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Nutrigenomic Engineering in Children Under Five With Infectious Diseases After the Covid-19 Pandemic

Ignatius Hapsoro Wirandoko, Catur Setiya Sulistiyana
Universitas Swadaya Gunung Jati, Indonesia
Email: ignatiushapsorowirandoko@gmail.com, Catursetiya71@gmail.com

Abstract

It is estimated that about 3 million children worldwide each year exhibit xerophthalmia, i.e. they are clinically deficient in vitamin A and are at risk of blindness. In addition, about 250 million more children under five are estimated to have sub-clinical vitamin A deficiency and are at risk of severe morbidity and premature death. Zinc is a vital element for the synthesis of DNA and RNA. This mineral is needed in the formation of eye tissue so that it can remain seeing in the dark, the formation of white blood cells in the immune system, gastric function, skin health, growth and function of the reproductive system, fetal growth and the central nervous system. Zinc also helps in the activity of immune function. The purpose of this study is to determine nutrigenomic intake (Vit A, Zinc, Fe iron) in toddlers with infectious diseases during the pandemic. Research Method using Pre n post test Research Design. One month before the intervention, blood sampling levels of Vitamin A, Zinc, and Iron (Fe) were asked about infectious diseases. (How many times in the last 1 month). One month after the intervention, blood samples were taken again, levels of Vitamin A, Zinc, and Iron (Fe) were asked again infectious diseases. The results of the analysis showed that vitamin A intake was low compared to the RDA of 4.39 (CI 1.62-4.89) times in children whose parents had low socioeconomic status, while according to age 1.01 (CI 0.98-1.18) times. While iron intake is lower than the RDA of 2.52 (CI_), according to age 1.07 (CI 1.01-1.14). Zinc intake was lower than the RDA of 91.6 (CI 0.11-756.3). Food intake of zinc, iron and vitamin A for children 24-60 months in Indonesia is still unable to meet the needs and is far below the Daily Value (RDA).

keywords: nutigenomik, vitamin A, Zink, Fe, Infeksi.

INTRODUCTION

The era of genetic nutrition was marked by the start of human genome mapping research (*Human Genome Project*) in 1998 (Wardani et al., 2017). Nutrigenomics in humans began to be widely carried out so it gave birth to a new area of study, namely Nutrigenomics and Nutrigenetics (Essers, 2013). Rapid advances in gene mapping will change scientists' systems of thinking and approaches to nutritional status and public health as well as disease prevention and therapy (Saidin et al., 1998) (National Academies of Sciences and Medicine, 2018).

In this era there is also a rapid progress in the application of genetic engineering in the field of food production *(Genetically Modified Food*) and nutritional genetic selection (Vitamin A, Iron

(Fe), Zinc and other minerals) to develop food through food biofortification and the surge in progress of digital and cellular communication science and technology (Frewer et al., 2004).

Nutrigenomics studies the relationship or effect of dietary variations, micronutrients, or bioactive components of food with gene expression (Fanardy, 2020). Nutrigenetics studies the relationship or effect of gene expression with dietary response, micronutrients, bioactive components of food, and body health conditions.

Unlike the relatively stable human genome, nutrigenomic aspects in humans are not permanent or reversible plasticity and interactions between nutrition and DNA to modify gene expression. An interesting example in the world of bees, is that bee larvae are genetically similar, but only larvae fed royal jelly will develop into Queen Bees, while other bees become worker bees (Kucharski et al., 2008). Knowledge of nutrigenomics allows us to explain why certain nutrient responses are not the same in every child.

Vitamin A deficiency is a real public health problem in more than 70 countries (Chakravarty, 2000) including Southeast Asia (Combs Jr & Gray, 1998). In 1995, it was estimated that about 3 million children worldwide each year exhibited *xerophthalmia*, i.e. they were clinically deficient in vitamin A and were at risk of blindness. In addition, approximately 250 million more children under five are estimated to have sub-clinical vitamin A deficiency and are at risk of severe morbidity and premature death (Howson *et el.,* 1998). Depending on the criteria used, the number of people with vitamin A deficiency in the world can reach more than 500 million (Kelly & West, 1998) (Angeles-Agdeppa et al., 2019).

Zinc is a vital element for the synthesis of DNA and RNA. This mineral is needed in the formation of eye tissue so that it can remain seeing in the dark, the formation of white blood cells in the immune system, gastric function, skin health, growth and function of the reproductive system, fetal growth and the central nervous system. Zinc also helps in the activity of immune function (Gibson et al., 2008; Widiyanto et al., 2022).

There are several causes of anemia, namely infection, vitamin A deficiency, helminthic infestation, and hemoglobinopathy. It also explains that not all who are iron deficient suffer from anemia. This mistaken assumption is the main cause of the failure of UNICEF-funded health projects to reduce anemia. Although iron supplementation and fortification are the most effective strategies, it is also necessary to take into account the complexity of these issues in order to succeed an intervention.

METHODS

One month before the intervention, blood sampling levels of Vitamin A, Zinc, and Iron (Fe) were asked about infectious diseases. (How many times in the last 1 month). One month after intervention Blood samples were taken again levels of Vitamin A, Zinc, and Iron (Fe) asked again infectious diseases. Research Variables tied to infectious diseases in toddlers. Free variables of Nutrigenomic Intake in the form of Vitamin A, mineral Zinc and iron (Fe).

Measure levels of nutrigenomic intake of vitamin A, minerals Zinc and iron (Fe) in the blood. Measuring infectious diseases in toddlers. There are 20 children under five children in the Puskesmas in the city of Cirebon.

