



Original Research Article

Effectiveness of Giving Multivitamin to Biochemical Nutrition Status Malaria Child Patients in Sanggeng Health Center, Manokwari District

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ABSTRACT

Background: Children are the group age that gets affected from malaria which affects lymphocyte levels and decreases in hemoglobin as measured by the erythrocyte index.

Objective: To find out the effectiveness of multivitamins on the biochemical nutritional status of malaria sufferers in Sanggeng Health Center, Manokwari Regency.

Research Methods: The experiment with two group case control. The population was 61 children with malaria and a sample of 15 children in the case group (giving vitamin B complex and vitamin C) and a control group that was not treated. Data were obtained using a questionnaire for respondents' identities and laboratory tests using hematology analyzer Sysmex 300 to determine lymphocytes, MCV levels, MCH and MCHC.

Results: Respondents with malaria in children aged 6-9 years as many as 15 people (50%) and at the age of 10-12 years as many as 15 people (50%). Male sex as many as 16 people (53.3%) and women as many as 14 people (46.7%). There were no differences in lymphocyte levels before and after administration of vitamin B complex and Vitamin C in children with malaria sufferers in Sanggeng Community Health Center, Manokwari Regency (p-value = 0.318) with differences in average lymphocyte levels of -0.6133. There were differences in MCV levels before and after administration of vitamin B complex and Vitamin C in children with malaria sufferers in Sanggeng Health Center, Manokwari Regency (p-value = 0.044) with an average value in the jerseys and controls group of -2.27000. There were differences in MCH levels before and after administration of vitamin B complex and vitamin C in children with malaria sufferers in Sanggeng Health Center, Manokwari Regency (p-value = 0,000) with an average value in the case group of -2.12000. There are differences in MCH levels before and after administration of vitamin B complex and vitamin C in children with malaria sufferers in Sanggeng Community Health Center, Manokwari Regency (p-value = 0.001) with an average value in the case and control groups of -1.06333.

Keywords: Multivitamin, Malaria, Child

1. INTRODUCTION

Malaria is a global health problem which is still a concern for governments and world health agencies with a high prevalence rate in 106 tropical and subtropical countries. The estimated incidence of malaria in 2017 ranges from 227 - 670 million cases, with the number of

deaths from malaria reaching 4.3 million cases per year and affecting the quality of health for infants, toddlers and pregnant women (WHO, 2017). Malaria cases in Indonesia until 2016 there were 374 malaria-endemic districts / cities including Papua, NTT, Maluku and North Maluku. Nationally, malaria incidence in 2014 was

256,592 cases with annual parasitic incidence (API) of 1.94, in 2015 as many as 417,819 cases with API amounting to 1.69 and in 2016 as many as 343,527 with APIs of 1.38. This shows that nationally from 2014 to 2016, API fell 0.56% (Indonesian Ministry of Health, 2016). The incidence of malaria in West Papua Province in 2014 was 141,670 with API 64, 2015 as many as 168,530 (API = 58), 2016 as many as 241,450 (API = 77). The malaria incidence in Manokwari Regency in 2014 Annual Malaria Incidence (AMI) was 18.6 per 1000 and API 84.6, 2015 AMI was 27.9 per 1000 and API = 12.7 and in 2016 AMI was 26 per 1000 and API = 10.3. This shows an increase in the incidence of malaria in West Papua Province and Manokwari Regency. Tropical malaria is a parasitic infectious disease caused by *Plasmodium falciparum* which attacks young erythrocytes and is only characterized by the discovery of asexual forms in red blood caused by *Plasmodium falciparum* protozoa which are transmitted to humans through mosquito saliva (Sucipto, 2015).

Plasmodium infection causes an increase in lymphocytes due to the presence of lymphocyte cells played by helper 1 T cells that are specific to *Plasmodium* antigens which overproduce and changes in hematological status include the erythrocyte index (changes in hemoglobin level), thrombocytopenia and leukopenia to leukocytosis which causes lymphocyte changes due to the process hemolysis by malaria parasites (Van, 2013).

The research conducted by Mau (2017) in positive patients with *Plasmodium falciparum* found 84% increased lymphocyte cells from reference values. The average number of *P. falciparum* 39.7200 lymphocytes with statistical test results showed that there was a significant difference between the numbers of lymphocytes in *P. falciparum*. Whereas Muslim research (2015) found changes in hemoglobin levels in tropical malaria patients between 7-14 g / dL with an average of 8.96 g / dL due to a decrease in

hemoglobin levels affecting the erythrocyte index value. Research conducted by Sofiyetti (2016) reveals that administration of zinc supplementation with zinc and vitamin B12 can increase hemoglobin levels and erythrocyte index in malaria vivax. Research conducted by Fitri (2013), that the administration of vitamin C can reduce high lymphocyte levels to normal on the third and seventh day and Mizoc (2011) study of giving vitamin B contributed to lymphocyte proliferation, lymphoid tissue formation and in the antibody response.

The Malaria incident in Manokwari district from the Manokwari District Health Office report data amounted to 4,127 with API values of 22.17 (Manokwari District Health Office, 2018). The incidence of malaria in Sanggeng Manokwari Community Health Center in 2018 had malaria cases with 1,717 cases, tropical malaria with 115 cases and malaria mix in 3 cases. In January 2019, there were 61 cases of malignant malaria, 11 cases of tropical malaria and 1 case of malaria mix.

Sanggeng Health Center was used as a place for sampling and research, because there were many malaria sufferers with hemoglobin results below the normal range. In addition there are many cases of tropical malaria in the Sanggeng Health Center using an examination of the number of lymphocytes and erythrocyte indices using automatic tools using the Hematology Analyzer (Sysmex XP 300). Sanggeng Health Center is a health center located in the center of Manokwari and covers a wide area. The treatment process for Malaria sufferers in the puskesmas is a dilemma because there are two methods of treatment that are equally believed to produce good results. The first treatment to provide multivitamins in malaria patients and the second treatment does not provide multivitamins in malaria sufferers. Looking for the truth of the two methods of treatment for malaria sufferers, a research is needed to do a research entitled "Effectiveness of Multivitamins Giving against the Biochemical Nutritional Status of Malaria

Patients in Children in Sanggeng Health Center, Manokwari Regency".

2. MATERIALS AND METHODS

2.1 Type of Research

This type of research is quantitative with the true experimental pre-post test method in the treatment group and the control group to determine the effect of multivitamins (vitamin B Kompleks and C) on lymphocytes, MCV, MCH, and MCHC. (Sastroasmoro, 2010).

2.2. Research Location

The location of this study was conducted at the Sanggeng Health Center in the Manokwari District Health Office Working Area in West Papua and blood biochemical examination of samples was carried out at the Sanggeng Health Center Laboratory and the Diva Laboratory from 17 September - 4 February 2019

2.3 Population and Samples

a. Population

The populations in this study were all sufferers of children identified with Malaria on 20 September 2018 - 4 February 2019 as many as 73 people.

b. Samples

The samples in this study were 61 children diagnosed with tertian malaria. The

sampling technique in this study used random sampling, namely children aged 6-12 years and willing to become respondents. The parents of children who were willing to respond and participated in this study were 30 people divided into case groups (giving vitamin B complex and vitamin C) as many as 15 people and in the control group who were not given treatment or administration of vitamin B complex and vitamin C.

3. RESULTS

3.1 Univariate Analysis

a. Age and Sex

Table 1. Age, Sex in Malaria Sufferers in Sanggeng Health Center, Manokwari Regency

No	Variables	Number (n)	(%)
1	Age		
	6-9 year	15	50
	10-12 year	15	50
2	Sex		
	Male	16	53,3
	Female	14	46,7
Number		30	100

Table 1, shows that from 30 respondents at the age of 6-9 years as many as 15 people (50%) and at the age of 10-12 years as many as 15 people (50%). Respondents who were male were 16 people (53.3%) and women were 14 people (46.7%).

b. Lymphocytes

Table 2. Pre and Post Lymphocyte Levels of Vitamin B complex and Vitamin C administration in Malaria Sufferers in Sanggeng Health Center, Manokwari Regency

No	Lymphocyte	Pre				Post			
		Casus		Control		Casus		Control	
		N	%	n	%	n	%	n	%
1	Not normal	4	26,7	6	40	2	13,3	7	46,7
2	Normal	11	73,3	9	60	13	86,7	8	53,3
Number		15	100	15	100	15	100	15	100
Average		25,7%		24,8%		27,6%		24,1%	

Table 2 shows that lymphocyte levels before vitamin B complex and Vitamin C administration in the case group were 11 people (73.3%) in the normal category and after the administration of vitamin B complex and Vitamin C there was an increase of 13 people (86.7%) in the normal category. In the control group before giving vitamin B complex and Vitamin C as many as 9 people (60%) in the normal

category and after 2 weeks there was a decrease to as many as 8 people (53.3%) in the normal category. The mean value in the case group before treatment amounted to 25.7% of sebsar lymphocyte levels and 27.6% after treatment, whereas in the control group lymphocyte levels were 27.6% and after 2 weeks without treatment, 24.1%.

c. MCV Level

Table 3. Pre and Post MCV Levels of Vitamin B complex and Vitamin C administration in Malaria Sufferers in Sanggeng Health Center, Manokwari Regency

No	MCV level	Pre				Post			
		Causus		Control		Causus		Control	
		n	%	n	%	n	%	n	%
1	Normocytic	5	33,3	4	26,7	11	73,3	4	26,7
2	Microcytic	10	66,7	11	73,3	4	26,7	11	73,3
3	Macrocytic	0	0	0	0	0	0	0	0
Number		15	100	15	100	15	100	15	100
Average		77,4 fl		75,8 fl		82,1 fl		75,7 fl	

Tables 3, shows that MCV levels before administration of vitamin B complex and Vitamin C in the case group were 5 people (33.3%) in the normocytic category and after administration of vitamin B complex and Vitamin C there was an increase of 11 people (73.3%) in the normocytic category. In the control group before giving vitamin B complex and Vitamin C as many as 4 people

(26.7%) in the normocytic category and after 2 weeks there was no increase of 4 people (26.7%) in the normocytic category. The mean value of MCV levels in the cases before treatment was 77.4 fl and after treatment was 75.8 fl whereas in the control group it was 82.1 fl and after 2 weeks without treatment it was 75.7 fl.

d. MCH

Table 4. Levels of MCH Pre and Post administration of Vitamin B complex and Vitamin C in Malaria Sufferers in Sanggeng Health Center, Manokwari Regency

No	MCH level	Pre				Post			
		Causus		Control		Causus		Control	
		n	%	n	%	n	%	N	%
1	Normochromic	5	33,3	4	26,7	10	66,7	7	46,7
2	Hypochromic	10	66,7	11	73,3	5	33,3	8	53,3
Number		15	100	15	100	15	100	15	100
Average		25 pg		24,9 pg		28,3 pg		25,9 pg	

Table 4 shows that the levels of MCH before administration of vitamin B complex and Vitamin C in the case group were 5 people (33.3%) in the normochromic category and after the administration of vitamin B complex and Vitamin C there was an increase of 10 people (66.7%) in the normochromic category. In the control group before giving vitamin B complex and

Vitamin C as many as 4 people (26.7%) in the normochromic category and after 2 weeks there was an increase to as many as 7 people (46.7%) in the normochromic category. The mean value of MCH before treatment is 25 pg and after treatment is 24.9 pg. in the control group before 28.3 pg and after 2 weeks without treatment 25.9 pg.

e. MCHC

Table 5. Levels of MCHC Pre and Post administration of Vitamin B complex and Vitamin C in Malaria Sufferers in Sanggeng Health Center, Manokwari Regency

No	MCHC Level	Pre				Post			
		Causus		Control		Causus		Control	
		n	%	n	%	n	%	n	%
1	Normochromic	10	66,7	11	73,3	15	100	12	80
2	Hypochromic	5	33,3	4	26,7	0	0	3	20
Number		15	100	15	100	15	100	15	100
Average		31,8%		32,8%		33,8%		32,9%	

Table 4.4 shows that the levels of MCHC before administration of vitamin B complex and Vitamin C in the case group were 10 people (66.7%) in the normochromic category and after

administration of vitamin B complex and Vitamin C there was an increase of 15 people (100%) in normochromic category. In the control group before giving vitamin B complex and Vitamin C as many as 11

people (73.3%) in the normochromic category and after 2 weeks there was an increase of 12 people (80%) in the normochromic category. The mean value of the MCHC before treatment was 31, 8% and after treatment amounted to 32.8%. In the control group before 33.8% and after 2 weeks without treatment 32.9%.

