The function of Extract Curcuma (Curcuma xanthorrhiza Roxb) In Restoring Hemoglobin, erythrocyte and hematocrit On Soccer Athlete

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Abstract. The purpose of this study is to determine the effect of giving *temulawak* (Curcuma *Xanthorrhiza Roxb*) in athletes after having running activity 5000 meters toward hemoglobin, erythrocyte and hematocri level. The research design is double blind randomized controlled trial. The subjects were 35 male football athletes from PPLP (Centre for Education and Training Student) Salatiga, Central Java. The subjects were divided into 5 group with different treatments; group I giving t*emulawak* extract capsule containing curcumin (ETKK) 250 mg / day, group II ETKK 500 mg / day, group III ETKK750 mg / day, group IV were given multivitamin and mineral (MVM) capsules per day (beta carotene 5000 UI, Vitamin E 200 UI, Vitamin C 500 mg, 15 mg zinc, selenium 50 mcg) and group V were given placebo while the capsule were given for 21 days. The giving of *temulawak* extract (Curcuma xanthorrhiza Roxb) gave no effect on the improvement of hemoglobin levels, eritrsit and hematocrit in athletes after having 5000 meters running test.

INTRODUCTION

The improvement of the use of oxygen, especially on performed by contraction muscle, causes the improvement of electron leakage of mitochondria that will become ROS (Reactive Oxygen Species) (Clarkson 2000; Sauza 2005). Generally, 2-5% of oxygen used in metabolism process is changed into superoxide ion, so that a heavy physical exercise is able to cause the improvement of free radical production (Chevion 2003). Oxidative stress caused by heavy physical exercise induces erythrocyte damage and reduction of hemoglobin level (Senturk dkk. 2001). The damage of erythrocyte effects on age of erythrocytes, in which the age of erythrocytes is normally 120 days. So if the production of hydrogen peroxide still continues, it causes anemia because of the damage of erythrocytes. Anemia results the lack of oxygen transportation to cell. It gives effect to metabolism of cell, therefore the cell is not able to make any regeneration (Guyton; 2002). The function of erythrocyte is as oxygen carrier that carries the oxygen through all body's tissue. Haemoglobin, that binds the oxygen, is the inside part of erythrocyte. Haemoglobin carries the oxygen from the lung, and then the oxygen is released when the erythrocyte passes the capillaries.

In normal condition, the form of free radicals is balanced with the form of endogenous antioxidants. Body has protection mechanism that neutralize the free radicals by producing endogenous antioxidants, such as SOD (superoxide dismutase), GPx (glutation peroxide), and catalase. Body is not able to produce antioxidants, so that the body needs exogenous antioxidants from outside of the body. Exogenous antioxidants include vitamin E, vitamin A, vitamin C, Cu, ZN, Mn (Gordong 1994; Simajuntak 2007; Winarsi 2011).

Temulawak (*Curcuma xanthorrica roxb)* is one of medicinal plants that contains with efficacious active ingredients as antioxidants. The study result shows that bioactive subtances contained in temulawak rhizome include kurkumin (Kunchandy and Rao 1990 ; Tonnesen and Greenhill1992), demetoksikurkumin and bisdemetoksikurkumin (Tonnesen and Greenhill 1992). Another study indicates that active ingredients of kurkuminoid found in temulawak has higher antioxidants effectivity than kurkumin, demetoksikurkumin and bisdemetoksikurkumin (Sutrisno dkk. 2008). The purpose of this research is to study the effect of giving *temulawak* (Curcuma *Xanthorrhiza Roxb*) in athletes after having 5000 meters-running activity toward the level of hemoglobin, erythrocyte and hematocrit.

METHOD

The research design used was double blind randomized controlled trial. The subjects were 35 male football athletes from PPLP (Centre for Education and Training Student) Salatiga, Central Java. The subjects were divided into 5 groups with different treatments; group I was given t*emulawak* extract capsule containing curcumin (ETKK) 250 mg / day, group II was given ETKK 500 mg / day, group III was given ETKK750 mg / day, group IV was given multivitamin and mineral (MVM) capsules per day (beta carotene 5000 UI, Vitamin E 200 UI, Vitamin C 500 mg, 15 mg zinc, selenium 50 mcg) and group V was given placebo while the capsule were given for 21 days. The giving of *temulawak* extract (Curcuma xanthorrhiza Roxb) gives no effect on the improvement of hemoglobin levels, eritrsit and hematocrit in athletes after having 5000 meters running test. The research was conducted in Pusat Pendidikan dan Latihan Pelajar Olahraga (Centre for Students Education and Training) Salatiga Central Java. The intervention of temulawak extract capsule was given for 21 (twenty one) days. Physical activity was tested with 5000-metres of fast running. This research has been approved by ethical clearance approval issued by Health Ethics Committee Faculty of Medical Diponegoro University Semarang No. 214/EC/FK/RSDK/2012.

RESULT

Haemoglobin (Hb), Hematocrit (Ht) and Erythrocyte

Generally, after the intervention, the mean of haemoglobin level reduces as 0,13±0,69 g/dL (1,2-1,8 g/dL). The mean of haemoglobin level on treatment group with ETKK 250 mg and 750 mg increases as 0,16±0,56 g/dL and 0,10±1,00 g/dL respectively. The reduction of the average of haemoglobin level found on treatment groups with MVM 250 mg, ETKK 500 mg and placebo are 0,58±0,73 g/dL, 0,51±0,58 g/dL, 0,34±0,36 g/dL respectively. The result of anova test of those groups are not significantly different (p>0,05).

After the intervention, the treatment group that have the reduction of the average of hematocrit level are group of placebo, group of MVM 500 mg and ETKK 500 mg as 1,23±1,30%, 1,23±1,30% and 0,11±5,06% of each. The treatment group with TKK 750 mg and treatment group ETKK 250 mg have the increase of the average of hematocrit level as much as 0,74±3,17% and 0,39±1,85% respectively. After performing the anova test, there is no significant difference on those five of treatment groups (p>0,05).

The average number of erythrocytes found is decline after the intervention as 0,06±0,24 million u/L (0,44-0,65 million u/L). The average number of erythrocytes that have increased is only found on the treatment group with ETKK 750 mg as much as 0,05±0,38 million u/L. The reductions of the average number of erythrocytes of the treatment group with ETKK 500 mg, placebo, MVM and ETKK 200 mg are 0,16±0,23 million u/L, 0,09±0,19 million u/L, 0,07±0,21 million u/L, 0,01±0,16 million u/L respectively. The result of anova test of those groups are not significantly different (p>0,05).

TABLE 1. The mean of Haemoglobin, Hematocrit, Erythrocyte Level Based on The Treatment Group Before and After Intervention

Haemoglobin Level (g/dL)	Placebo	ETKK250 mg	ETKK500 mg	ETKK750 mg	MVM	p
Before	13,99±1,01	15,36±0,83	14,86±0,84	14,29±0,91	14,24±0,74	0,045
After	13,64±0,84	15,51±0,72	14,34±0,63	14,39±1,35	14,19±0,99	0,015
Difference	-0,34±0,36	0,16±0,56	-0,51±0,58	0,10±1,00	-0,58±0,73	0,302
Hematocrit Level (%)						
Before	43,21±2,85	46,17±2,53	44,71±2,06	43,91±1,68	44,43±0,70	0,133
After	41,98±2,61	46,57±2,12	44,60±4,73	44,66±3,29	43,76±2,05	0,123
Difference	-1,23±1,30	0,39±1,85	-0,11±5,06	0,74±3,17	-0,67±1,64	0,729
Number of Erythrocyite (million u/L)						
Before	5,21±0,56	5,25±0,32	5,11±0,32	5,30±0,46	5,46±0,59	0,708
After	5,13±0,53	5,24±0,29	4,94±0,19	5,34±0,45	5,39±0,53	0,300
Difference	-0,09±0,19	-0,01±0,16	-0,16±0,23	0,05±0,38	-0,07±0,21	0,580

There is no alteration of the proportion of haemoglobin level before and after intervention on all group of treatment. After performing intervention, the proportion of haemoglobin level which experience anemia on group of MVM treatment and group of placebo are one athlete (14,3%) of each group. The result of fisher's exact test shows that there is no difference of the proportion of haemoglobin level on all group of treatment (p>0,05).

When the proportion of hematocrit level is compared to the hematocrit level before conducting intervention, its proportion is slightly difference on the group with MVM treatment. Before intervention, there is 1 (one) athlete (14,3%), however no athlete is found after the intervention. The result of fisher's exact test indicates that there is no different of the number of erythrocytes on all groups with treatment (p>0,05).

