

Behavioral Based Nutrition Education Intervention to Increase Fish Consumption among School Children Using Raised Bed Pool Media: Protocol for a Randomized Control Trial

Trias Mahmudiono^{1,2}, Triska Susila Nindya¹, Qonita Rachmah¹, Luh Ade Wiradnyani²

¹Departement of Nutrition–Faculty of Public Health, Universitas Airlangga, Jl. Mulyorejo Kampus C, Surabaya 60115, Indonesia, ²Departement of Nutrition–SEAMEO Regional Centre for Food and Nutrition, Universitas Indonesia, Jl. Salemba Raya No.6, Jakarta 10430, Indonesia

Abstract

Objective: The aim of the study is to analyze the effectiveness of behavioral based nutrition education to increase fish consumption among school children using raised bed pool media.

Method: This is a randomized control trial involving 104 elementary school children to increase their fish consumption. Children in the intervention group will be given six-sessions nutrition education intervention for 3 months with additional raised bed pool media for education. General Linear Modeling Repeated Measure will be used to assess difference in the increase of fish consumption.

Discussion: Raised bed pool will serve as visual reminder to the children that magnify the effect of nutrition education. The strength of the study is that evidence on the effectiveness of nutrition education intervention using raised bed pool was scarce relatively to the abundance body of knowledge related to raised bed garden. Raised bed pool is unique as it provide potential protein source from the fish in the RBP that are lacking from the raised bed garden. The intervention offers the advantage of potentially active ingredients to support behavioral change, such as improved knowledge, attitude, perceived behavioral control and intention.

Keywords: Nutrition education, fish consumption, school children, raised bed pool.

Introduction

Hidden hunger, a micronutrient deficiency such as iron, iodine, vitamin A, or calcium, is one of nutrition problem that still exist in developing country including Indonesia. Prevalence of anaemia in schoolchildren globally reached 37% in which found to be higher in Asian children than African⁽¹⁾. Based on the IFLS

survey, the prevalence of anaemia in children aged 5-12 years declined from 36.4% in 2000 to 20.6% in 2008⁽²⁾. The latest report on Basic Health Research 2013 shows that the prevalence of anaemia in children aged 5 - 14 years is 26.4% and count as public health problem⁽³⁾. A study in one primary school in Surabaya found the anaemia prevalence in schoolchild reached 13.2%⁽⁴⁾.

In the short term, anaemia in schoolchildren affects the level of learning concentration due to reduced oxygen supply to the brain causes lack of haemoglobin⁽⁵⁾. The results of the study in Makassar showed a positive relationship between the intakes of heme protein with the incidence of anaemia in school children. School children who only occasionally consume heme protein sources (2-3 times/week) are more at risk of anaemia than those who frequently consume (4-7 times/week)⁽⁶⁾. Studies conducted on children in Brazil also found that children

Corresponding Author:

Trias Mahmudiono

Departement of Nutrition–Faculty of Public Health,
Universitas Airlangga, Jl. Mulyorejo Kampus C,
Surabaya 60115, Indonesia

e-mail: trias-m@fkm.unair.ac.id

triasmahmudiono@gmail.com

with protein intake <28.8 g/day had an increased risk of anaemia than children with a protein intake >44.6 g/day⁽⁷⁾. Similar results were also demonstrated by a study in North Boolang Mongondow, Indonesia in which children who consumed protein less than RDI were more at risk of anaemia than children with protein intake more than RDI⁽⁸⁾.

Fish is one source of heme protein that has good iron absorption rate. Protein content in fish reaches 18% and consists of essential amino acids. According to the Indonesian Food Exchange List, one serving of fresh fish (50 g) contains 10 grams of protein. The Total Diet Study in 2014 reported the average consumption of fish and processed fish meat. In the children group (aged 5-12 years) was 70.7 grams per person per day, with the most percentage derived from marine fish as much as 37.9 grams per person per day or equivalent to 54% of the total consumption of fish then continued by the intake of freshwater fish that accounts for 38% of total fish consumption or about 26.9 grams per person per day⁽⁹⁾. The annual report of the Ministry of Marine Affairs and Fisheries shows that fish consumption per capita per year has increased from 2010 to 2014. In 2010, fish consumption was still 30.48 kg/capita/year and increase to 38.14 kg/capita/year in 2014 with the highest growth reaching 8.32% per year. Fish consumption in East Java in 2010 was only 19.01 kg/capita/year up to 27.89 kg/capita/year with 46% growth level in the last 4 years⁽⁷⁾. In 2019, fish consumption is targeted to reach 54.49 kg/capita/year⁽⁸⁾.