3.2 Bivariate Analysis

Table 6. Difference between Giving Vitamin B Complex and Vitamin C to Lymphocyte, MCC, MCH and MCHC Levels at Sanggeng Health Center, Manokwari Regency

No	Variables	Mean	Std. Deviation	p-value
1	Lymphocyte Pre Post	-0,61333	3,30420	0,318
2	MCV Pre Post	-2,27000	5,90716	0,044
3	MCH Pre Post	-2,12000	2,59634	0,000
4	MCHC Pre Post	-1,06333	1,57315	0,001

Table 6, shows that before and after administration of vitamin B complex and vitamin C at lymphocyte levels with an average value of -0.6133 with a standard deviation value of 3.30420. The paired t test results obtained a significance value at the significance level of 95% $p\text{-value} = 0.318 > \alpha 0.05$ which means that there were no differences in lymphocyte levels before and after administration of vitamin B complex and Vitamin C in children with malaria in Sanggeng District Health Center Manokwari.

MCV levels before and after administration of vitamin B complex and vitamin C at an average value of -2.27000 with a standard deviation value of 5.90716. The paired t test results obtained a significance value at the significance level of 95% $p\text{-value} = 0.044 < 0.05$ which means that there were differences in MCV levels before and after administration of vitamin B complex and Vitamin C in children with malaria sufferers at Sanggeng Health Center, Manokwari Regency .

The levels of MCH before and after administration of vitamin B complex and vitamin C at an average value of -2.12000

with a standard deviation value of 2.59634. The paired t test results obtained a significance value at the significance level of 95% $p\text{-value} = 0,000 < 0,05$ which means that there were differences in MCH levels before and after vitamin B complex and vitamin C administration in children with malaria sufferers at Sanggeng Health Center, Manokwari Regency. Levels of MCHC before and after administration of vitamin B complex and vitamin C at an average value of -1.06333 with a standard deviation value of 1.57315. The paired t test results obtained a significance value at the significance level of 95% $p\text{-value} = 0.001 < 0.05$ which means that there are differences in the levels of MCH before and after administration of vitamin B complex and vitamin C in children with malaria in Sanggeng Health Center, Manokwari Regency .

4. DISCUSSION

Malaria is one of the public health problems because it affects high rates of morbidity and mortality. High risk groups who are prone to malaria infection are toddlers, children, pregnant women and nursing mothers. Other high risk groups are residents who visit malaria endemic areas such as refugees, transmigrants and tourists (Harijanto, 2012).

Malaria can cause blood deficiency because many destroyed blood cells are damaged or eaten by plasmodium. Malaria also causes splenomegaly, which is an enlarged spleen which is a symptom of a typical malaria clinic. Anemia occurs mainly due to the rupture of infected red blood cells, plasmodium falciparum infects all stages of red blood cells until a decrease in hemoglobin levels below normal can occur in acute and chronic infections. Anemia is a state of decreased hemoglobin levels, hematocrit and rupture of red blood cells below the normal value added for individuals (MOH, 2007). Experiments carried out on 30 respondents in children who were divided into case groups and controls by giving a multivitamin, namely

the administration of vitamin B complex and vitamin C are described as follows:

4.1. Provision of multivitamins (vitamin B complex and vitamin C) in the age of malaria sufferers in children

The results showed that of 30 respondents at the age of 6-9 years as many as 15 people (50%) and at the age of 10-12 years as many as 15 people (50%). In children who are given vitamin B complex and vitamin C occurs changes in lymphocyte, MCC, MCH and MCHC levels in normal levels. Research is in line with previous research conducted by Jannah that giving vitamin B complex syrup and vitamin C to anemic elementary school child in Sayung Subdistrict, Demak Regency, given once a week for three months can increase Hemoglobin levels by 2.2 g / dL (Jannah, 2009). Research by Subandi (1998) revealed that phagocytosis is very evident when parasitemia falls, this is because the presence of circulating antigens is also caused by the presence of prooxins that can attract all circulating macrophage cells into peritoneal fluid and activate it.

Vitamin B complex is needed in the formation of blood cells red and is important in the final maturation of red blood cells for DNA synthesis (Deoxyribonucleic Acid) because each vitamin in a different way is needed for the formation of thymidine triphosphate, which is one of the essential building blocks of DNA deficient in vitamin B12 or folic acid can cause DNA abnormalities and reduction and consequently are failure of core maturation and cell division (Guyton, and Hall, 2008). Vitamin B complex and vitamin C are known as anti-oxidant vitamins in the body, whose role is to help reduce free radicals simultaneously with endogenous antioxidants SOD (Super Oxide Dismutase), GPX (Glutathione Peroxidase), and catalase. In addition to functioning as an antioxidant, vitamin C has another important role, namely maintaining Se stability in the stomach (Suwondo, 2009).

