

Short Communication

Testing the acceptability of liquid fish oil in older adults

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Inflammatory conditions likely to benefit from fish oil therapy are prevalent in older adults however acceptability in this group is uncertain. This study aimed to assess the palatability of a range of liquid fish oil concentrations, the frequency and extent of side effects, and to summarise any effects on adherence to fish oil therapy in older adults. One hundred patients (≥ 60 years) completed a randomised, single-blind palatability study, conducted in two parts. In part one, 50 subjects, blinded to random sample order, consumed multiple liquid fish oil samples (2x10%, 40% and 100%). In part two, 50 subjects tasted one concentration, or 100% extra light olive oil (control). Pleasantness of taste was scored on a 5-point Likert scale. Side effects were recorded 24-hr post-tasting. Results of part one showed that 9/50 participants reported increasingly unpleasant taste with increasing fish oil concentration. 14/50 reported unpleasant taste for 100% fish oil vs 7/50 for 10%. 14/50 reported side effects which would not affect compliance with therapy. For part two, 1/12 reported unpleasant taste for 100% vs 0/13 for 10% fish oil or control. 4/50 reported side effects and 2/4 indicated these would prevent ongoing fish oil therapy. The authors conclude that taste itself is not a deterrent to fish oil therapy. Furthermore, reported adverse effects may not be a true reaction to fish oil, or dissuade patients from compliance. Liquid fish oil supplements are acceptable to older adults, therefore should be investigated as a therapy for geriatric conditions.

Key Words: fish oils, older adults, acceptability, taste, adverse effects

INTRODUCTION

Inflammatory conditions likely to benefit from fish oil therapy are prevalent in older adults.¹ While patients with coronary heart disease may benefit from as little as one gram fish oil per day, the anti-inflammatory dose required is 2.7g or more per day.^{2,3} With fish oil capsules, it may be possible to achieve doses which would be therapeutic for the treatment of inflammation however the quantity of capsules required would be 10 or more.^{3,4}

Liquid fish oil can provide larger doses but there is limited evidence around its acceptability in older adults. Commonly reported side effects of fish oil include repeating taste and loose bowels.³ While traditionally the taste of fish oil has been perceived as unpleasant, improvements in the manufacture and increased recognition of health benefits may attenuate the magnitude of reported side effects, and whether these would deter an older adult from adhering to fish oil therapy. Therefore, the aims of this study were to (1) assess the initial palatability of a range of liquid fish oil concentrations; (2) describe the frequency and extent of self-reported side effects; and (3) summarise whether palatability or side effects would affect short-term adherence to fish oil therapy in older adults.

MATERIALS AND METHODS

A randomised, single-blind palatability study was performed with participants aged ≥ 60 years, from outpatient clinics and rehabilitation inpatient wards of the Repatria-

tion General Hospital, Adelaide, South Australia. Patients were ineligible if they were aged < 60 years, allergic to seafood, unable to consume thin fluids, currently taking fish oil, had severe gastrointestinal disturbances or a gastrointestinal stoma, had a history of recent haemorrhagic stroke or thrombocytopaenia, or did not provide written informed consent. Ethical approval for the study was obtained from the Research and Ethics Committee at Repatriation General Hospital and all participants provided written informed consent. The study was registered on the Australian New Zealand Clinical Trials Registry (ACTRN 12609000195257).

The liquid fish oil used in this trial was manufactured with the addition of a lemon oil to help mask the fishy odour and taste (Nordic Naturals Inc, California, USA). Samples were presented in random order according to a computer-generated random numbers table. Study participants were blinded to the test order and concentration.

In part one of the trial, 50 subjects tasted three samples of liquid fish oil (10%, 40% and 100% v/v), diluted

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Manuscript received 19 October 2010. Initial review completed 28 January 2011. Revision accepted 15 February 2011.

with extra light olive oil to 10 ml (1 ml, 4 ml and 10 ml fish oil respectively). Oil was floated on 20 ml pure orange juice sourced from local supermarkets, and a second 10% sample was included to assess the stability of the taste scale, resulting in a total of four samples with a total volume of 16 ml liquid fish oil (5.2 g Eicosapentanoic Acid; 3.6 g Docosahexanoic Acid). There was a lapse of 2-3 minutes between delivery of each sample.