RESULTS AND DISCUSSION

Overview of children aged 2-5 years

An overview of children aged 2-5 years can be seen in the Table. A. Gender data with equal proportions between boys and girls. The socioeconomic situation of families in the village is 10.4 percent classified as very low economic conditions and only 27.4 percent of economic conditions are very high.

Vitamin A (µg) intakes averaged 303±11 and iron intakes averaged 5.74±0.3 mg, while zinc intakes averaged 3.8±0. When compared with the Daily Value (RDA), the average intake of vitamin A, iron and zinc does not meet the RDA of 75.7±2.9 percent, 75.0±4.3 percent and 47.4±1.8 percent.

The Height/Age Indicator (TB/U) of many children with stunting is 15.9 percent, while children with obese weight/height indicator (BB/TB) is 1 percent.

The description of the health condition of the study sample found that more than half of the samples suffered from Acute Respiratory Infection (ARI) 60.4 percent and diarrhea 21.3 percent diarrhea.

Factors associated with lowrisk intake of iron, vitamin A and zinc according to RDA in children

Many factors are associated with lowrisk intake of iron, vitamin A and zinc including socioeconomic status, place of residence, age. Table. B is the result of *multiple logistic regression analysis* between factors related to the risk of intake of vitamin A, iron and zinc compared to the RDA of children aged 24-60 months. The results of the analysis showed that vitamin A intake was low compared to the RDA of 4.39 (CI 1.62-4.89) times in children whose parents had low socioeconomic status, while according to age 1.01 (CI 0.98-1.18) times. While iron intake is lower than the RDA of 2.52 (CI_), according to age 1.07 (CI 1.01-1.14). Zinc intake was lower than the RDA of 91.6 (CI 0.11-756.3).

Table. 1 Overview of children aged 2-5 years and socioeconomic

Overview of household sosek	Village
Socio-Economic RT	
Very low	10,4
Low	16,9
Intermediate	23,9

Overview of household sosek	**Village**
Tall	21,4
Highest	27,4
Gender	
Man	48,5
Woman	51,5
Child age (month)	
24 – 36	37,4
37 – 48	36,5
49 – 60	26,1
X $\pm$ SE	14.26 $\pm$ 0.51
Micronutrient Intake	
Vitamin A (µg)	303 $\pm$ 11
Iron (mg)	5.7 $\pm$ 0.3
Zinc (mg)	3.8 $\pm$ 0.2
Micronutrient intake	
Vitamin A (%DV)	75.7 $\pm$ 2.9
Iron (%DV)	75.0 $\pm$ 4.3
Zinc (%DV)	47.4 $\pm$ 1.8
Nutritional Indicators	
BB/Age WAZ (X $\pm$ SE)	-0.87 $\pm$ 0.08
BB/TB WHZ (X $\pm$ SE)	-0.55 $\pm$ 0.09
TB/U HAZ (X $\pm$ SE)	-0.93 $\pm$ 0.11
BMI/U BAZ (X $\pm$ SE)	-0.44 $\pm$ 0.09
Nutritional Status (WAZ) (percent)	
BB less weight	1,5
BB less	12,4
Good nutrition	84,2
More Nutrition	2,0
Nutritional Status (HAZ) (percent)	
Severe stunting	6,2
Stunting	15,9
Normal TB	77,9
Nutritional Status (WHZ) (percent)	
Very thin	1,0
Thin	9,7
Usual	85,2

Overview of household sosek	Village
Overweight	3,1
Obese	1,0
Nutritional Status (BAZ) (percent)	
Very thin	1,5
Thin	9,2
Usual	84,6
Overweight	3,1
Obese	1,5
Sick a month ago	
Acute respiratory tract infections	60,4
Diarrhea	21,3

Table 2 Factors Associated with Low Risk of Vitamin A, Iron and Zinc Intake Compared to Indonesian RDA in Children 24-60 Months

Variable	Label	VitaminA		Iron		Zink	
		Odd ratio	95% CI	Odd ratio	95% CI	Odd ratio	95% CI
Social status economics	Intermediate >	1,00		1,00	1,26 -5,06	1,00	
	Low <	4,39	1,62-4,89	2,52		91,6	0,11-756,3
Residence	Village	-	-	2,52	1,26-5,06	-	-
Age (months)	24-60	1,01	0,98-1,18	1,07	1,01-1,14	-	-

The results of research conducted by SEANUTS illustrate that more than half of the children who participated as samples had intakes below Indonesia's Daily Value (RDA). Currently, Indonesia is still experiencing double nutrition problems where the prevalence is high in stunting and underweight and the high prevalence of iron nutrition anemia in children under 2 years old3.

Stunting according to WHO is the lack of height growth according to age. This indicates a chronic state of malnutrition, and is the result of prolonged lack of food intake, lack of quality food, increased pain (frequent illness) or a combination of the two factors (Mann & Truswell, 2017).

Research conducted by Ker et al., (2012) states that diet alone prevalence for the fulfillment of nutrients is low except for calcium, magnesium, vitamins A and D (Truswell & Leach, 2023).

The results of the SEANUTS study on the diet of children aged 6-23 months provide an illustration that the consumption of meat, fish and poultry is rarely consumed even most do not or have never consumed (Mann & Truswell, 2017). This diet results in unfulfilled intake of iron, vitamin A and zinc so that the percent RDA is low.

CONCLUSION

Food intakes of zinc, iron and vitamin A for children 24-60 months in Indonesia still cannot meet the needs and are far below the Daily Value (RDA). Factors that consistently affect the fulfillment of micronutrient needs (iron, zinc, vitamin A) and low socioeconomic status.

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