Content of Essential Fatty Acids in Polymeric Formula for Stunting Prevention

Hendrayati[1*], Adriyani Adam[2], Laras Budyghifary[3]

[1,2] Nutrition Department, Health Polytechnic of Makassar, Indonesia
[2] Faculty of Agricultural Technology, Hasanuddin University Makassar Indonesia
*Email: hendrayati@poltekkes-mks.ac.id

ABSTRACT

The problem of stunting in children is of particular concern in Indonesia. In 2024 the target prevalence was 14%. In 2021 the prevalence will reach 27.9%. Fulfillment of essential fatty acids in children is still low, even though these fatty acids have the potential to prevent stunting because of their role as nutrients in helping cell formation. The Purpose of this study was to assess the content of essential fatty acids in the form of omega-3, omega-6, DHA and EFA in polymeric formulas composed of local Indonesian foods. The research method was pre-experimental with post-test group design. The polymeric formula was made from various flours such as 20% brown rice, 20% black rice, 20% green beans, 5% carrots, 15% pumpkin, 5% fresh anchovies, 10% cornstarch, 5% refined sugar and various full cream milks 0%,10%,20% and 30%. Formulation was made in the food technology laboratory, Department of Nutrition, Health Polytechnic of Makassar and determination of fatty acid content was carried out at Sig. Laboratory Bogor, method code omega-6 (18-6-1/MU/SMM-SIG (GC)) DHA (18-6-1/MU/SMM-SIG (GC)), Omega (18-6-1/ MU/SMM-SIG (GC) and EPA (18-6-1/MU/SMM-SIG (GC). The results showed that the highest content of essential fatty acids was found in formula 1 for every 100 g of the formula containing omega-6 = 749.35 mg, omega-3 = 203.86 mg, DHA = 15.5 mg and EPA = 14.3 mg. The conclusion of this study shows that the essential fatty acid content of local food ingredients is very good, when referring to the DHANH & MRC recommendation that the fulfillment of omega-3 essential fatty acids in children aged 1-3 years of 40 mg, will meet the needs of DHA and EPA adequately. this means that formula 1 is sufficient if consumed as much as 25 g/day.

Keywords: *DHA, EPA, polymeric formula, Omega-3, Omega-6*

INTRODUCTION

Essential fatty acids are fatty acids that cannot be synthesized by the body and have very good roles such as for the normal growth and function of all tissues. Essential fatty acids have the potential to prevent nutritional problems including stunting. Substances essential fatty acids are alpha linoleic acid (omega 6) and alpha linolenic acid (omega 3). Fatty acid derivatives derived from essential fatty acids are arachidonic acid from EPA (eicosapentaenoic) linoleic acid and DHA (docosahexaenoic acid) from linolenic acid (Jasani, 2017).

Essential fatty acids are precursors of hormone-like eicosanoids, prostaglandins, prostacyclins, thromboxanes, and leukotrienes. These compounds regulate blood pressure, heart rate, immune function, nervous system stimulation, muscle contraction and wound healing. Essential fatty acids potential of in the role of growth, essential fatty acids can be used for the prevention of stunting in children. Essential fatty acids cannot be produced by the body so they must be provided from the food consumed daily (Ricardo, 2009). Fulfillment of essential fatty acids in children can be given in the form of daily food, for example in the form of main meals or snacks from local food ingredients that are spread in every region in Indonesia. The intake of essential fatty acids in Indonesian children is still low, so it is necessary to have a form of food with a small volume but high in essential fatty acids, for example in the form of a polymeric formula.

Polymeric formulas are formulas containing macronutrients such as carbohydrates, proteins and fats that are still intact or unbroken. Polymeric formulas can also be used as high energy density foods. Polymeric formulas can be composed of various local food ingredients that can enrich the nutrients they contain. The advantage of polymeric formulas lies in their ease of digestion because they are made from materials that have changed their basic structure, for example in the form of flour.

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METHOD

Type of research is pre-experimental with a one-shot case study design. The research consisted of 2 stages. Stage 1, Making the Polymeric Formula Formulation, Stage 2, Analysis of the essential amino acid content in the polymeric formula which omega-3, omega-6, DHA and EPA.

Phase 1 research was conducted for 2 months (April-May 2021) at the Food Technology Laboratory, Department of Nutrition, Poltekkes, Ministry of Health, Makassar and phase 2 research was carried out for 1 month, namely analyzing the essential amino acid content in polymeric formulas which include omega-3, omega-6, DHA. and EPA. on four formulations of polymeric formulas carried out at GIS Laboratory Bogor.

