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Validation of a Food Frequency Questionnaire to assess intake of n-3 Polyunsaturated Fatty Acids in Switzerland

I Herter-Aeberli[1], C Graf[1], A Vollenweider[1], I Häberling[2], P Srikanthan[3], M Hersberger[3], G Berger[2], and D Mathis[3]

[1]Institute of Food, Nutrition and Health, Laboratory of Human Nutrition, ETH Zurich, Zurich, Switzerland. [2]Department of Child and Adolescent Psychiatry, University Hospital of Psychiatry Zurich, Zurich, Switzerland. [3]Clinical Chemistry and Biochemistry, University Children's Hospital Zurich, Zurich, Switerzland

Background and Objective

Population-based data suggest that high intake of n-3 polyunsaturated fatty acids (PUFA) may be beneficial in a variety of health conditions. It is likely that mainly those patients with preexisting omega-3 deficiency are those that benefit most from omega-3 fatty acid supplementation. Therefore, for targeted interventions, a fast and reliable screening tool for n-3 PUFA intake is necessary.

The aim of this project was to adapt and validate a food frequency questionnaire (FFQ) for n-3 PUFA intake in Switzerland using as references: 1) 7-day food records (FR) and 2) n-3 fatty acid composition of red blood cells (RBC).

Results 1

FFQ vs FR

Neither total n-3 intake nor the individual PUFA's differed significantly between the two assessment methods. Correlation analysis showed a moderate significant association between FFQ and FR for α-linolenic acid (ALA) (r=0.526), eicosapentanoic acid (EPA) (r=0.585), docosahexanoic acid (DHA) (r=0.586), and total n-3 (r=0.523) (all p<0.001). Bland Altman analysis further showed good agreement between the two methods and no proportional bias (Figure 1).

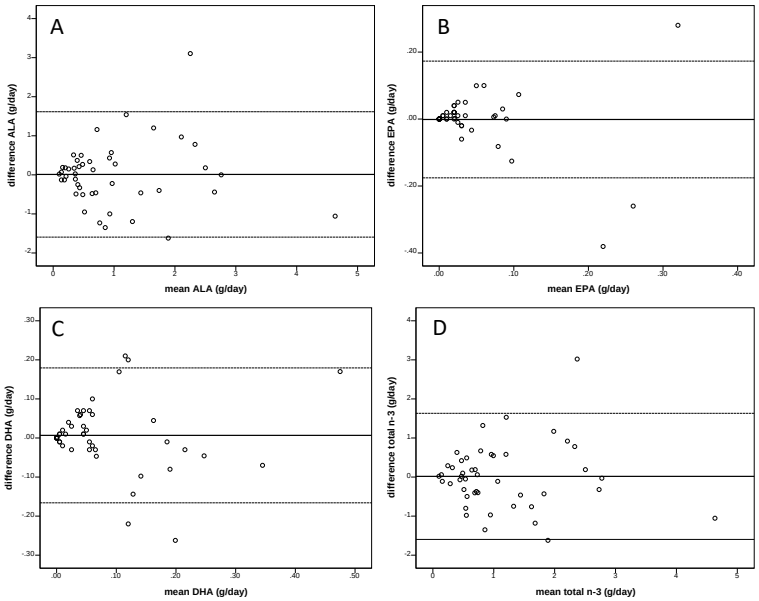

Figure 1: Bland Altman plots showing the agreement between 7-day FR and FFQ to assess the intake of: A: α-linolenic acid (ALA), B: eicosapentanoic acid (EPA), C: docosahexanoic acid (DHA), and D: total n-3 polyunsaturated fatty acid intake (total n-3). The limits of agreement (dotted line) indicates the 95% confidence interval (mean±1.96*SD).

Conclusions

In conclusion, our study shows that the adapted Swiss n-3 PUFA FFQ is a valid tool to assess dietary n-3 PUFA intake, especially DHA and EPA intake, and that this intake is associated with RBC PUFA status. Therefore, the Swiss n-3 PUFA FFQcan be applied as a screening tool in population based studies, in particular to detect high risk populations with a severely insufficient omega-3 intake that should undergo confirmatory RBC n-3 PUFA analysis to determine if a dietary change or a supplementation with omega-3 fatty acids might be indicated.

Financial Support

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Study design

We adapted a self report FFQ based on the American n-3 PUFA FFQ by Sublett et al.[1]. We used sales data on fish and seafood and general dietary habits for the adaptation.

For study 1 we recruited 46 healthy male and female participants who completed the adapted FFQ and a 7 day weighed FR.

For part 2 we recruited 152 healthy male and female participants who completed the adapted FFQ and gave a venous blood sample for the determination of RBC n-3 fatty acid composition.

All dietary data was analyzed using the dietary software EBISpro for Windows. RBC fatty acid composition was determined by gas chromatography mass spectrometry (GC-MS). The trial was registered at clinicaltrials.gov as NCT03409445.

Results 2

FFQ vs RBC fatty acid composition

Correlations between FFQ and RBC fatty acid composition were also moderate for EPA and DHA (r=0.430 and r=0.605, p<0.001, Figure 2) but weaker for ALA and total n-3 (r=0.314 and r=0.211, p<0.01).

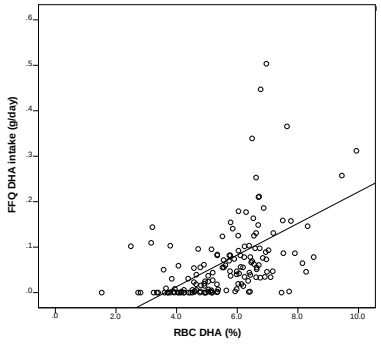

Figure 2 Correlation between FFQ and RBC fatty acid composition for DHA (r=0.605)

The following equations result from regression analyses with RBC PUFA values as the dependent variables and the corresponding FFQ value as well as gender, age, fish and supplement intake as independent variables:

1. RBC ALA (%) = 0.102 + (0.013 * calculated FFQ ALA) – (0.014 * gender) – (0.004* supplement intake) + (0.004 * fish intake) (R^2=0.212)
2. RBC EPA (%) = 0.368 + (1.497 * calculated FFQ EPA) – (0.016 * gender) + (0.005 * age) + (0.280 * supplement intake) – (0.053 * fish intake) (R^2=0.449)
3. RBC DHA (%) = 5.344 + (5.029 * calculated FFQ DHA) – (0.631 * gender) + (0.013 * age) + (0.595 * supplement intake) – (1.397 * fish intake) (R^2=0.430)
4. RBC total n-3 (%) = 7.158 + (0.246 * calculated FFQ total n-3) – (0.323 * gender) + (0.021 * age) + (1.612 * supplement intake) – (1.874 * fish intake) (R^2=0.367)

The efficacy of the FFQ to classify individuals into the same or the adjacent quartile of RBC PUFA content ranged between 70 and 87% for the different fatty acids.

Reference [1] Sublette, M.E. et al, Validation of a Food Frequency Questionnaire to Assess Intake of n-3 Polyunsaturated Fatty Acids in Subjects with and without Major Depressive Disorder. Journal of the American Dietetic Association, 2011. 111(1): p. 117-123.

For further information please contact:
isabelle.herter@hest.ethz.ch

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich