The Effect of High Intensities and Moderate Intensities Football Specific Circuit Training on Selected Hematological Variables among Under-17 Football Players

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Abstract

Objective: The purpose of the study was to investigate the comparative effect of high intensities and moderate intensities football specific circuit training on selected Hematological Variables among Under-17 football players in Ethiopia.

Method: Randomized control group pretest-posttest design was implemented for this experimental study. For the purpose of this study from a total of ninety (90) football players of Adigrat city sixty (60) footballers were taken as a sample size. The subjects were at the age of 16.15±.71 years, height of 1.62±.54 meter and weight of 50.67±3.71. These subjects were distributed into the experimental groups of high intensity circuit training group (HICT group) N_1=20, moderate intensity circuit training group(MICT group)N_2=20and control group (CG) N=20. Only HICT group and MICT group were engaged in high intensity circuit training and moderate intensity circuit training for sixteen weeks respectively. The selected hematological parameters were Red blood cells (RBC), White blood cells (WBC), Hemoglobin (Hgb), Hematocrit (HCT), Mean cell volume (MCV) and Mean cell hemoglobin (MCH). The data was collected from cubital vein as per the guide for blood specimen collection procedure at both pre and post-tests. The data was analyzed using ANCOVA and post hoc test for paired mean comparison when significant difference exists.

Result: Our finding indicated that the High intensity circuit training group increased significantly in RBC, WBC, Hgb and MCV than control group with (519, P=.000), (91.595, P=.000), (.903, P=.019) and (5.668, P=.000) respectively. Moderate intensity circuit training Group increased significantly from the control group on RBC, WBC, Hgb and MCV with a mean difference of (.746, P=.000), (1.894, P=.000), (1.238, P=.000) and (2.777, P=.000) respectively. The High intensity circuit training group decreased significantly in HCT and MCH with (-3.175, P=.000) and (-1.344, P=.000) respectively. Moderate intensity circuit training Group decreased significantly from the control group on HCT and MCH with (-4.310, P=.000) and (-2.076, P=.000) respectively. In addition to this the Moderate intensity circuit training Group showed significant increase in RBC and decrease in MCH from High intensity circuit training group with (.227, P=0.014) and (.732, P=.032) respectively. The High intensity circuit training group increased significantly in MCV than the Moderate intensity circuit training Group with (2.892, P=.001).

Conclusion: From our finding we conclude that different intensity of training brings different changes in different Hematological parameters and similar changes in some variables as well. Thus the circuit training intensity should be considered in the coaching plan for junior players.

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Introduction

[1]Football is the well-known and widely spread type of sport in the world and it is also among the leading sports in Ethiopia.[2] The match of football is an intermittent type of activities that requires both aerobic and anaerobic qualities of its participants and thus to ensure players quality as per the demand of the match.[3] The coaches of Football training have been incorporating systematic method of training . [4] Among which the modern circuit training method is one of the most commonly used method in many sports including football. [5 & 6] This method of training has been playing a role on improving the physical, physiological and hematological demands of footballers to participate in the game efficiently. [7] Circuit training is a conditioning training method in which 9 to 12 exercise protocols were arranged in different stations where participants perform at moderate intensity at each stations with rest time in between stations. [8 & 9] Some studies indicated that increasing the intensity of this type of training by limiting the rest time given between stations would give better benefits for the trainers as well as trainees. But the comparative benefit of varied intensity of circuit training in relation to the hematological variables is not studied yet to focus. Thus, researchers of the current study initiated to fulfill the study gap related to hematological variables in relation to the intensity. This study was focused on subjects of under 17(seventeen) football players. This is because; [10] this stage of age category is the stage, from which qualified players of high level football develops their physical, physiological and hematological qualities. [11 & 12] Hematological parameters are crucial for the football players to be efficiently provided with enough amount of energy that the game required for its aerobic performance demand of the players. [13 & 14] The changes in blood parameters bring changes in the physical performance capacity of the players to enhance aerobic performance and [15 & 16] the hematological parameters can be changed as the result of training. However the change on hematological parameters depends on type and intensity of training. So the current study was intended to examine the comparative effect of high intensity and moderate intensity football specific circuit training on selected hematological parameters of Under 17 football players in Ethiopia. We hypothesized that there would be significant difference on the effect of moderate and high intensity circuit training groups on hematological parameters.