Surabaya is included as the second largest metropolitan city in Indonesia with approximately 2.8 million people⁽¹⁰⁾. Public health issues in metropolitan city such as anaemia require a comprehensive policy approach, although in developing countries, resource limitations are often becoming a constraint⁽¹¹⁾. However, given the magnitude of the impact of anaemia on the quality of Indonesian human resources, efforts should be made to overcome the problem with the improvement of intervention method. Nutrition education is one of the most cost-effective interventions and resulting a long-lasting impact⁽¹²⁾.

One of behaviour change theory that is widely used in nutrition education is *Theory of Planned Behaviour* (TPB)⁽¹³⁾. Behaviour is strongly influenced by intention, which is jointly influenced by attitudes, subjective norms, and perceived behavioural control. The youth garden program based on the Theory of

Planned Behaviour succeeded in improving the attitude in boys (p-value<0.001) and girls (p-value<0.001), and increased of perceived behaviour control in consuming vegetables and fruits in girls (p-value=0.014)⁽¹⁴⁾. Nutrition education interventions based on school gardens succeeded in increasing the desire and intention to try eating vegetables and fruits in children, increasing children's knowledge of the importance of eating vegetables and fruits, as well as improving children's attitudes and skills to increase vegetable and fruit consumption^(15,16) also fruit and vegetable asking behaviour at home⁽¹⁷⁾.

RBP media in nutrition education serve as instant reminder for schoolchildren is expected to increase school children intention to love eating fish. The RBP Project also targets variables to increase school children perceived behaviour control to eat fish with a weekly fishmeal program, fish-game cards, and catfish-based food menu making. School gardening and raised bed pool equally prioritize the concept of mastery experience for children to be actively involved in the management of gardening programs or cultivating freshwater fish. Compared to the raised bed garden, the raised bed pool program produces an animal food source of heme-iron protein that is relatively easily absorbed by the body than non-heme iron. School children characteristics are more interested in interacting with moving objects rather than stationary objects. We hypothesize that RBP have a higher appeal to actively involve the school children than the raised bed garden. Therefore this study aimed to evaluate the effectiveness of RBP as media of nutrition education to improve protein intake and prevent anaemia among school-children.

Method/Design

This research is a randomized control trial (RCT) with intervention in the form of nutrition education for 3 months to elementary school children 4th and 5th grade. Intervention in this study consists of a combination of 6 nutritional education sessions based on Theory of Planned Behavior by utilizing the raised bed pool in the school environment. The study will be using a parallel assignment with the two groups of samples experiencing different interventions during the same period of time.

Setting: The school was chosen purposively by considering the location of Sidotopo Subdistrict; the majority of the population is in the economic status of medium to low income. Selection of Sidotopo Wetan I

and II elementary school is based on easy accessibility, there is no raised bed pool, and there is no similar research before.

Sample Size: The sample size in this study was determined using formula of sample size for compare the mean of a continuous measurement in two samples, using a z-statistic to approximate the t-statistic with the effect size calculated from the results of McAleese, et al.⁽¹⁸⁾ on increased consumption of vegetables per serving in nutritional education interventions based on school gardening (n=45, SD=1.7, ES=1.2) compared with control group. By using 80% power and alpha of 0.05, the minimum samples obtained without cluster correction were 32 subjects for each group. Then, taking into account the design effect $1 + (p(m+1))$ using cluster size 30 and Inter-cluster Correlation Coefficient (ICC)=0.043 based on manual diabetic research⁽¹⁹⁾, the minimum sample required was 46 primary school children in each group with the consideration of 10% drop out, the sample in this study was 52 school children in each group. Based on preliminary survey conducted in both elementary schools, the total number of grade 4 and 5 students recorded is 900 children (research population). A screening then performed based on several criteria and 400 eligible subjects were retrieved. Assuming 10% of refusal to follow the study, then 104 children were eligible and willing to become research subject.

Inclusion and exclusion criteria: Inclusion criteria required participants to be aged 10-12 years, not allergic to fish, and not on a special diet. While the dropout criteria are the subject missing out from >50% or more than 3 times intervention sessions. The subjects were chosen because of the good literacy in 4th and 5th grade of elementary school at baseline.

Intervention: The RBP will be built at the school environment upon permission from the principal. Each consented participant in the intervention group will be given six sets of educational materials in the form of comic, recipe book, and info graphic. The comic describes benefit of catfish in increasing student's concentration during school hours. In addition, stationeries worth USD \$1 or about IDR 15,000 provided each participant after consenting to involve the whole study. Six education sessions for RBP group will be given once every two weeks for three months. During the nutrition education sessions, hands-on activities will be provided to help children improve their self-efficacy

toward fish consumption. The comparison group will not receive any nutrition education or exposure to raised bed pool in their school environment.