Table 1. Polymeric Formulation and Code of Essential Fatty Acid Analysis

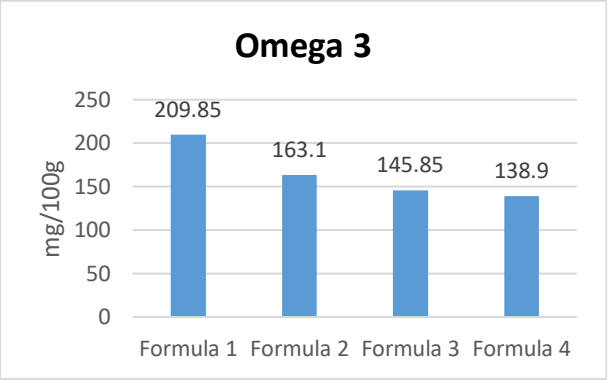
Ingredients	Treatment	Formulation			
		Formula 1	Formula 2	Formula 3	Formula 4
Red rice flour	**Temperature : 60 ° C Time : 10 hours Yield : 81 %**	**20 %**	**20 %**	**20 %**	**20 %**
Black rice flour	**Temperature: 60 ° C Time : 6 hours Yield : 80%**	**20 %**	**20 %**	**20 %**	**20 %**
Green bean flour	**Temperature: 60 ° C Time : 8 hours Yield : 80%**	**20 %**	**20 %**	**20 %**	**20 %**
Fresh anchovy flour	**Temperature : 60 ° C Time : 12 hours Yield : 18%**	**5 %**	**5 %**	**5 %**	**5 %**
Carrot flour	**Temperature : 60 ° C Time : 10 hours Yield:7.8%**	**5 %**	**5 %**	**5 %**	**5 %**
Pumpkin flour	**Temperature : 60 ° C Time : 11 hours Yield: 11.12**	**15 %**	**15 %**	**15 %**	**15 %**
Corn starch	**Temperature : 15 ° C Time : 1 hours Yield : 92%**	**10 %**	**10 %**	**10 %**	**10 %**
Sugar	**Temperature : 0 Time : 0 Yield : 100 %**	**5 %**	**5 %**	**5 %**	**5 %**
Full cream milk	**Temperature : 0 Time : 0 Yield : 100 %**		**10 %**	**20 %**	**30 %**
Omega-6 analysis		18-1/MU/SMM-SIG (GC)	18-1/MU/SMM-SIG (GC)	18-1/MU/SMM-SIG (GC)	18-1/MU/SMM-SIG (GC)
Omega-3 analysis		18-6-1/MU/SMM-SIG (GC)	18-6-1/MU/SMM-SIG (GC)	18-6-1/MU/SMM-SIG (GC)	18-6-1/MU/SMM-SIG (GC)
DHA analysis		18-6-1/MU/SMM-SIG (GC)	18-6-1/MU/SMM-SIG (GC)	18-6-1/MU/SMM-SIG (GC)	18-6-1/MU/SMM-SIG (GC)
EPA analysis		18-6-1/MU/SMM-SIG (GC).	18-6-1/MU/SMM-SIG (GC).	18-6-1/MU/SMM-SIG (GC).	18-6-1/MU/SMM-SIG (GC).

RESULTS AND DISCUSSION

RESULTS

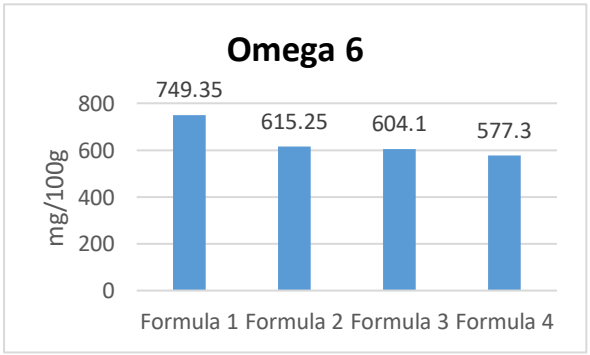
The polymeric formula in this study was composed of vegetable, animal, vegetable, sugar and full cream milk ingredients. The results of the analysis of the essential fatty acid content of the 4 (four) formulations can be seen in graphs 1,2 and 3.

Graph 1: Content of Omega 3 Fatty Acids in Polymeric Formula



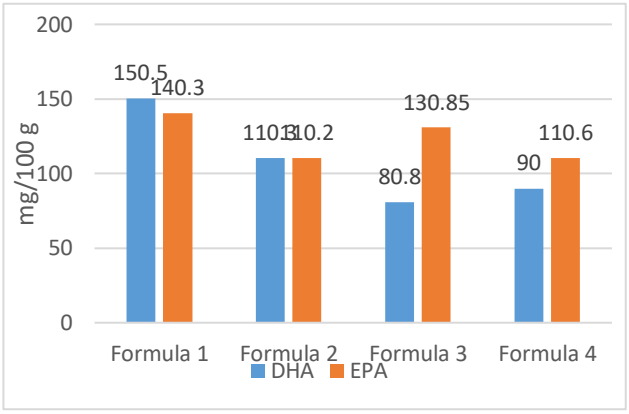
The content of omega 3 fatty acids in polymeric formulas when compared with the Regulation of the Minister of Health (PMK) RI No. 28 of 2019 concerning the Nutrition Adequacy Rate (RDA) which is recommended for the Indonesian people, that the need for omega 3 in children aged 1-3 years is 0.7 g and the age is 0.7 g. 4-6 years of 0.9 g. If formula 1 will be used, then to meet 0.9 g, it is enough to consume 43 g / day.