Materials and Method

Study setting and ethical approval: Ethical clearance was obtained from Mekelle University, College of health sciences, Health Research Ethics Review Committee (HRERC) with a Ref. ERC 1236/2019 dated 7/ 03/2019 and the written assent from the subject themselves and the consent from their guardians was obtained before the experimental procedures and Physical activity readiness questionnaire form was fulfilled by each participant. The study was conducted in Adigrat city which is found in eastern zone of Tigray regional state of Ethiopia with an elevation of 2,457 meters above sea level. It is located at longitude and latitude 14°16'N and 39°27E.

Study design and participants: The design of this study was Randomized control group pretest-posttest which aimed to study on the effect of high intensity and moderate intensity football specific circuit training on selected hematological variables among Under-17 football players. For the purpose of this study from a total of ninety (90) players of Adigrat city sixty (60) players were taken as a sample size using the[15 & 16] corrected formula for finite population. I.e. $n = \frac{no}{1+\frac{no-1}{N}}$ to meet 80% of power where=is new adjusted sample size; no is Cochran's sample size recommendation at p=0.2 variance; 95% confidence and $\pm$5 precision; N is population size.

Inclusion Criteria: In this study male players are at the age of 15-17 years and volunteers to give their assent and consent from their guardian were included.

Excluding criteria

Those who were taking any drug for any medical case

Who fails to fulfill physical activities readiness questionnaire

Randomization: The sixty (60) subjects were randomly using the random number selected from the eligible subjects. These were distributed into the experimental N_1=20 (high intensity circuit training group), N_2=20 (moderate intensity circuit training group) and N=20 (control groups) using the simple random sampling technique.

Procedures of data collection: To collect the data from blood specimen at both pre and post training the subjects were well instructed to be fasting during the blood specimen collection time. Before testing the subjects were removed their tight closes, the subjects were take 15 minutes of rest in a sitting chair. The subjects were sat with feet flat on the floor, arms were supported at the heart level on the chair and the body had support back to the chair. The data was collected from cubital vein at 7:00–9:00 AM East African time zone using 5ml syringe to take 3-5ml of whole blood. The collected blood was drawn in to k2EDTA anticoagulant test-tube. After properly mixing the blood with EDTA anticoagulant the sample was transported to area where hematological analysis is taking place. The hematology machine (Mindras 5800) was checked its quality control using the high, normal and low values of the quality control samples to check the machine performance and also using the background (blank) checkups. After, the machine is passed all the necessary quality inspection steps the sample was analyzed. The machine took 6µl of whole blood of the sample. The result was printed out for further analysis.

Training (Interventions): For the purpose of this study pilot study was taken to determine the required intensity which is 75% to 85% of HR max for Moderate intensity and 85% to 90% of HR max for high intensity training using the heart rate monitor. Thus the training program was designed based on the required intensity. The two experimental groups of HICT group and MICT group were engaged in the high intensity circuit training (HICT) and Moderate intensity circuit training (MICT) respectively for sixteen(16) weeks and three times per week whereas the Control group did not engage in the circuit training but in the activities that are not performed by the experimental groupsexcept the circuit training. Pre-test was taken to consider the base line data and After 16 weeks training post-test was taken. The intensity was determined based on a relationship between the work intensity and HR. (Banister 1991).

Data Analysis: Descriptive statistics was employed for mean, standard deviation, minimum and maximum of the data and P-P-plot was used to check the normality of the continuous data. To check significance difference among the groups analysis of covariance (ANCOVA) was employed and its assumptions were checked. In the result that showed significant difference boneferrani post hoc test was used for paired mean comparison to identify which group significantly differs from the others. All statistical analyses were performed using IBM-SPSS version 23. Significant level was set at 0.05.

Results

The comparison on demographic parameters of HICT group, MICT group and Control group showed that they had no significant difference in all parameters of the demographic characteristics (Table 1). Thus we can conclude that the groups formed for the purpose of this study were almost homogeneous groups.

Table 1: Comparison on the Demographic data of HICT Group, MICT group and Control group

Variables	HICT group (n=20)	MICG group (n=20)	Control group (n=20)	F' ratio	Sig
Age	16.20±.69	16.30±.73	15.95±.68	1.30	.297
Weight	51.70±2.90	50.55±4.01	49.75±4.03	1.41	.253
Height	1.62±.041	1.64±.049	1.60±.064	2.43	.097
BMI	19.55±.93	19.42±1.15	19.14±1.73	.497	.611