TABLE 2. Classification of Haemoglobin Level Based on The Group of Treatment Before and After The Intervention.

Haemoglobin Level	Plascbo		ETKK 250 mg		ETKK 500 mg		ETKK750 mg		MVM		p
	n	%	n	%	n	%	n	%	n	%	
Before											**1,00**
Anemia	1	14,3	0	0	0	0	0	0	1	14,3	
Normal	6	85,7	7	100	7	100	7	100	6	85,7	
After											**1,00**
Anemia	1	14,3	0	0	0	0	0	0	1	14,3	
Normal	6	85,7	7	100	7	100	7	100	6	85,7	
Hematocrit Level											
Before											**1,00**
Low	1	14,3	0	0	0	0	0	0	1	14,3	
Normal	6	85,7	6	85,7	7	100	7	100	6	85,7	
High	0	0	1	14,3	0	0	0	0	0	0	
After											**1,00**
Low	1	14,3	0	0	0	0	0	0	0	0	
Normal	6	85,7	6	85,7	6	85,7	6	100	7	100	
High	0	0	1	14,3	1	14,3	1	14,3	0	0	
Number of Erythrocyite											
Before											**1,00**
Low	1	14,3	0	0	0	0	0	0	0	0	
Normal	5	71,4	6	85,7	6	85,7	5	71,4	6	85,7	
High	1	14,3	1	14,3	1	14,3	2	28,6	1	14,3	
After											**0,948**
Low	1	14,3	0	0	0	0	0	0	0	0	
Normal	5	71,4	6	85,7	7	100	6	85,7	6	85,7	
High	1	14,3	1	14,3	0	0	1	14,3	1	14,3	

Mean Corpuscular Volume(MCV), Mean Corpuscular Hemoglobin(MCH), Mean Corpuscular Hemoglobin Concentration(MCHC)

After the intervention, the treatment groups have the reduction of average value of MCV on MVM and placebo as 0,33±0,25 fL and 0,06±0,74 fL of each of them. The highest improvement of the MCV value as 0,43±0,56 fL is found on the group of 750 mg ETKK treatment. The result of anova test tells that there is no distinction on average difference of MCV value on those five of treatment groups (p>0,05). The average value of MCH has decreased after the intervention on the group with ETKK 500 mg treatment, the group of ETKK 750 mg treatment and the group of MVM treatment as 1,00±0,29 pg/sel, 0,10±0,35 pg/sel dan 0,09±0,16 pg/sel. The highest improvement as much as 0,06±0,30 pg/sel is found on the treatment group with ETKK 250 mg. The anova test indicates that there is no distinction on average difference of MCV value on those five of treatment groups (p>0,05). The difference average of MCHC value has decreased by 0,03±0,36 g/dL (0,90-0,80 g/dL). The average value of MCHC has reduced by 0,29±0,38 g/dL dan 0,07±0,45 g/dL respectively on the group with ETKK 750 mg treatment and the group with ETKK 500 mg treatment. The increase of the average value of MCHC on the group of ETKK 250 mg treatment, placebo, and MVM severally are 0,13±0,40 g/dL, 0,06±0,24 g/dL, and 0,03±0,21 g/dL. The result of anova test points that there is no distinction on average difference of MCHC value on those five of treatment groups (p>0,05).

TABLE 3. The Average Value of MCV, MCH, MCHC Based on The Treatment Group Before and After The Intervention

MCV Value (fL)	Placebo	ETKK250 mg	ETKK500 mg	ETKK750 mg	MVM	p
Before	83,43±6,34	88,04±3,52	87,63±2,85	83,30±5,71	82,11±8,29	0,206
After	83,37±5,80	88,04±3,75	87,63±2,96	83,73±5,92	81,79±8,14	0,175
Difference	-0,06±0,74	0,00±0,84	0,00±0,46	0,43±0,56	-0,33±0,25	0,255

MCHC Value (g/dL)						
Before	26,99±2,24	29,30±1,23	29,13±1,28	27,09±2,23	26,66±3,42	0,084
After	26,99±2,19	29,36±1,37	29,03±1,09	26,99±2,14	26,57±3,37	0,064
Difference	0,00±0,28	0,06±0,30	-1,00±0,29	-0,10±0,35	-0,09±0,16	0,776
Value MCHC (g/dL)						
Before	32,36±0,60	33,26±0,38	33,20±0,59	32,50±0,96	32,37±1,18	0,087
After	32,41±0,69	33,39±0,67	33,13±0,49	32,21±0,70	32,40±1,21	0,034
Difference	0,06±0,24	0,13±0,40	-0,07±0,45	-0,29±0,38	0,03±0,21	0,236

Based on the limitation of normal MCV value as 80 – 100 fL, normal MCH value is 28– 34 pg/ sel and normal MCHC value is 32 – 36 g/dL (Kemenkes 2011), the proportion description of MCV, MCH and MCHC category accordingly can be seen on Table 4.

TABLE 4. Classification of MCV, MCH, MCHC Value Based on The Treatment Group Before and After the Intervention.

Classification of MCV Value	Placebo		ETKK 250 mg		ETKK 500 mg		ETKK750 mg		MVM		p
	n	%	n	%	n	%	n	%	n	%	
Before											**0,771**
Microcytic	1	14,3	0	0	0	0	2	28,6	1	14,3	
Normositik	6	85,7	7	100	7	100	5	71,4	6	85,7	
After											**0,771**
Microcytic	1	14,3	0	0	0	0	2	28,6	1	14,3	
Normositik	6	85,7	7	100	7	100	5	71,4	6	85,7	
Classification of MCH Value											
Before											**0,170**
Hipokromik	4	57,1	1	14,3	1	14,3	4	57,1	4	57,1	
Normokromik	3	42,9	6	85,7	6	85,7	3	42,9	3	42,9	
After											**0,143**
Hipokromik	5	71,4	2	28,6	1	14,3	4	57,1	5	71,4	
Normokromik	2	28,6	5	71,4	6	85,7	3	42,9	2	28,6	
Classification of MCHC Value											
Before											**0,297**
Low	4	57,1	1	14,3	1	14,3	4	57,1	4	57,1	
Normal	3	42,9	6	85,7	6	85,7	3	42,9	3	42,9	
After											**0,240**
Low	2	28,6	0	0	0	0	3	42,9	1	14,3	
Normal	5	71,4	7	100	7	100	4	57,1	6	85,7	

After performing the intervention, there is no alteration on the proportion of MCV. The *fisher's exact test* indicates that there is no significant difference on MCV proportion of those treatment groups before and after the intervention (p>0,05). There is prevalence hipokromik as much as 4 (four) athletes (42,9%) found in each treatment group of placebo, ETKK 750 mg and MVM; while, the MCHC value proportion in low category on the treatment groups of ETKK 250 mg and ETKK 500 mg are 14,3% of each of them. The *fisher's exact test* shows that there is no significant difference on MCV proportion of those treatment groups before and after the intervention (p>0,05). The value of MCHC in low category is not found on the treatment groups of ETKK 250 mg and ETKK 500 mg; hovewer the result of fisher's exact test indicates that there is no difference on MCV proportion of those treatment groups before and after the intervention (p>0,05).

DISCUSSION

Haemoglobin (Hb)

The average level of haemoglobin found in the treatment groups of ETKK 250 mg and 750 mg increases severally as 0,16±0,56 g/dL and 0,10±1,00 g/dL. In line with the research conducted by Sutamik (2007) that tells that the give of *temulawak* extract (*Curcuma xanthorrhiza Roxb*.) is able to improve the level of haemoglobin on the blood of female strain wistar rats (*Rattus norvegicus)* that be given with lead nitrate solution ($Pb(NO_3)_2$). The research performed by Sugiharto shows that the give of temulawak rhizome infusion together with the give of

solution lead [$(PbNO_3)_2$] is able to prevent the reduction of Haemoglobin level of the rats. Nevertheless, the treatment groups of MVM, ETKK 500 mg and placebo have had the reduction of the average level of haemoglobin (Δ level of haemoglobin) as much as 0,58±0,73 g/dL, 0,51±0,58 g/dL, 0,34±0,36 g/dL respectively. The average level of haemoglobin before the intervention is 10,70±0,48 g/dl and the average level of haemoglobin after the intervention is 9,40 ±0,67 g/dl.

Hematocrit (Ht)

After the intervention, the treatment groups that have had the reduction of average level of hematocrit are placebo, MVM and ETKK 500 mg as much as 1,23±1,30%, 1,23±1,30% and 0,11±5,06%. The research performed by Bahri dkk. (2012) toward the athletics athletes after running for an hour shows the reduction of hematocrit level either on the control or treatment groups (coconut water, sugar and supplement).