4.2. Provision of multivitamins (vitamin B complex and vitamin C) in the sex of malaria sufferers in children

Respondents who were male were 16 people (53.3%) and women were 14 people (46.7%). This research is in line with Fitri's research (2013) that administration of vitamin B complex and Vitamin C is given to children with malaria regardless of sex.

Length of time given to children for 14 days, both route and frequency of giving vitamin B complex and vitamin C to children. The presence of parasites that persist in the human body can cause immunosuppressive reactions and can cause pathological tissue trauma. So that the main problem that occurs in the pathology of malaria is increased production of free radicals and decreased immune response (immunosuppression) in the final stages of the disease course. Immunosuppression that occurs in malaria turns out to be about cellular and humoral immune responses. The effects of immunosuppression occur on macrophage activity, antigen presentation and secretion of immunoregulatory mediators (Fitri, 2013).

4.3. Effectiveness of giving multivitamins (vitamin B complex and vitamin C) to lymphocyte levels of malaria sufferers in children

Lymphocytes are cells that play a role in the immune response because they have the ability to recognize antigens through special surface receptors and divide themselves into a number of cells with identical specificity, with long life span of lymphocytes which makes the cell ideal for adaptive responses (Suparman, 2014). The results were obtained in children suffering from malaria with lymphocyte levels before the administration of vitamin B complex and Vitamin C in the case group as many as 11 people (73.3%) in the normal category and after administration of vitamin B complex and Vitamin C there was an increase of 13 people (86.7%) in the normal category. In the control group before giving vitamin B complex and Vitamin C as many as 9 people (60%) in the normal category

and after 2 weeks there was a decrease to as many as 8 people (53.3%) in the normal category.

Before giving vitamin B complex and vitamin C to lymphocyte levels, the average value in the case group was 25.7% and after giving vitamin B complex and vitamin C to lymphocyte levels, the average value in the case group was 27.6%, while in the control group it was 24.8% and after 2 weeks it decreased with an average of 24.1%.

The mean value is -0.6133 with a standard deviation value of 3.30420. The paired t test results obtained a significance value at the significance level of 95% $p\text{-value} = 0.318 > \alpha 0.05$ which means that there were no differences in lymphocyte levels before and after administration of vitamin B complex and Vitamin C in children with malaria in Sanggeng District Health Center Manokwari. This research is in line with that conducted by Fitri (2013), that administration of vitamin C can reduce high lymphocyte levels to normal on the third and seventh day. While in this study the researchers examined lymphocyte levels on day 14. This can cause changes in lymphocyte levels that are not significant. In addition, with the presence of the malaria drug which decreases the level of parasitemia, lymphocyte levels experience a significant insignificant decrease in normality.

Vitamin B consists of several forms, and those that are beneficial in the immune system are vitamin B12, vitamin B6, folic acid and niacin. Vitamin B6 contributes to lymphocyte proliferation, lymphoid tissue formation and in antibody responses. Vitamin B12 plays a role in the augmentation of phagocyte performance and T cell proliferation. Folic acid with vitamin B12 can affect NK cells (Mizoc, 2011). Giving vitamin C here can also be intended as an immunostimulator because vitamin C is a nutrient that is able to regulate the immune system because of its anti-viral and antioxidant abilities, has an important role in phagocytic function and has the effect of

stimulating lymphocyte cells. Giving vitamin C also caused a significant increase in phagocytic activity of peritoneal macrophages in mice. This is probably due to the immunostimulatory effect found in vitamin C, this has also been proven by (Fuente et al. 1997) who found that vitamin C can increase the proliferation and activity of immunocompetent cells, especially macrophages and T lymphocytes,

4.4. Effectiveness of giving multivitamins (vitamin B complex and vitamin C) to MCV levels

Low MCV values indicate small size of red blood cells (called microcytes), normal MCV values indicate normal size of red blood cells and high MCV values indicate large red blood cell size (or macrocytes). This value can determine the type of anemia (lack of red blood cells) based on the size of the red blood cell. Normal values of 80-97 fl / red blood cell MCV in adults. The range of normal values can be different in each laboratory and the age of the patient (Kurniawan, 2016). The results showed that MCV levels before administration of vitamin B complex and Vitamin C in the case group were 5 people (33.3%) in the normocytic category and after administration of vitamin B complex and Vitamin C there was an increase of 11 people (73.3%) in the normocytic category. In the control group before giving vitamin B complex and Vitamin C as many as 4 people (26.7%) in the normocytic category and after 2 weeks there was no increase of 4 people (26.7%) in the normocytic category. The mean value of MCV levels in the case group before administration of vitamin B complex and Vitamin C was 77.4 fl and after administration of vitamin B complex and Vitamin C was 82.1 fl. In the MCV level control group a value of 75.8 fl and after 2 weeks was 75.7 fl.