The analysis of covariance for RBC, WBC, Hgb, HCT, MCV and MCH (Table 2) yieldedF ratio of 50.96, 13.64, 9.27, 26.06, 29.21 and 27.55 respectively. This showed the F ratio found for each selected hematological parameters was greater than the required table Value for Df (2,56) which is 3.155 and thus the three groups showed significant difference on their RBC, WBC, Hgb, HCT, MCV and MCHas the result of the intervention. The result was subjected to the boneferrani post hoc test for paired mean comparison(Table 3). The RBC result yielded that the mean difference of HICT group and MICT Group was (-.227). This result showed that the difference made by MICT group over HICT group was significant (P=.014), the mean difference made by HICT group on Control Group was (.519) which is significant (P=.000). The mean difference made by MICT group

on Control group (.746) was significant (P=.000). The mean difference of WBC made by HICT group on Control Group (1.595) was significant (p=.000) and the mean difference made by MICT group on Control Group (1.894) was significant (P=.000). The mean difference made by MICT group on HICT group (.299) was not significant (P=1.000). The mean difference of Hgb made by HICT group on Control group was (.903) which was significant (P=.019). The mean difference made by MICT group on Control Group (1.238) was found to be significant at (P=.000). The mean difference made by HICT group on MICT group was (-.336) which was not significant(P=.989). The HCT mean difference made between HICT group and Control group was (-3.175, P=.000). The mean difference of MICT group and Control Group (-4.310) was found to be significant at 0.05 levels (P=.000). The mean difference made by HICT group and MICT group (1.135) showed no significant difference (P=.212). The MCV mean difference of HICT group and Control group showed significant difference. I.e. the HICT group increases significantly(5.668, P=.000). The mean difference of MICT group and Control Group were found to be significant at 0.05 levels(2.777, P=.001). The MICT group increased significantly. The HICT group also showed significant increase than the MICT group (2.892, P=.001). The MCH mean difference made between HICT group and Control group showed significant difference. That is HICT group decreased significantly (-1.344, P=.000). The mean difference of MICT group and Control Group showed significant difference at 0.05 levels. That is the MICT group showed significant decrease from Control group(-2.076, P=.000). The MICT group showed significant decrease from HICT group (.732, P=.032) and

Table 2 Analysis of covariance for the adjusted post-test mean of HICT group, MICT group and Control group

Variables		Source of Variance	Sum of squares	Df	Mean square	F ratio
RBC in ($x10^6/\mu L$)	Adjusted post-test	Between	5.85	2	2.92	50.96*
		Within	3.21	56	.057	
WBC in ($x10^6/\mu L$)	Adjusted post-test	Between	41.42	2	20.71	13.64*
		Within	85.02	56	1.51	
Hgbin (g/dL)	Adjusted post-test	Between	16.40	2	8.20	9.27*
		Within	49.51	56	.88	
HCT in %	Adjusted post-test	Between	194.27	2	97.13	26.09*
		Within	208.43	56	3.72	
MCV in(fL)	Adjusted post-test	Between	320.68	2	160.34	29.21*
		Within	307.39	56	5.48	
MCH in (Pg)	Adjusted post-test	Between	42.50	2	21.25	27.55*
		Within	43.19	56	.77	

Significant at 0.05 level of significance F=Ratio was tested its significance at 0.05 level of significance = Df (2, 57) = 3.155, df (2, 56) = 3.155

Table 3 Boneferrani post hoc test for paired mean comparison

Variables	HICT group	MICT group	Control group	Mean difference	Sig
RBC	5.91	6.14		-.23*	.014
	5.91		5.34	.52*	.000
		6.14	5.34	.746*	.000
WBC	7.86	8.16		-.299	1.000
	7.86		6.27	1.595*	.000
		8.16	6.27	1.894*	.000

Variables	HICT group	MICT group	Control group	Mean difference	Sig
Hgb	16.62	16.95		-.336	.989
	16.62		15.72	.903*	.019
		16.95	15.72	1.238*	.000
HCT	46.96	46.32		1.135	.212
	46.96		49.96	-3.00*	.000
		46.32	49.96	-3.63	.000
MCV	92.59	89.70		2.89*	.001
			86.92	5.66*	.000
		89.70	86.92	2.77*	.001
MCH	28.56	27.82		.732*	.032
	28.56		29.90	-1.34	.000
		27.82	29.90	-2.07	.000

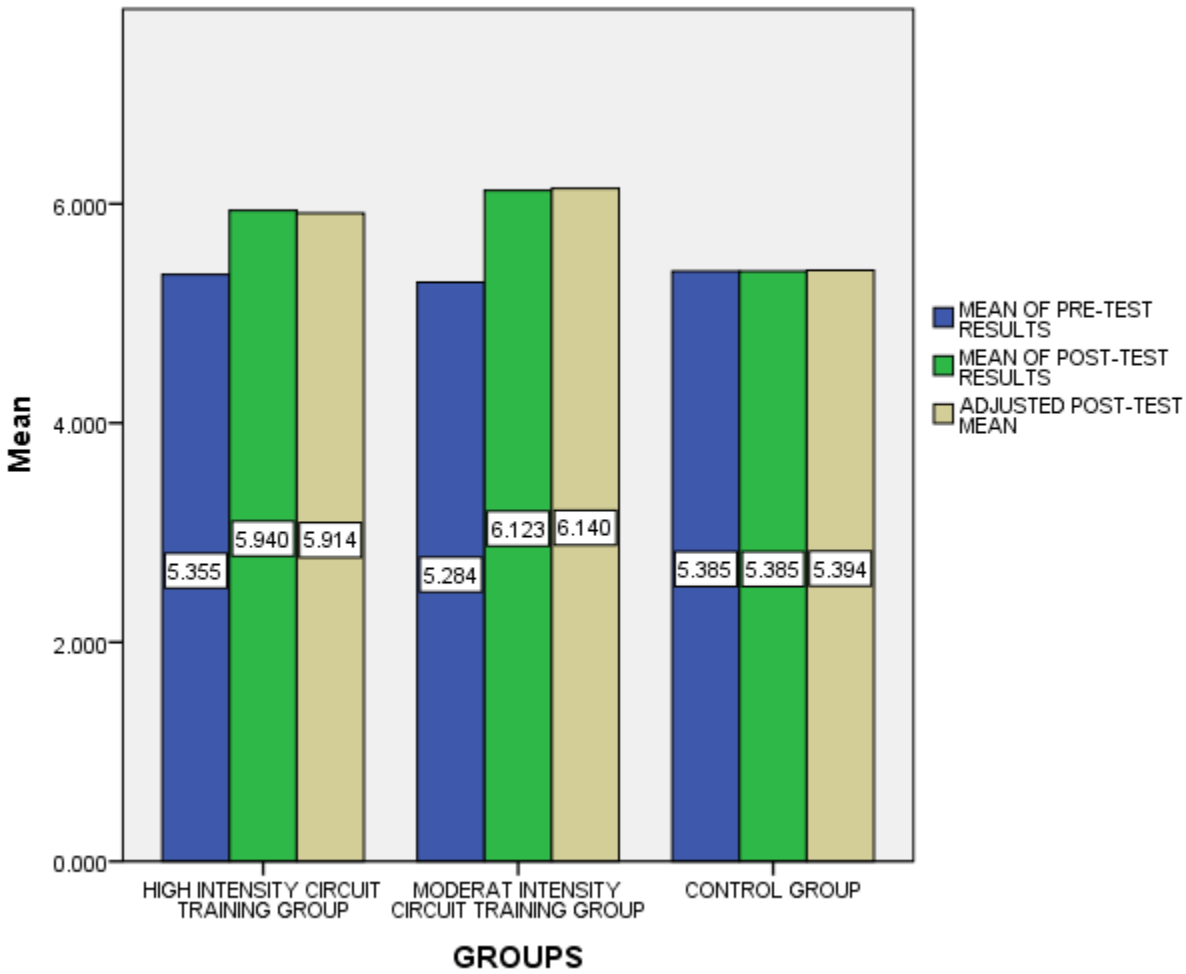

Fig. 1 Descriptive statistics of RBC.