Outcome: Primary outcome is measured at the beginning and at the end of the study or after three months' education. The primary outcome is the change in fish consumption (gram/day). Fish consumption will be measured using food diary record. A total of three-days food diary records will be collected in a week. Dietary data will be analyzed using food processor software drawing from a database of Indonesian Food updated yearly by the Department of Nutrition, Universitas Airlangga – Indonesia. Secondary outcomes for the study are: anthropometric and body composition data, parent's characteristics, child's nutrition knowledge, and psychological variables.

Anthropometric and body composition data: Data will be collected including age, weight, and height of the children. Weight is going to be measured using Omron HBP-317 digital scale with 0.01 kg correction and will be measured in light clothing without shoes. Height is going to be measured to the nearest 0.1 cm using a stadiometer (SECA 213). Both weight and height is going to be measured twice to ensure the result's validity. Another measurement to assess the nutritional status of the children is body composition including body fat and body muscle percentage, as well as resting metabolic rate. These indicators are going to be measured using Omron HBF-317 that validated with SECA digital weight scale.

Characteristics: A general questionnaire is developed to obtain parent's characteristic data that includes parent's educational background, employment, and number of family member, literacy level, family income, and food expense. Child's nutrition knowledge is measured using previously validated questionnaire. The questionnaire consists of three parts; the first part focus on the nutrition and health knowledge with total of six questions and the second part focus on household serving size to measure how well children know about the portion, and the last part consist of questions related to MyPlate Indonesia.

Psychological data: All of the psychological data questionnaires were developed as Likert scale answers based on Bandura's guide for constructing attitude, subjective norm, perceived behavioral control, behavior, and intention scales. Children attitude to consume fish

as the source of animal protein will be measured using a three items questionnaire. Perceived behavioral control, behavior and intention to consume fish are going to be measured using three questions.

Statistical analysis plan: To analyze the difference in outcomes of control and intervention groups, a paired t-test will be used for normally distributed data and Kruskal Wallis test will be employed to data that is not normally distributed. In order to have more robust conclusion, the results will be adjusted for possible confounders such as school children characteristics, SES and household characteristics using General Linear Modeling Repeated Measure (GLM-RM). All data analyzes were performed at IBM SPSS Statistics 22.

Discussion

This study will compare the effectiveness of six-session nutrition education intervention using RBP with control receiving only printed educational materials about the benefit of fish consumption. The study setting is in low to middle income elementary school in Surabaya City, Indonesia. It is hypothesized that participants in the intervention group (RBP) will benefit from the six sessions nutrition education developed based on the theory of planned behavior. The raised bed pool will be served as visual reminder to the children that believed will magnify the effect of the 6 sessions of behaviorally oriented nutrition education.

One of the strengths of the study is that evidence on the effectiveness of nutrition education intervention using raised bed pool was scarce relatively to the abundance of knowledge related to raised bed garden. Raised bed pool is unique as it provides potential protein source from the fish in the RBP that are lacking from the raised bed garden. Both elementary schools involved in this study were drawn from public schools located in the low to middle income population. Generalization of the results of the intervention could be limited due to the present setting of the sample.

The intervention offers the advantage of potentially active ingredients to support behavioral change, such as improved knowledge, attitude, perceived behavioral control and intention. We will employ 2 times anthropometric measurement of the elementary school children during recruitment to reduce measurement bias. Selection bias will be reduced by random allocation of consented participants. Due to the nature of the intervention, blinding participants as well as nutrition

educators and research assistants delivering the intervention are not possible. In order to limit potential bias, all measurements were performed through standardized protocol, and all enumerators were trained prior to data collection.

Declarations

Competing interests: We have no conflict of interest to report for this study.

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Ethical Clearance: Ethics approval for this study was received from the Institutional Review Board (IRB) at Faculty of Public Health Universitas Airlangga. This study was given Universal Trial Number (UTN=U1111-1199-992) and was registered in the Thai Clinical Trials Registry (TCTR20171207002).

References

1. De Benoist B, Mclean E. Worldwide Prevalence of Anemia 1993-2005 WHO Global Database on Anemia [Internet]. Geneva: 2008 [cited 2019 Jun 19]. Available from: https://apps.who.int/iris/bitstream/handle/10665/43894/9789241596657_eng.pdf?ua=1
2. Barkley JS, Kendrick KL, Codling K, Muslimatun S, Pachón H. Anaemia Prevalence over Time in Indonesia: Estimates from the 1997, 2000, and 2008 Indonesia Family Life Surveys. Asia Pac J Clin Nutr [Internet] 2015 [cited 2019 Jun 19];24(3):452-5. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/26420186>
3. Riskesdas. Ris et Kesehatan Dasar (RISKESDAS) 2013. Lap Nas 2013 2013;1-384.
4. Hermawati MU. HUBUNGAN TINGKAT KONSUMSI ENERGI DAN PROTEIN DENGAN STATUS ANEMIA PADA ANAK USIA SEKOLAH DASAR: Studi Pada Anak Usia Sekolah Dasar di SDN Pegirian II, Surabaya. 2008 [cited 2019 Jun 19]; Available from: <http://repository.unair.ac.id/23515/>
5. Resti I. PENGGUNAAN SMARTPHONE DIKALANGAN MAHASISWA FAKULTAS

