illness burden for people with schizophrenia.

### Method

We have included only systematic reviews (systematic literature search, detailed methodology with inclusion/exclusion criteria) published in full text, in English, from the year 2000 that report results separately for people with a diagnosis of schizophrenia, schizoaffective disorder, schizophreniform disorder or first episode schizophrenia. Reviews were identified by searching the databases MEDLINE, EMBASE, CINAHL, Current Contents, PsycINFO and the Cochrane library. Hand searching reference lists of identified reviews was also conducted. When multiple copies of reviews were found, only the

most recent version was included. Reviews with pooled data are prioritised for inclusion.

Review reporting assessment was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist, which describes a preferred way to present a meta-analysis<sup>1</sup>. Reviews rated as having less than 50% of items checked have been excluded from the library. The PRISMA flow diagram is a suggested way of providing information about studies included and excluded with reasons for exclusion. Where no flow diagram has been presented by individual reviews, but identified studies have been described in the text, reviews have been checked for this item. Note that early reviews may have been guided by less stringent reporting checklists than the PRISMA, and that some reviews may have been limited by journal guidelines.

Evidence was graded using the Grading of Recommendations Assessment, Development and Evaluation ([GRADE](#)) Working Group approach where high quality evidence such as that gained from randomised controlled trials (RCTs) may be downgraded to moderate or low if review and study quality is limited, if there is inconsistency in results, indirect comparisons, imprecise or sparse data and high probability of reporting bias. It may also be downgraded if risks associated with the intervention or other matter under review are high. Conversely, low quality evidence such as that gained from observational studies may be upgraded if effect sizes are large or if there is a dose dependent response. We have also taken into account sample size and whether results are consistent, precise and direct with low associated risks (see end of table for an explanation of these terms)<sup>2</sup>. The resulting table represents an objective summary of the available evidence, although the conclusions are solely the opinion of staff of NeuRA (Neuroscience Research Australia).



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### Results

We found five systematic reviews that met our inclusion criteria.<sup>3-7</sup>

- Moderate to high quality evidence finds no benefit of adjunctive essential fatty acids for symptoms or global state.



Cakici N, van Beveren N, Judge-Hundal G, Koola M, Sommer I

**An update on the efficacy of anti-inflammatory agents for patients with schizophrenia: A meta-analysis**

Psychological Medicine 2019; 49: 2307-19

[View review abstract online](#)

Comparison	Adjunctive fatty acids eicosapentaenoic (0.5g daily), docosahexaenoic (4g daily), or omega-3 (0.4 to 2.2g daily) vs. placebo.
Summary of evidence	Moderate to high quality evidence (large sample, inconsistent, precise, direct) suggests no significant differences between groups.
<b>Symptoms</b>	
<i>No significant differences between groups;</i> 11 RCTs, N = 652, $g = 0.19$ , 95%CI -0.02 to 0.40, $p = 0.07$ , $I^2 = 41\%$	
Consistency in results <sup>‡</sup>	Inconsistent
Precision in results <sup>§</sup>	Precise
Directness of results <sup>  </sup>	Direct

Cho M, Lee TY, Kwak YB, Yoon YB, Kim M, Kwon JS

**Adjunctive use of anti-inflammatory drugs for schizophrenia: A meta-analytic investigation of randomized controlled trials**

Australian and New Zealand Journal of Psychiatry 2019; 53: 742-59

[View review abstract online](#)

Comparison	Adjunctive omega-3 fatty acids vs. placebo.
Summary of evidence	High quality evidence (large sample, consistent, precise, direct) suggests no significant differences between groups.



<b>Symptoms</b>	
<p><i>No significant differences between groups;</i>                      20 RCTs, N = 778, <math>g = 0.03</math>, 95%CI -0.14 to 0.20, <math>p &gt; 0.05</math>, <math>I^2 = 21\%</math>                      The result was similar for positive and negative symptoms.</p>	
<b>Consistency in results</b>	Consistent
<b>Precision in results</b>	Precise
<b>Directness of results</b>	Direct

*Fusar-Poli P, Berger G*

**Eicosapentaenoic Acid Interventions in Schizophrenia. Meta-Analysis of Randomized, Placebo-Controlled Studies**

**Journal of Clinical Psychopharmacology 2012; 32: 179-185**

[View review abstract online](#)