In part two of the trial, a further 50 subjects tasted one of three liquid fish oil concentrations (10%, 40% and 100% v/v) or 100% extra light olive oil, prepared as above. Data are reported for taste of the varied fish oil doses and control sample in addition to any reported side effects to explore whether participants were able to differentiate between any dose of fish oil versus no fish oil (control). In both parts of the trial, each sample was washed down by 20ml pure fruit juice. Water was given to rinse the mouth between samples.

After each sample plus washout, participants were asked to score taste on a 5-point Likert scale ranging from "extremely unpleasant" (score 1) to "extremely pleasant" (score 5), as this scale has been reported to be reliable for assessment of taste preference.⁵ Aftertaste was scored using an identical scale approximately one minute after the initial taste was scored. Twenty-four hours post-tasting, all participants were contacted via telephone (outpatients) or visited (inpatients) and questioned about side-effects.

To summarise, the studies described above were designed to (1) assess participant's ability to detect increas-

ing doses of fish oil (and the prevalence of adverse events) and (2) assess the participants' ability to distinguish between varied doses of fish oil and no fish oil (control) whilst trying to minimise the total volume consumed (which might independently influence side effects). Data were analysed using SPSS for Windows, version 17.0.1 (SPSS Inc, Chicago). All tests were two-tailed and statistical significance was set at $p < 0.05$. Median (interquartile range (IQR)) and frequency (n) was reported. Mann-Whitney U test was performed to assess differences in age, and Fisher's Exact test to assess differences in gender, between the two parts of the trial. For part one, differences in mean scores for taste and aftertaste for each concentration were assessed by the Friedman test.

To assess the stability of the 5-point Likert scale, comparison of scores for the duplicate 10% samples was conducted by Spearman's correlation and systematic bias was assessed using Wilcoxon signed rank test.

RESULTS

Subjects

A convenience sample of the first 100 eligible patients to consent was recruited into this study (see Table 1).

Tasting

Multiple samples

Full results of tasting of multiple samples are reported in Table 2. Nine out of fifty participants who tasted multiple samples reported increasingly unpleasant taste with in-

Table 1. Characteristics of participants in a single-blind study investigating the palatability of liquid fish oil in older adults

		Male [†]		Female [†]		Total		
		Median	IQR [‡]	Median	IQR	Median	IQR	
Part I	Participants (n [§])	27		23		50		
	Age [¶]		81.0	14.0	79.0	17.0	79.5	17.0
	Followed up (n)	26		23		49		
Part II	Participants (n)	28		22		50		
	Age [¶]		79.0	13.7	80.0	10.5	79.5	13.0
	Followed up (n)	28		22		50		

[†]no significant difference in gender between parts one and two ($p=1.000$)

[‡]IQR, interquartile range

[§]n, number

[¶]no significant difference in age between parts one and two (male $p=0.522$; female $p=0.467$; total $p=0.945$)

Table 2. Taste ratings of 50 study participants (n (%)) tasting multiple samples of liquid fish oil

	10% (1) fish oil [†]		10% (2) fish oil [‡]		40% fish oil [‡]		100% fish oil [§]	
	Taste [*]	Aftertaste ^{**}	Taste [*]	Aftertaste ^{**}	Taste	After-taste	Taste	Aftertaste
Extremely unpleasant	0 (0.0)	1 (2.0)	0 (0.0)	0 (0.0)	2 (4.1)	1 (2.0)	2 (4.0) ^{***}	2 (4.0) ^{****}
Unpleasant	3 (6.1)	1 (2.0)	5 (10.0)	2 (4.0)	5 (10.2)	4 (8.2)	12 (24.0)	12 (24.0)
Neither pleasant nor unpleasant	31 (63.3)	32 (65.3)	31 (62.0)	34 (68.0)	29 (59.2)	33 (67.3)	27 (54.0)	29 (58.0)
Pleasant	13 (26.5)	14 (28.6)	13 (26.0)	12 (24.0)	12 (24.5)	10 (20.4)	8 (16.0)	6 (12.0)
Extremely pleasant	2 (4.1)	1 (2.0)	1 (2.0)	2 (4.0)	1 (2.0)	1 (2.0)	1 (2.0)	1 (2.0)

[†]1ml fish oil + 9ml extra light olive oil

[‡]4ml fish oil + 6ml extra light olive oil

[§]10ml fish oil + 0ml extra light olive oil

^{*}Moderate positive correlation between samples $r=0.466$, $p=0.001$; no significant difference between tastings $p=0.371$