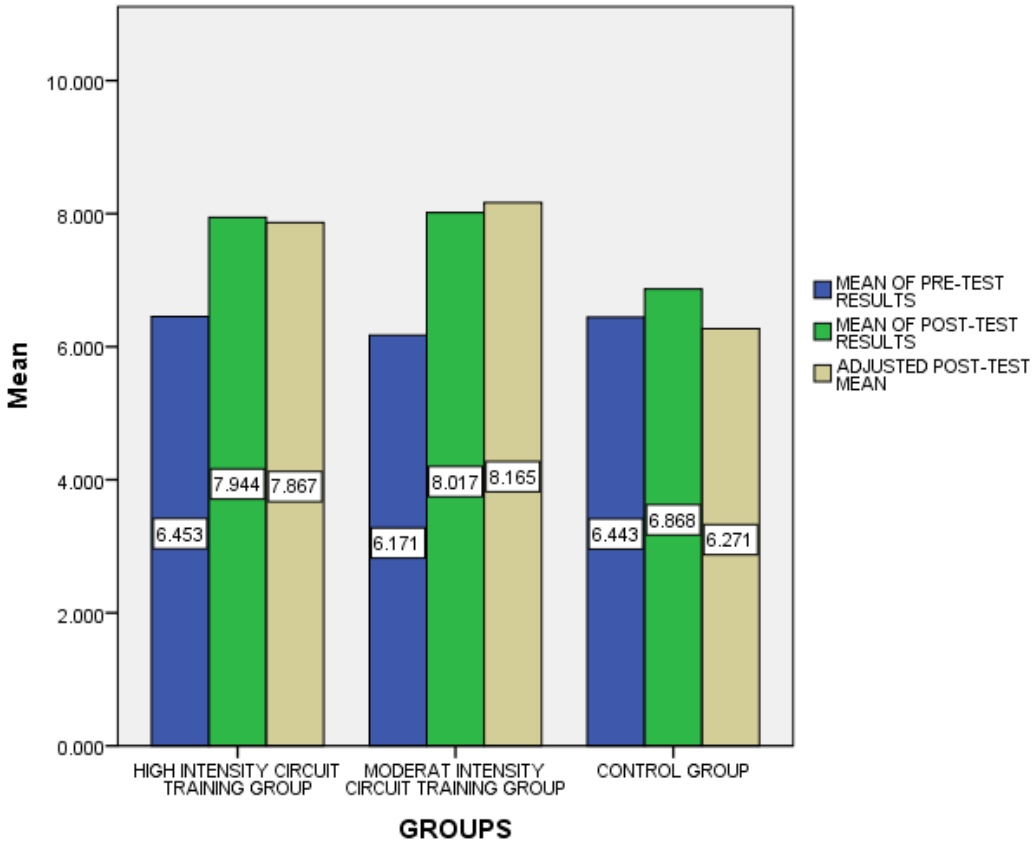

Fig. 2 Descriptive statistics of WBC.

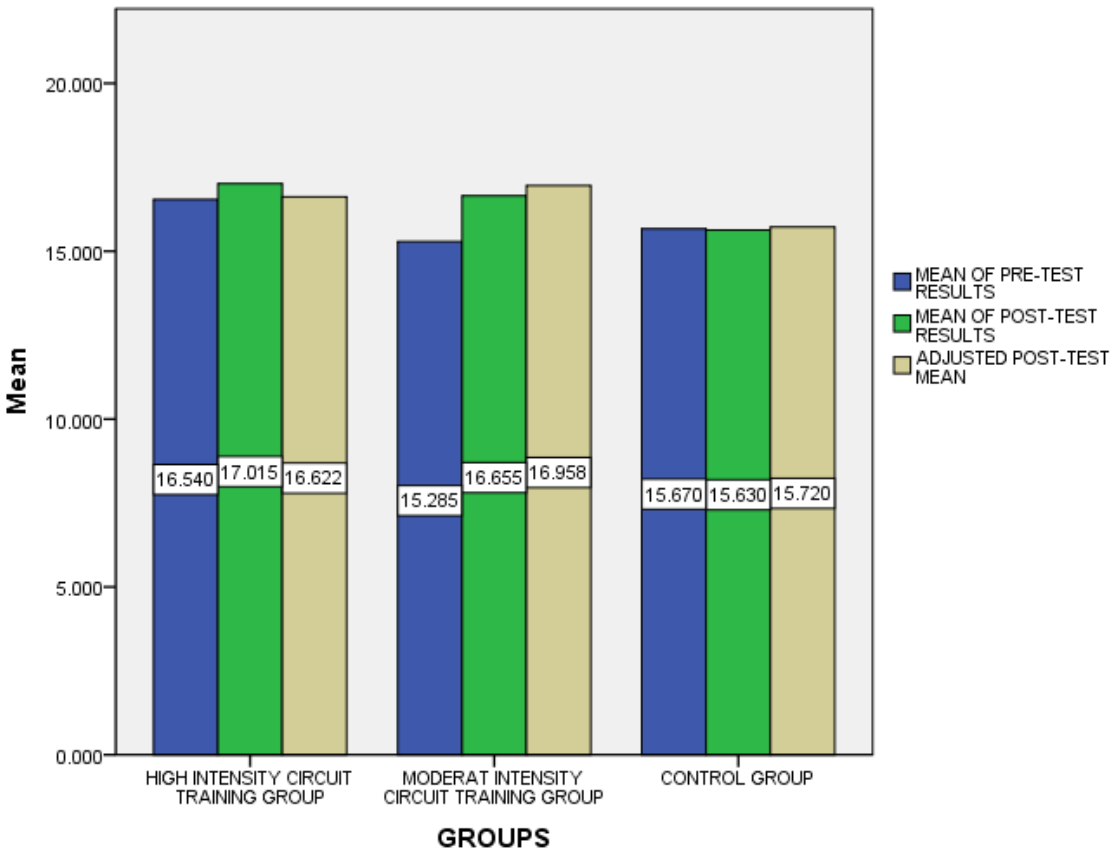

Fig. 3 Descriptive statistics of Hgb.