Graph 2: Content of Omega 6 Fatty Acids in Polymeric Formula



The highest content of omega 6 fatty acids is found in formula 1 of 749.35 mg/100 g. The 2019 RDA recommends the need for omega 6 fatty acids for children aged 1-3 years at 7 g. So if you use formula 1, this requirement will be fulfilled consume 100 g/day.

Graph 3: The content of DHA and EPA in the Polymeric Formula



The Food and Agriculture Organization of the United Nations (FAO) recommends that the DHA and EPA requirements for children aged 2-4 years are 100-150 mg/day. So polymeric formulas with various formulations can be used as sources of DHA and EPA.

DISCUSSION

Essential fatty acids are fatty acids that must be obtained from the daily diet because humans have limitations in synthesizing unsaturated fatty acids such as linolenic fatty acids (omega-3) and linoleic fatty acids (omega-6). These essential fatty acids do not include fatty acids that only function as an energy source but have many roles for health.

The essential fatty acid content of the polymeric formula is quite good as illustrated in graphs 1, 2 and 3. This study did not analyze derivatives of omega-6 such as dihomo-gamma linolenic acid (DGLA) and arachidonic acid

(AA), but analyzed the content and long-chain omega-3 fatty acids, such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). . The results of the analysis of the content of DHA and EPA in polymeric formulas are still low when compared to the needs for children, so modifications or additions of other ingredients are still needed.

The content of DHA and EPA in this polymeric formula is still low due to the use of fresh anchovy flour (stolephorus, SP) of 5%. The low composition of fish meal is caused by the presence of fish taste and a sharp fish aroma when added up to 10%. Panelists can accept if the addition is only 5%. The use of mackerel as a source of omega 3 has been carried out by Ibnu Malkan, et al, with the results showing that mackerel as a source of biological food can be used as an easy and cheap source of omega 3 for the community (Ibnu 2016). Indra's research, et al. Regarding the results of the analysis of the fatty acid content in various fish oils, it was revealed that some types of fish are rich in essential fatty acid content (Indra, 2014).

The content of Omega 6 in formula 1 has a high content compared to formulas 2,3 and 4. This is because the ingredients for this formula are mostly vegetable sources such as green beans and vegetables, namely carrots and pumpkin. Omega 6 fatty acids are fatty acids that are widely found in grains, nuts and vegetables, while omega 3 is sourced from fish (Ibnu, 2016).

The use of polymeric formulas as a source of essential fatty acids can be said to be potential in preventing stunting in toddlers. Omega-3 and omega-6 are important structural components of cell membranes. In phospholipids, essential fatty acids will affect the properties of cell membranes, such as fluidity, flexibility, permeability, and membrane-bound enzyme activity so that cells will become healthy and can support child growth well (Ricardo, 2009).

Essential fatty acids can also synthesize other lipid mediators, eicosanoids, which have important roles in immune and inflammatory responses. In addition there are isoprostanes as markers of oxidative stress, isoprostanes can also function as inflammatory mediators, exerting pro and anti-inflammatory effects. In cases of malnutrition such as stunting, it is basically caused by low intake and the presence of infection in children. If the child has sufficient intake of essential fatty acids, the incidence of infection can be reduced. (Jasani 2017).

Omega-3 and omega-6 essential fatty acids can modulate the expression of genes, fatty acids involved with fatty acid metabolism and inflammation. Omega-6 and omega-3 fatty acids regulate gene expression by interacting with certain transcription factors, such as peroxisome proliferator-activated receptors (PPARs), this is evidence that essential fatty acids can prevent infection (Ricardo, 2016).

Eicosapentaenoic Acid (EPA) and Docosahexaenoic Acid (DHA) are nutrients that are known to help brain development so as to stimulate children's intelligence. DHA needs can be met from breast milk. When the child is not getting breast milk, the level of DHA in his body begins to decrease. DHA also helps the development of motor skills and visual acuity and helps in fat metabolism in children, so that foods rich in DHA are needed by children during their growth period. (Youjin, 2019).

The need for essential fatty acids such as omega 3 for children aged 1-3 years is 0.7 g/day and omega 6 is 7 g./day. At the age of 4-6 the need increases to 0.9 g/day for omega 3 and 10 g/day for omega 6. Fulfillment of essential fatty acid intake in Indonesian children is currently still low, so efforts are needed to provide food

or foods that are rich in essential fatty acids and can be accepted by children (PMK, 2019).

CONCLUSION

1. The polymeric formula composed of local food ingredients contains essential fatty acids that are quite good and can be used as a source of essential fatty acids because they can meet concerning RDA 2019 and FAO recommendations.
2. The content of omega 3, omega 6, DHA and EPA fatty acids varies in each polymeric formula formulation, so that in its use it can be selected according to the essential fatty acids needed.
3. The use of polymeric formulas for stunting prevention is very potential considering the role of essential fatty acids in the growth and development of children is very important.

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