^{**}Moderate positive correlation between samples $r=0.453$; no significant differences between aftertastes $p=0.819$

^{***}100% fish oil taste significantly less pleasant than other concentrations $p=0.002$

^{****}100% fish oil aftertaste significantly less pleasant than other concentrations $p < 0.001$

Table 3. Taste ratings of study participants (n (%)) tasting single samples of liquid fish oil

	0% fish oil (control) [†] (n=13)		10% fish oil [‡] (n=13)		40% fish oil [§] (n=12)		100% fish oil [¶] (n=12)	
	Taste	After-taste	Taste	After-taste	Taste	After-taste	Taste	After-taste
Extremely unpleasant	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Unpleasant	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (8.3)	1 (8.3)	1 (8.3)	0 (0.0)
Neither pleasant nor unpleasant	4 (30.8)	3 (23.1)	6 (46.2)	4 (30.8)	9 (75.0)	9 (75.0)	3 (25.0)	5 (41.7)
Pleasant	3 (23.1)	4 (30.8)	6 (46.2)	8 (61.5)	2 (16.7)	2 (16.7)	5 (41.7)	4 (33.3)
Extremely pleasant	6 (46.2)	6 (46.2)	1 (7.7)	1 (7.7)	0 (0.0)	0 (0.0)	3 (25.0)	3 (25.0)

[†]0ml fish oil + 10ml extra light olive oil

[‡]1ml fish oil + 9ml extra light olive oil

[§]4ml fish oil + 6ml extra light olive oil

[¶]10ml fish oil + 0ml extra light olive oil

creasing concentrations of fish oil. For 100% fish oil, 2/50 participants reported extremely unpleasant taste and aftertaste, and 12/50 participants reported unpleasant taste with 9/12 reporting continued unpleasant aftertaste. This compared with 7/50 reports of unpleasant taste for 10% fish oil, reducing to 3/7 after one minute.

Study participants scored taste for 100% fish oil significantly less pleasant (mean score = 2.09) than the other concentrations (10% (1) = 2.79; 10% (2) = 2.63; 40% = 2.52: Friedman test, $p=0.002$). Similarly, aftertaste score for 100% fish oil was significantly lower (mean score = 2.03) than other concentrations (10% (1) = 2.73; 10% (2) = 2.73; 40% = 2.50: Friedman test, $p<0.001$).

There were 14 reports of minor gastrointestinal side effects in this group 24 hours post-tasting, however none of these subjects reported that this would reduce adherence to prescribed therapy.

Reliability of the scale

Spearman's correlation analysis demonstrated moderate positive correlation between scores for taste for the two 10% fish oil samples ($\rho=0.466$, $p=0.001$). A Wilcoxon signed rank test revealed no significant difference between tastings for the 10% samples ($z=-0.894$, $p=0.371$). For assessment of aftertaste scores there was a moderate positive correlation between the two 10% samples ($r=0.453$, $p=0.001$) and no significant difference between aftertaste ($z=-0.229$, $p=0.819$).

Single sample

Full results of tasting of a single sample are reported in Table 3. Of those tasting a single sample, 1/12 tasting 100% fish oil reported unpleasant taste, compared with 8/12 who reported pleasant or extremely pleasant taste and 3/12 who reported that the sample was neither pleasant nor unpleasant. There were no reports of unpleasant taste for 10% fish oil (n=13) or control samples (n=13). Four of the 50 participants reported minor gastrointestinal side effects 24 hours post-taste test with 2 of those indicating that these would prevent ongoing liquid fish oil therapy. One of these tasted 40% fish oil and the other tasted a control sample.

DISCUSSION

To our knowledge this is the first study to investigate the acceptability and initial tolerance of liquid fish oil in older adults. Our results indicate that older adults may not be

able to reliably distinguish between fish oil doses when presented according to this standard protocol, and most would not cease consumption of fish oil if experiencing mild side effects. Furthermore, we cannot be confident that side effects reported by older adults are always directly associated with consumption of fish oil.

There is little literature on adherence to higher dose fish oil therapy, i.e. ≥ 3 g/day. The literature indicates that adherence to moderate dose fish oil capsules is good e.g. 3 grams per day for 12 weeks; adherence 89% in stroke patients;⁶ 5.4 grams per day for 26 weeks; adherence 96% in older adults;⁷ but there is limited evidence reporting adherence to liquid fish oil at any dose. Cleland *et al.* (2006) reported good adherence to 15 ml liquid fish oil for 3 years in younger adults,⁸ and our findings confirm that this would be a feasible therapy in older adults.