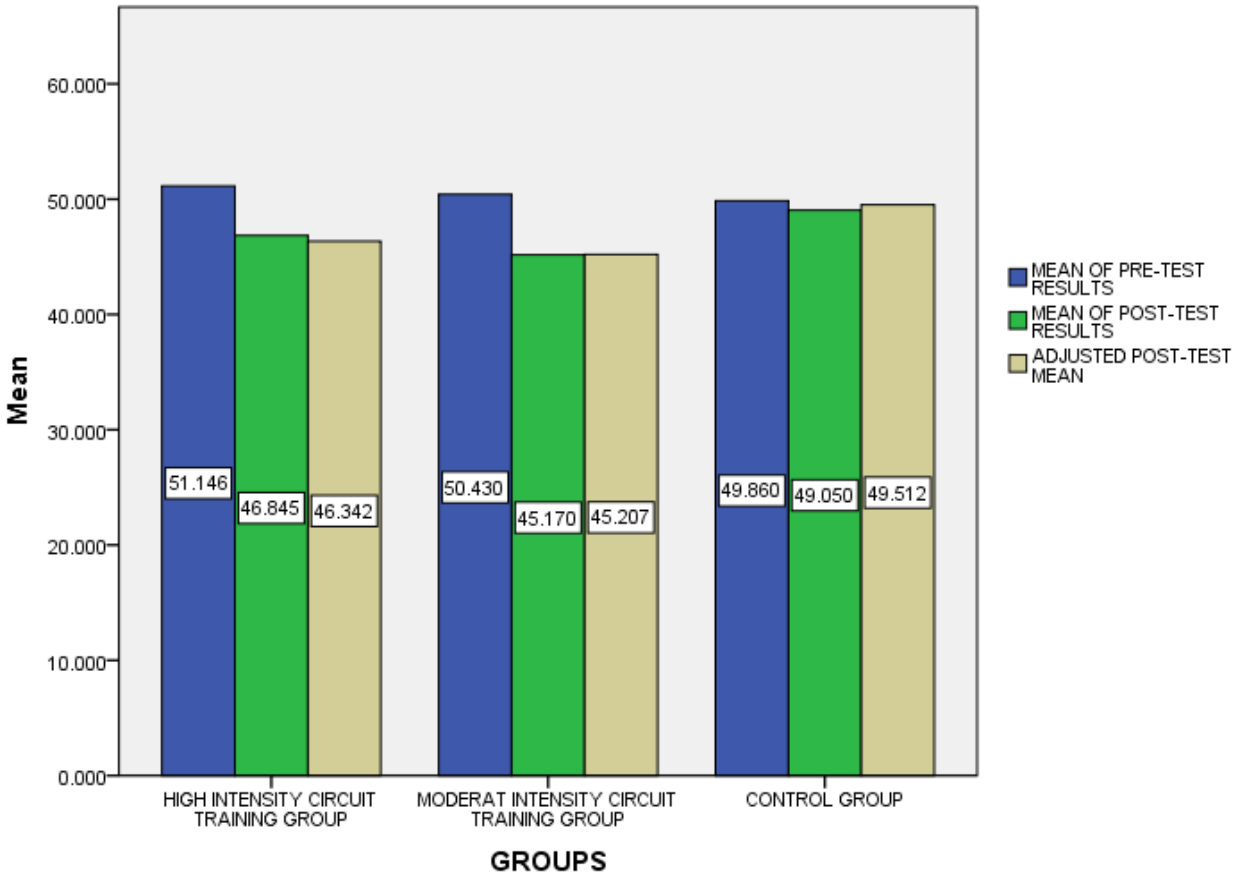

Fig.4 Descriptive statistics of HCT.