MCV levels before and after administration of vitamin B complex and vitamin C at an average value of -2.27000 with a standard deviation value of 5.90716. The paired t test results obtained a significance value at the significance level

of 95% p-value = 0.044 < 0.05 which means that there were differences in MCV levels before and after administration of vitamin B complex and Vitamin C in children with malaria sufferers at Sanggeng Health Center, Manokwari Regency. Research conducted by Sofiyetti (2016) which examined the effect of zinc and vitamin b6 and vitamin C supplementation on hemoglobin levels, hematocrit and erythrocyte index of anemia in vivax malaria patients revealed that there were differences in mean values of MCV levels after vitamin supplements

The results of the research on the combination of vitamin B complex and vitamin C were able to reduce rigorist degrees and provide healing in mice infected with Plasmodium berghei. However, it turns out that the combination of vitamin B complex and vitamin C can reduce the degree of parasitemia faster. This is likely because in vitamin C there is an immunostimulator effect so that it can increase the proliferation and activity of peritoneal macrophages which in turn will cause the parasite elimination process to occur faster. In addition to the second possibility, the group treated with anti-malarial drugs has the effect of releasing free radicals so that the healing process from malaria infection is slower than the group treated with a combination of Chloroquine and vitamin C, so that chloroquine eliminates vitamin C. antioxidants will help prevent tissue damage from free radicals (Fitri, 2013).

4.5. Effectiveness of multivitamins (vitamin B complex and vitamin C) on MCH levels (mean corpuscular hemoglobin)

Patients who have low MCH have a tendency to have iron deficiency type anemia. Anemia that occurs in these patients usually occurs due to lack of iron nutrition or bleeding that occurs, such as in colon cancer and bleeding in other digestive tracts. High MCH can indicate a large size of red blood cells that can occur due to liver damage, vitamin B12 deficiency and also

lack of folic acid (Kurniawan, 2016). The results showed that the levels of MCH before administration of vitamin B complex and Vitamin C in the case group were 5 people (33.3%) in the normochromic category and after administration of vitamin B complex and Vitamin C there was an increase of 10 people (66.7%) in the normochromic category. In the control group before giving vitamin B complex and Vitamin C as many as 4 people (26.7%) in the normochromic category and after 2 weeks there was an increase to as many as 7 people (46.7%) in the normochromic category. The mean value of the respondents' MCH levels before giving vitamin B complex and vitamin C was 25 pg and after the treatment was 28 pg or there was an increase in MCV levels in the normal direction. Whereas in the control group before treatment, 32.8 pg and after 2 weeks without treatment increased to 32.9 pg or 0.1 pg. this increase is lower than the provision of vitamin B complex and vitamin C.

The level of MCH before and after administration of vitamin B complex and vitamin C in the case and control groups with an average value of -2.12000 with a standard deviation value of 2.59634. The paired t test results obtained a significance value at the significance level of 95% p-value = 0,000 < 0,05 which means that there were differences in MCH levels before and after vitamin B complex and vitamin C administration in children with malaria sufferers at Sanggeng Health Center, Manokwari Regency.

This study is in line with Sofiyetti's research (2016) revealing that there are differences in MCH levels before zinc and vitamin b6 supplementation with hemoglobin, hematocrit and erythrocyte levels of anemia in vivax malaria patients.

Vitamin C has a very important role in iron absorption especially from iron nonhem which is found in plant foods. Food containing iron hem 37% of which can be absorbed while iron nonhem food ingredients are only 5% which can be

absorbed by the body. Iron nonhem absorption can be increased by the presence of absorption agents such as vitamin C and other driving factors such as meat, chicken, fish (Berdanier, 1998 in Jukarnain, 2012).