Many lay individuals are concerned about taking fish oil because they fear side effects such as repeating taste and diarrhoea. Our data suggests that side effects may not be directly associated with the consumption of fish oil, and that taste itself is not a deterrent to fish oil therapy. We believe that the sheer volume of liquid consumed by those who tasted multiple samples may have been a contributing factor to increased side effects in that group. With a rapid intake of 200 ml of juice and oil, plus water between samples, the multiple sample group consumed considerably more than the single dose group (50ml, plus water). Therefore, in practice we would envisage levels of adverse effects more in line with the number reported in the single sample group.

Furthermore, there is evidence that non-odour and non-flavour stimuli, and outside influences, such as the lay media, affect taste perception therefore may influence results of studies such as this.⁹ It is feasible that taste and side effects reported by our study participants were swayed by an expectation of what they would experience, as a result of such influences. The authors suggest that while marketing of fish oil products has progressed, it should continue to improve, to help dispel preconceived ideas in the public arena; and therefore to encourage use of these supplements, particularly in light of research which indicates that patients are highly influenced by advertising.¹⁰

Side effects were only examined in the short-term. However, from our findings it appears that even if side effects are experienced they may not be a disincentive to fish oil therapy in this population of older adults, therefore it is recommended that therapists advocate for this

treatment where necessary. Where a clinical need is identified which cannot be met by fish meals, clinicians should advise patients on fish oil supplements and fully inform them of the benefits, while reassuring them that negative effects, such as gastrointestinal disturbances, are minimal and rare.

While the authors acknowledge that this trial was limited by its cross-sectional nature and short-term assessment of adverse effects, we believe that this study adds valuable information on initial tolerance of fish oil in older adults to a field where such little evidence as there is, is gleaned from longer term observations.

In conclusion, this research has demonstrated that liquid fish oil supplements are acceptable to older adults in the short term. The authors therefore recommend investigation into the role of fish oil in geriatric conditions.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the staff and patients of Orthopaedic and Plastics outpatient clinics, the Day Rehabilitation service and rehabilitation inpatient wards at Repatriation General Hospital, Adelaide; and Pawel Skuza, statistical consultant at Flinders University, for guidance relating to the analyses conducted in this research. Finally, we acknowledge Nordic Naturals Inc, California, USA, for provision of the fish oil for this study.

We also wish to acknowledge Flinders University and the Department of Rehabilitation & Aged Care at Repatriation General Hospital for the provision of a research stipend to the research higher degree student (AY).

AUTHOR DISCLOSURES

The authors declare no conflict of interest related to this project.

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測試老年人對液態魚油的接受度

炎症性疾病受益于鱼油治疗的可能性常见于老年人，可是老年人對魚油的接受性并不确定。这研究旨在评估，對老年人，不同浓度的液態鱼油之适口性、鱼油副作用的频率和程度、和总结鱼油治疗的所有效應。研究分两部分，共計 100 位患者(≥60 岁)，完成一项随机单盲的适口性試驗。第一部分，50 位受試者，以随机抽样次序，攝取多次液体鱼油樣品(2x10%，40%和 100%)。在第二部分，50 位受試者分别品尝其中一个鱼油样本，或 100%的淡味橄榄油(对照组)。受試者对油样本味道的喜好度，以 5 点計分的 Likert 量表來评估。对于油样本之副作用，在品尝后 24 小时被记录。第一部分的结果表明，9/50 受試者报告，随着鱼油的浓度增高，令人不悅的味道亦上昇。有 14/50 的受試者不喜歡 100%鱼油的口味，有 7/50 的受試者覺得 10%鱼油不適口。14/50 受試者报告有鱼油的副作用，但这不会影响他们對治疗的依从性。至于第二部分，1/12 品尝 100%鱼油与 0/13 品尝 10%鱼油或橄榄油的受試者，宣稱有不悅的味道。4/50 受試者报告有副作用，而其中 2 位表示这会阻止他们繼續进行鱼油治疗。结论是，味道本身并不会妨碍鱼油治疗。此外，报告的副作用有可能不是对于鱼油的真正反应，或阻止患者遵从治疗。液体鱼油补充剂老年人可接受，因此針對治疗老年状况应加以调查。

關鍵字：魚油、老年人、接受度、品嚐、副作用