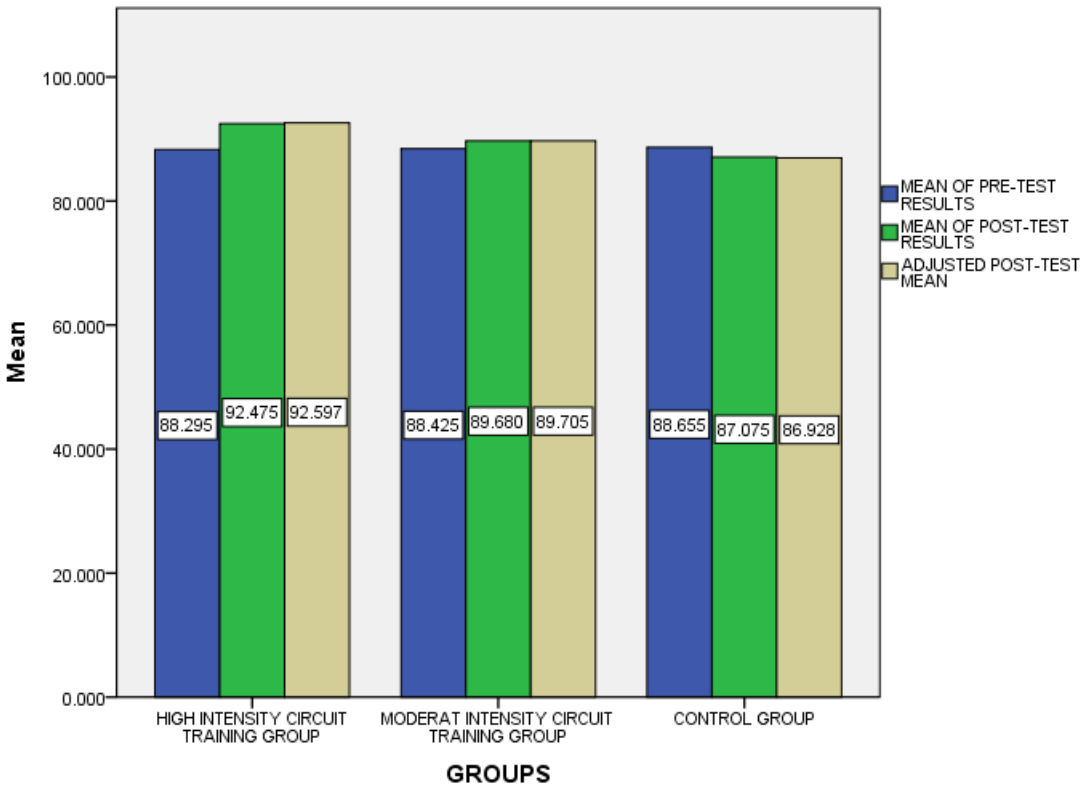

Fig. 5 Descriptive statistics of MCV.