The treatment groups with ETKK 750 mg and ETKK 250 mg have the improvement of average level of hematocrit as 0,74±3,17% and 0,39±1,85%. The research performed by Senturk dkk (2004) that involved the trained-male students and untrained-male students of Akdeniz University, Antalya, Turki indicates that there is an improvement of level of hematocrit on both trained-male students and untrained-male students after having maximal physical exercise and giving Vitamin A (β-carotene 50 mg/day), vitamin C (ascorbic acid 1000 mg/day), and vitamin E (α-tocopherol 800 mg/day). Sugiarto research (2003) shows that the give of 20% temulawak rhizome infusion is able to improve hematocrit level on rats (*Rattus norvegicus*) after being given the solution of inorganic lead.

Erythrocyte

The average amount of erythrocytes is increase only on the treatment group with ETKK 750 mg as much as 0,05±0,38 million u/L. The research done by Sugiharto (2004) that gave 20% temulawak rhizome infusion and 0,5 ml $(PbNO_3)_2$) 50 ppm shows that a slight improvement of average amount of erythrocytes as 4,65 ± 0,14 million u/L compares to the group of control as 4,60 ± 0,13 million u/L. However, the give of 20% temulawak rhizome infusion and 0,5 ml $(PbNO_3)_2$) 50 ppm have the improvement of average amount of erythrocytes as 4,65 ± 0,14 million u/L compares to the group of control as 4,60 ± 0,13 million u/L. Djojosoewarno and Sjarief research (2002) tells that there is an improvement of of average amount of erythrocytes from 5,65 million u/L to 7,93 million u/L after having physical activity on the administration male employees.

The treatment groups with ETKK 500 mg, placebo, MVM and ETKK 250 mg have the decrease of average amount of erythrocytes respectively are 0,16±0,23 million u/L, 0,09±0,19 million u/L, 0,07±0,21 million u/L, 0,01±0,16 million u/L. In line with the research conducted by Silitonga (2011) indicates that there is the decrease of the amount of erythrocytes on the rats (*Rattus norvegicus*) that have been given the maximal physical activity and given *daun bangun-bangun* for 30 days compare to group of control.

Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC)

After the intervention, the treatment groups that have the reduction of average value of MCV are MVM and placebo as much as 0,33±0,25 fL and 0,06±0,74 fL. Dallak (2012) performed the research that finds that there is the reduction of average value of MCV on male-Wistar rats after the intervention with vitamin E and vitamin C and been swam compares to the control group. The research done by Hossein and Monireh (2012) on the male-basketball athletes also indicates the decrease of average value of MCV from 91,17 ± 1,94 fL to 91,10 ± 1,92 fL after having the intervention of plyometric exercise program. Hovewer, the treatment group with ETKK 750 mg has the highest improvement of average value of MCV as 0,43±0,56 fL. Wen et al (2007) shows that there is an improvement of average value of MCV from 90,00 ± 4,36 fL to 90,05 ± 5,18 fL on the basketball athletes after having the intervention by consuming purple sweet potato leaves (*Ipomoea batatas (L) Lam).*While, the research done by Vilela et al (2010) tells that there is a slight improvement of average value of MCV from 86,25 ± 0,35 fL to 86,29 ± 0,35 fL on the volunteers after the intervention with the extract of pequi fruit (*Caryocar brasilliense Camb*).

Based on the classification of MCV, there are micrositik category (<80 fL) and normositik category (80-100 fL) found on all treatment groups. The highest micrositik category is found on the treatment group with ETKK 750 mg as 2 athletes (28,6%). There is no athlete found in the treatment groups with ETKK 250 mg and ETKK 500 mg. The proportion of MCV does not change after getting the intervention. The anova test result indicates that there is no different on the difference of MCV value on those five of treatment groups (p>0,05). It is not similar with the

result of Tanuja research (2011) that be conducted by giving the turmeric extract (*Curcuma Longa)* and 5 Gy of Gamma radiation to Swiss albino mice. This intervention gives the effect to MCV value.

CONCLUSION

The give of temulawak extract (*Curcuma xanthorrhiza Roxb)* does not give any effect to the improvement the level of haemoglobin, erythrocytes and hematocrit in athletes after having 5000 meters running test.

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