<b>Comparison</b>	<b>Omega-3 EPA, average 2g daily for 12 to 16 weeks vs. placebo.</b>
<b>Summary of evidence</b>	<b>Moderate to high quality evidence (medium-sized sample, consistent, precise, direct) suggests no benefit of adjunctive low-dose omega-3 EPA over placebo.</b>
<b>Symptoms</b>	
<p><i>No significant difference between groups;</i>                      7 RCTs, N = 335, <math>g = 0.242</math>, 95%CI 0.028 to 0.512, <math>p &gt; 0.05</math>, <math>Q = 9.06</math>, <math>p = 0.170</math>, <math>I^2 = 33.81</math>                      There were no moderating effects of age, sex, and dose.</p>	
<b>Consistency in results</b>	Consistent
<b>Precision in results</b>	Precise
<b>Directness of results</b>	Direct



Irving CB, Mumby-Croft R, Joy LA

**Polyunsaturated fatty acid supplementation for schizophrenia**

Cochrane Database of Systematic Reviews 2006; Issue 3: Art. No CD001257

[View review abstract online](#)

<b>Comparison 1</b>	<b>Omega-3 E-EPA or EPA vs. placebo.</b>
<b>Summary of evidence</b>	<b>Moderate to low quality evidence (small samples, mostly imprecise, unable to assess consistency, direct) found no benefit for global or mental state.</b>
<b>Global and mental state</b>	
<p><i>No significant difference between groups in global state;</i> 1 trial, N = 87, MD = 0.00, 95%CI -0.29 to 0.29, <i>p</i> not reported</p> <p><i>No significant difference between groups in symptomatic response;</i> 1 trial, N = 69, RR = 0.90, 95%CI 0.50 to 1.63, <i>p</i> = 0.73</p> <p><i>No significant difference between groups in mental state;</i> 1 trial, N = 29, RR = 0.62, 95%CI 0.37 to 1.05, <i>p</i> = 0.073 1 trial, N = 87, MD = -1.00, 95%CI -8.15 to 6.15, <i>p</i> = 0.78</p>	
<b>Risks</b>	One trial, N = 77, reported no difference between omega-3 and placebo for average time until the first tardive dyskinesia response; MD = -0.40, 95%CI -1.94 to 1.14, <i>p</i> = 0.61
<b>Consistency in results</b>	Not applicable (1 trial in each comparison).
<b>Precision in results</b>	Unable to assess MDs, imprecise for RRs.
<b>Directness of results</b>	Direct
<b>Comparison 2</b>	<b>Omega-3 E-EPA or EPA vs. omega-3 DHA.</b>
<b>Summary of evidence</b>	<b>Low quality evidence (very small sample, unable to assess consistency, imprecise, direct) is unclear as to any differences between EPA and DHA.</b>
<b>Mental state</b>	



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<p><i>No significant differences between groups;</i> 1 trial, N = 31, RR = 0.66, 95%CI 0.39 to 1.11, <i>p</i> not reported</p>	
<b>Consistency in results</b>	Not applicable, one trial only.
<b>Precision in results</b>	Imprecise
<b>Directness of results</b>	Direct

Marshall M, Rathbone J

**Early Intervention for psychosis**

Cochrane Database of Systematic Reviews 2011; Issue 6. Art. No.: CD004718. DOI: 10.1002/14651858.CD004718.pub3

[View review abstract online](#)

<b>Comparison</b>	<b>Omega-3 E-EPA dose 500 mg/twice a day for 3 months plus second generation antipsychotics vs. placebo plus second generation antipsychotics.</b>
<b>Summary of evidence</b>	<b>Moderate to low quality evidence (small sample, imprecise, direct) suggests no differences between groups.</b>
<p><b>Global state</b> <b>Not responded to treatment by 12 weeks</b></p>	
<p><i>No differences between groups at 12 weeks;</i> 1 RCT, N = 80, RR = 0.90, 95%CI 0.57 to 1.43, <i>p</i> = 0.65</p>	
<b>Consistency in results</b>	Not applicable, 1 RCT only
<b>Precision in results</b>	Imprecise
<b>Directness of results</b>	Direct

Explanation of acronyms

AIMS = Abnormal Involuntary Movement Scale, CI = confidence interval, *d* = Cohen's *d* and *g* = Hedges' *g* = standardised mean differences, *I*<sup>2</sup> = the percentage of the variability in effect estimates



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that is due to heterogeneity rather than sampling error (chance), MD = mean difference, N = number of participants,  $p$  = statistical probability of obtaining that result ( $p < 0.05$  generally regarded as significant), PANSS = Positive and Negative Syndrome Scale, Q = Q statistic for the test of heterogeneity, RCT = randomised controlled trial, RR = risk ratio, vs. = versus



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### Explanation of technical terms

\* Bias has the potential to affect reviews of both RCT and observational studies. Forms of bias include; reporting bias – selective reporting of results; publication bias - trials that are not formally published tend to show less effect than published trials, further if there are statistically significant differences between groups in a trial, these trial results tend to get published before those of trials without significant differences; language bias – only including English language reports; funding bias - source of funding for the primary research with selective reporting of results within primary studies; outcome variable selection bias; database bias - including reports from some databases and not others; citation bias - preferential citation of authors. Trials can also be subject to bias when evaluators are not blind to treatment condition and selection bias of participants if trial samples are small.<sup>8</sup>

† Different effect measures are reported by different reviews.