- ILMU SOSIAL DAN ILMU POLITIK UNIVERSITAS RIAU. J Online Mhs Bid Ilmu Sos dan Ilmu Polit [Internet] 2015 [cited 2018 Oct 18];2(1):1–15. Available from: <https://jom.unri.ac.id/index.php/JOMFSIP/article/view/4840>
6. Sirajuddin S, Masni M. Kejadian Anemia pada Siswa Sekolah Dasar. *Kesmas Natl Public Heal J* [Internet] 2015 [cited 2019 Jun 21];9(3):264. Available from: <http://journal.fkm.ui.ac.id/kesmas/article/view/574>
7. Ditjen PDSPKP (Direktorat Jenderal Penguatan Daya Saing Produk Kelautan dan Perikanan Kementerian Kelautan dan Perikanan). *Konsumsi Ikan 2010-2015* [Internet]. Jakarta: 2015 [cited 2019 Jun 21]. Available from: <https://kkp.go.id/artikel/944-direktur-jenderal-penguatan-daya-saing-produk-kelautan-dan-perikanan>
8. Depkes RI. *Ikan untuk ketahanan pangan dan gizi* [Internet]. Jakarta: 2017 [cited 2019 Jun 21]. Available from: <http://gizi.depkes.go.id/wp-content/uploads/2015/02/IKAN-UNTUK-KETAHANAN-PANGAN-DAN-GIZI-NASIONAL-Bag-II.pdf>
9. Balitbangkes. *Survei Konsumsi Makanan Individu Dalam Studi Diet Total Provinsi DKI Jakarta*. 2015.
10. Badan Pusat Statistik Kota Surabaya. *Surabaya Dalam Angka 2014*. Surabaya: 2015.
11. Popkin BM. The nutrition transition in low-income countries: an emerging crisis. *Nutr Rev* [Internet] 1994 [cited 2018 Mar 7];52(9):285–98. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/7984344>
12. Contento IR. Nutrition education: linking research, theory, and practice. *Asia Pac J Clin Nutr* [Internet] 2008 [cited 2018 Oct 18];17 Suppl 1:176–9. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/18296331>
13. Ajzen I, Fishbein M. *The Influence of Attitudes on Behavior* [Internet]. In: *Attitudes, Personality, and Behavior*. Berkshire: McGraw Hill; 1980 [cited 2018 Oct 18]. page 191. Available from: <https://pdfs.semanticscholar.org/2779/def3b6e5ff2a03baa06f9b70c42cfe70d95b.pdf>
14. Lautenschlager L, Smith C. Understanding gardening and dietary habits among youth garden program participants using the Theory of Planned Behavior. *Appetite* [Internet] 2007 [cited 2019 Jun 21];49(1):122–30. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17336424>
15. Morris JL, Zidenberg-Cherr S. Garden-enhanced nutrition curriculum improves fourth-grade school children's knowledge of nutrition and preferences for some vegetables. *J Am Diet Assoc* [Internet] 2002 [cited 2019 Jun 21];102(1):91–3. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0002822302900271>
16. Hutchinson J, Christian MS, Evans CEL, Nykjaer C, Hancock N, Cade JE. Evaluation of the impact of school gardening interventions on children's knowledge of and attitudes towards fruit and vegetables. A cluster randomised controlled trial. *Appetite* [Internet] 2015 [cited 2019 Jun 21];91:405–14. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25937511>
17. Heim S, Stang J. A Garden Pilot Project Enhances Fruit and Vegetable Consumption among Children. *YJADA* [Internet] 2009 [cited 2019 Jun 21];109:1220–6. Available from: <http://healthinfo.montana.edu/health-wellness/Gardenpilot.pdf>
18. McAleese JD, Rankin LL. Garden-Based Nutrition Education Affects Fruit and Vegetable Consumption in Sixth-Grade Adolescents. *J Am Diet Assoc* [Internet] 2007 [cited 2019 Jun 20];107(4):662–5. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/17383272>
19. Littenberg B, MacLean CD. Intra-cluster correlation coefficients in adults with diabetes in primary care practices: the Vermont Diabetes Information System field survey. *BMC Med Researh Methodology* 2006;6.