FULL ABSTRACT

Effect of Enhanced Counseling Using Complementary Feeding Recommendation Based on Linear Programming in Improving the Nutritional Status of Obese-Prone Children.

Inge Permadhi, Rina Agustina, Erfi Prafiantini, Purnawati Hustina Rachman, Ridwan Anshari, Fitrianna Cahyaningrum, Seala Septiani, Beatrice Anggono.
Department of Nutrition, Faculty of Medicine, Universitas Indonesia, Jakarta.
Correspondence: ingepermadhi@yahoo.com

Background: The prevalence of pediatric obesity has increased in many parts of the world including in Indonesia. Obesity during first two years of life could be resulted into permanent heath consequences. Dietary counseling has become one of the approaches used by practitioners to overcome the problem of pediatric obesity. Diets with a specific omega-6 (n-6)/omega-3 (n-3) fatty acid ratio have been reported to have favourable effects in controlling obesity in adults. However, development and application on an affordable local-based complementary diet by considering the ratio of these fatty acids for improving the nutritional status of overweight and obese children is lacking.

Objectives: We conducted studies in 2 phases with the following objectives Phase 1 1. Using linear programming, to develop an affordable optimised diet focusing on the ratio of omega-6 (n-6)/omega-3 (n-3) fatty acid intake for obese children aged 12–23 months. 2. To develop a valid and reliable Semi Food Frequency Questionnaire for assessing n-3 and n-6 intakes among Indonesian children Phase 2 1. To develop counseling tool and technique in delivering the message of an optimised diet menu for complimentary feeding 2. To investigate the effects of enhanced counseling using optimised diet based on LP to nutritional status and omega 3 fatty acids level among obese children age 12 to 23 months of age.

This study is expected to provide alternative intervention in improving quality counseling, which is one of the key to improve infant and young child feeding practices.

Methods Phase 1: In developing the optimised diet using Linear Programming, a cross-sectional study was conducted in two subdistricts of East Jakarta involving 42 normal- weight and 29 overweight and obese children, grouped on the basis of their body mass index for-age Z scores and selected through multistage random sampling. A 24-h recall was performed for 3-nonconsecutive days to assess the children's dietary intake levels and food patterns. We conducted group and structured interviews as well as market surveys to identify food availability, accessibility and affordability.

In developing a valid Semi Food Frequency Questionnaire, the same cross-sectional study was conducted by selecting 89 healthy children through multistage random sampling of East Jakarta. Dietary intakes were assessed using the SFFQ and a 3-day non-consecutive 24-h recall. Randomly selected children (n=35) were assessed for plasma phospholipid fatty acid (PFA). In total, 78 food items in the SFFQ, as in the Thai, Vietnamese, and American food composition databases, were validated using dietary recall and PFA. The SFFQ was readministered after 4 weeks to assess its reproducibility. The validity and reproducibility of the SFFQ were determined by Bland–Altman analysis.

Phase 2: A cross-sectional study was conducted in two subdistricts of East Jakarta involving 42 normal-weight and 29 overweight and obese children, grouped on the basis of their body mass index for-age Z scores and selected through multistage random sampling. A 24-h recall was

performed for 3-nonconsecutive days to assess the children's dietary intake levels and food patterns. We conducted group and structured interviews as well as market surveys to identify food availability, accessibility and affordability.

The design of this study is a randomized controlled trial and approved by the Faculty of Medicine, Universitas Indonesia (858/UN2.F1/ETIK/2014). Reporting of this RCT adheres to the guidelines set out in the CONSORT statement. This study was conducted in June to December 2015 in the East Jakarta, Indonesia. 12-23 months old children with BMI for age z score (BAZ) > +1 SD, not planning to move during intervention were recruited with following exclusion criteria had serious disease, physical disability, and twin children.

Results: Phase 1: Development of enhanced optimized diet. The median intakes of almost all essential fatty acids in the first SFFQ and the mean values of the 3-day 24-h recall data were comparable (no significant difference; $p>0.05$), except for the total n-3 PUFA, ALA, total n-6 PUFA, and LA. A large discrepancy in the total n-3 and n-6 PUFA intakes was observed, followed by the ALA and LA intakes, because ALA and LA were the main sources of total n-3 and total n-6 PUFAs, respectively. The SFFQ tended to record higher estimations than did the 3-day 24-h recall for the aforementioned nutrients. Furthermore, the median intakes of all essential fatty acids between the first and repeated SFFQ administration were comparable.

Development of valid SFFQ: According to the Bland–Altman and prior logtransformed graphs, the mean differences for all essential fatty acids between the first SFFQ administration and 3-day 24-h recall were nearly zero, except for total n-3 and n-6 PUFAs, ALA, and LA. To ensure that the bias or difference was acceptable from a nutrition perspective, the regression line was subjected to a fitting process to assess whether there was any correlation between the differences and averages from both methods. Most essential fatty acids, except for AA, exhibited positive linearity or magnitude dependency ($p < 0.05$). The differences between the SFFQ and 3-day 24-h recall intakes increased positively with the mean intakes. As suggested by Bland–Altman, log transformation was then used to obtain a clearer interpretation. The result also implies that the amounts of the essential fatty acids estimated in the SFFQ were approximately >1.5 times higher than those estimated in the 3-day 24-h recall.

Furthermore, this study estimated the absolute validity by comparing the intake from the first SFFQ with plasma phospholipid fatty acid content through a correlation test that was divided into two parts: nonadjusted and adjusted. The nonadjusted correlation test revealed a nonsignificant correlation between the first SFFQ and plasma fatty acid content for almost all essential fatty acids, except for LA ($r=0.37$, $p=0.04$), thus indicating a moderate correlation. This result was then confirmed through further analysis by performing a partial correlation test to adjust for other variables that can be considered as possible factors affecting the correlation between dietary intake and plasma fatty acid content. The adjusted correlation coefficients exhibited significant correlation for total n-6 PUFA and LA, after controlling for the weight-for-age z score and age. A positive correlation was identified between the SFFQ and plasma concentration of DHA, EPA, and ALA, indicating that the higher the intake of DHA, EPA, and ALA was, the higher the plasma concentration was, except for total n-3 PUFA and AA. However, these correlations were not statistically significant.

Phase 2: Randomized trial. Three types of affordable optimised 7-day diet meal plans were developed on the basis of breastfeeding status. The optimised diet plan fulfilled energy and macronutrient intake requirements within the acceptable macronutrient distribution range. The omega-6/omega-3 fatty acid ratio in the children was between 4 and 10. Moreover, the

micronutrient intake level was within the range of the recommended daily allowance or estimated average recommendation and tolerable upper intake level.

Conclusion: Phase 1. The developed SFFQ is relatively valid and reliable for estimating PUFA intakes in Indonesian children aged 6–23 months. However, total n-3 PUFA, ALA, total n-6 PUFA, and LA were poorly estimated by this SFFQ. The application of the proposed SFFQ to other populations should be adopted and interpreted with caution, because this SFFQ was developed by including mothers or cares with a medium-high education level and because the SFFQ estimation was not consistent with the plasma phospholipid content for some essential fatty acids. Phase 2. Enhanced counseling provides benefit in improving knowledge of the caregivers, but its effect on nutritional status and omega-3 fatty acids level may need further investigation. Even though control group who get standard counseling also gained an improvement, the enhanced counseling with additional information on omega-3 FAs might provide benefit in addition to standard one to treat at-risk children. It was evidently proven on this study that intervention group had significant better knowledge improvement. In addition, this study suggests to provide population-specific menu recommendation rather than general menu to increase compliance.