Prevalence refers to how many existing cases there are at a particular point in time. Incidence refers to how many new cases there are per population in a specified time period. Incidence is usually reported as the number of new cases per 100,000 people per year. Alternatively some studies present the number of new cases that have accumulated over several years against a person-years denominator. This denominator is the sum of individual units of time that the persons in the population are at risk of becoming a case. It takes into account the size of the underlying population sample and its age structure over the duration of observation.

Reliability and validity refers to how accurate the instrument is. Sensitivity is the proportion of actual positives that are correctly identified (100% sensitivity = correct identification of all actual positives) and specificity is the proportion of negatives that are correctly identified (100% specificity = not identifying anyone as positive if they are truly not).

Weighted mean difference scores refer to mean differences between treatment and comparison groups after treatment (or occasionally pre to post treatment) and in a randomised trial there is an assumption that both groups are comparable on this measure prior to treatment. Standardised mean differences are divided by the pooled standard deviation (or the standard deviation of one group when groups are homogenous) which allows results from different scales to be combined and compared. Each study's mean difference is then given a weighting depending on the size of the sample and the variability in the data. 0.2 represents a small effect, 0.5 a medium effect, and 0.8 and over represents a large effect.<sup>8</sup>

Odds ratio (OR) or relative risk (RR) refers to the probability of a reduction ( $< 1$ ) or an increase ( $> 1$ ) in a particular outcome in a treatment group, or a group exposed to a risk factor, relative to the comparison group. For example, a RR of 0.75 translates to a reduction in risk of an outcome of 25% relative to those not receiving the treatment or not exposed to the risk factor. Conversely, a RR of 1.25 translates to an increased risk of 25% relative to those not receiving treatment or not having been exposed to a risk factor. A RR or OR of 1.00 means there is no difference between groups. A medium effect is considered if  $RR > 2$  or  $< 0.5$  and a large effect if  $RR > 5$  or  $< 0.2$ <sup>9</sup>. InOR stands for logarithmic OR where a InOR of 0 shows no difference between groups. Hazard ratios





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measure the effect of an explanatory variable on the hazard or risk of an event.

Correlation coefficients (eg,  $r$ ) indicate the strength of association or relationship between variables. They can provide an indirect indication of prediction, but do not confirm causality due to possible and often unforeseen confounding variables. An  $r$  of 0.10 represents a weak association, 0.25 a medium association and 0.40 and over represents a strong association. Unstandardised ( $b$ ) regression coefficients indicate the average change in the dependent variable associated with a 1 unit change in the independent variable, statistically controlling for the other independent variables. Standardised regression coefficients represent the change being in units of standard deviations to allow comparison across different scales.

‡ Inconsistency refers to differing estimates of effect across studies (i.e. heterogeneity or variability in results) that is not explained by subgroup analyses and therefore reduces confidence in the effect estimate.  $I^2$  is the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance) - 0% to 40%: heterogeneity might not be important, 30% to 60%: may represent moderate heterogeneity, 50% to 90%: may represent considerable heterogeneity and over this is considerable heterogeneity.  $I^2$  can be calculated from  $Q$  (chi-square) for the test of heterogeneity with the following formula;<sup>8</sup>

$$I^2 = \left( \frac{Q - df}{Q} \right) \times 100\%$$

§ Imprecision refers to wide confidence intervals indicating a lack of confidence in the effect estimate. Based on GRADE recommendations, a result for continuous data (standardised mean differences, not weighted mean differences) is considered imprecise if the upper or lower confidence limit crosses an effect size of 0.5 in either direction, and for binary and correlation data, an effect size of 0.25. GRADE also recommends downgrading the evidence when sample size is smaller than 300 (for binary data) and 400 (for continuous data), although for some topics, these criteria should be relaxed.<sup>10</sup>

|| Indirectness of comparison occurs when a comparison of intervention A versus B is not available but A was compared with C and B was compared with C, which allows indirect comparisons of the magnitude of effect of A versus B. Indirectness of population, comparator and/or outcome can also occur when the available evidence regarding a particular population, intervention, comparator, or outcome is not available and is therefore inferred from available evidence. These inferred treatment effect sizes are of lower quality than those gained from head-to-head comparisons of A and B.



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