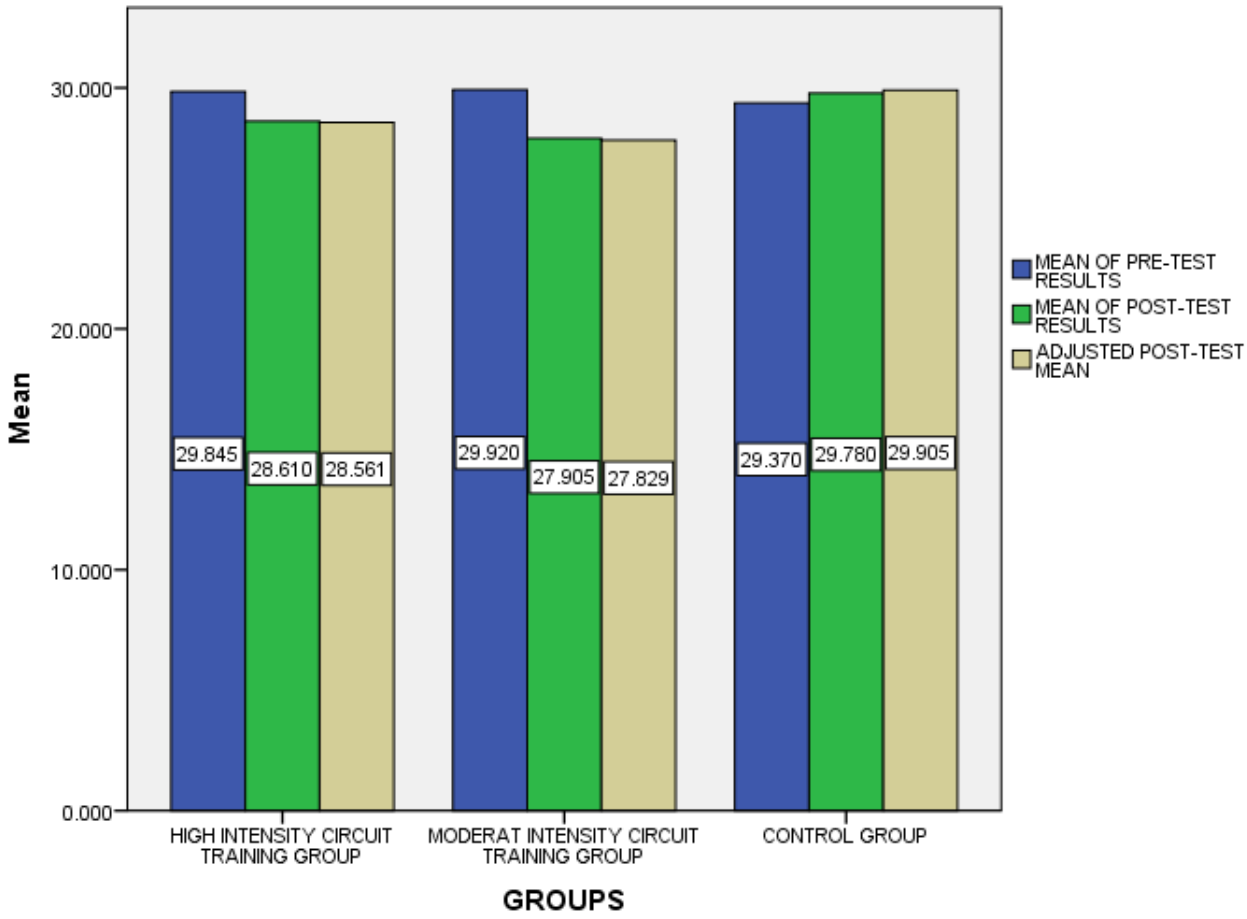

Fig. 6 Descriptive statistics of MCH.

Discussion

[18 & 19] This study gives clear information to understand the comparative effect of High intensity and Moderate intensity football specific circuit trainings on hematological parameters. It is believed that Hematological parameters affect the aerobic capacity of football players which is considered as basic for technical and tactical development of footballers. However the [20] improvement in hematological parameters depends on type, intensity and duration of the training. Thus our study was aimed to make clear understanding on the comparative effect of high and moderate intensity of circuit training to bring changes on hematological parameters for footballers. [21] Findings of the previous studies reviled that aerobic, strength training and preparation training of sport brings alterations in blood parameters. Besides of this study from our finding both experimental groups showed significant increment in the parameters of RBC, WBC, MCV and Hgb which was similar finding [22 & 23] with the finding of six month football preparation exercises. This is due to that the training stimulates erythropoiesis within [24] the bone marrow to boost the RBC production which is required to increase the oxygen carrying capacity of the cells as to the training created stress on the body and high intensity circuit training group showed significant improvement on WBC which was contradictory to the Previous study, [25] which ensured that well trained people are with a lower WBC as the result of training adaptation so this might be that the previous finding took athletes with five years of experience from different sports but did not specifically identify the activity the subjects were engaged on and it did not consider the intensity of the activity they were engaged on. In contrary both groups significantly decreased in MCH and HCT after sixteen week training of moderate and high intensity circuit training. This means that the concentration of hemoglobin in a specific volume of red blood cell decreased as the number of RBC increases in the blood even if they had a variation in the type and intensity of exercise this finding supports to the finding that found decreased MCH in the eight weeks training for preparation of teackando players. T

he current study also showed decreased HCT this was strengthen the finding that training increases blood plasma volume which resulted decreased in HCT. Our new finding to the quantum of knowledge was that the WBC increased only in high intensity circuit training groups and the MCV also significantly increased better in high intensity circuit training group than the moderate intensity circuit training group thus the parameters of WBC and MCV are sensitive to high stress of the body whereas the RBC increased better in moderate intensity circuit training group than the high intensity circuit training group so this showed that the adaptation of hematological parameters varies as the stress on the body or training load varies. Thus we conclude that the different intensity of training brings different changes in different Hematological parameters and similar changes in some variables as well. So coaches or trainers should well understand with the benefit of varied intensity while they are planning for training.

Conclusion

From our new finding we conclude that different intensity of training brings different changes in different Hematological parameters and similar changes in some variables as well. Thus the circuit training intensity should be considered in the coaching plan for junior players.

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Ethical Consideration: Approval and ethical clearance of the protocol was sought for Health Research and Ethical Review Committee of Mekelle University

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Conflict of Interest: Nil

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