Vitamin C acts as a powerful enhancer in reducing ferric ions to ferro ions, so it is easily absorbed in higher pH in the duodenum and small intestine. Vitamin C inhibits the formation of hemosiderin which is difficult to mobilize to free iron if needed. Iron absorption in the form of nonhem increases fourfold if there is vitamin C. Vitamin C plays a role in transferring iron from transferrin in plasma to ferritin (Almatsier, 2011).

The results of Saidin and Sukati, 1997 in Jukarnain (2012 regarding the administration of iron tablets with the addition of vitamin C to changes in Hb levels and serum ferritin proved that administration of iron tablets and vitamin C 150 mg, can increase the highest hemoglobin level compared to other groups. Deficiency of MCH anemia occurs because the body is deficient in vitamin B12, while the body needs it to make red blood cells and keep the nervous system working normally. The administration of vitamin B complex can help increase levels of MCH (Arisman, 2009).

4.6. Effectiveness of multivitamins (vitamin B complex and vitamin C) on MCHC levels (mean corpuscular hemoglobin concentration)

Erythrocyte index value is obtained from the calculation of hemoglobin levels, the number of erythrocytes and hematocrit. The MCHC value shows the average erythrocyte hemoglobin level (Gandasubrata S, 2010). MCHC reference value (32-36%) (Sudoyo AW, 2009). A person with hypochromic microcytic anemia will experience a decrease in the value of MCHC, whereas if a person experiences macrocytic anemia, the value of the Erythrocyte Index will increase. The new MCHC value will drop if anemia has been long or severe. The degree of change in Erythrocyte Index levels is related to the

weight and duration of anemia (Suega et al, 2007).

The results showed that the levels of MCHC before administration of vitamin B complex and Vitamin C in the case group were 10 people (66.7%) in the normochromic category and after administration of vitamin B complex and Vitamin C there was an increase of 15 people (100%) in normochromic category. In the control group before giving vitamin B complex and Vitamin C as many as 11 people (73.3%) in the normochromic category and after 2 weeks there was an increase to as many as 12 people (80%) in the normochromic category. The average level of MCHC before administration of vitamin B complex and vitamin C was 31.8% and after administration of vitamin B complex and vitamin C increased by 33.8% or increased by 2%. In the control group 32.8% and after 2 weeks without treatment 32.9% increased 0.1%. This increase shows that the administration of vitamin B complex and vitamin C can increase MCHC levels higher than without the provision of vitamin B complex and vitamin C.

Levels of MCHC before and after in the case group and the control of vitamin B complex and vitamin C administration with an average value of -1.06333 with a standard deviation value of 1.57315. The paired t test results obtained a significance value at the significance level of 95% p-value = 0.001 < 0.05 which means that there are differences in the levels of MCH before and after administration of vitamin B complex and vitamin C in children with malaria in Sanggeng Health Center, Manokwari Regency Vitamin B complex and vitamin C take an important role in the bone marrow in cellular metabolism and are needed in the normal development of erythrocytes in the bone marrow. Iron with vitamin C forms iron complex ascorbate which is soluble and easily absorbed by organs in the human body. Change in non-heme iron in form Inorganic compounds namely Ferri (Fe^{3+}) to ferro (Fe^{2+}) will be

even greater if the pH in the mixture becomes more acidic (Thankachan, 2008).

5. CONCLUSION

From the results of research data analysis conducted, conclusions were finally drawn as follows:

1. Respondents from malaria in children aged 6-9 years were 15 people (50%) and at the age of 10-12 years were 15 people (50%).
2. Respondents who were male were 16 people (53.3%) and women were 14 people (46.7%).
3. There is no difference in lymphocyte levels before and after administration of vitamin B complex and Vitamin C in children with malaria sufferers in Sanggeng Health Center, Manokwari Regency (p-value = 0.318) with a difference in average lymphocyte levels of -0.6133.
4. There are differences in MCV levels before and after administration of vitamin B complex and Vitamin C in children with malaria sufferers in Sanggeng Health Center, Manokwari Regency (p-value = 0.044) with an average value in the jerseys and control groups of -2.27000.
5. There are differences in MCH levels before and after administration of vitamin B complex and vitamin C in children with malaria sufferers in Sanggeng Health Center, Manokwari Regency (p-value = 0,000) with an average value in the case group of -2.12000.
6. There are differences in the levels of MCHC before and after administration of vitamin B complex and vitamin C in children with malaria sufferers in Sanggeng Health Center, Manokwari Regency (p-value = 0.001) with an average value in the case and control groups of -1.06333.

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