

SOME HAEMATOLOGICAL CHANGES DURING EXERCISE

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Summary: The effect of Master's two step exercise test was studied in 70 boys and 30 girls, who were apparently in good health. The results were statistically analysed and tabulated. The MCD, MCV, MCHC, monocyte % etc. were insignificantly affected; colour index, MCH etc. were significantly affected, while the changes with reference to Hb, RBC count, haematocrit%, total leucocyte count, polymorph %, lymphocyte %, eosinophil % etc. were highly significant.

Key words: exercise haematological changes

Man's ability to perform exercise is normally limited by the capacity of cardio-vascular system to increase the transport of oxygen to active muscles. This increase is governed by complex changes in the blood-vascular and respiratory systems (1, 5, 6, 7).

Different people react differently to various physical and emotional stresses, depending upon their habits and habitat. In this paper, haematological changes in the normal healthy youths of Rajasthan which occur during exercise are being reported.

MATERIALS AND METHODS

18-23 years old healthy medical students of Medical College, Ajmer were selected for this study. They included 70 boys and 30 girls. Haematological investigations such as erythrocyte mean cell diameter, Hb in gm %, total red cell count, colour index, haematocrit %, MCV, MCH, MCHC, total leucocyte count, differential leucocyte count etc. were undertaken in the semi-basal condition of each subject. Immediately after the first withdrawal of blood sample the subjects performed a mild exercise in the form of Master's two step exercise test. The mean work done by boys was 27.5 kg m/min (range : 23.7-39.9 kg m/min), while the mean work done by girls was 23.2 kg m/min (range : 17.5-29.7 kg m/min). Immediately after exercise, blood samples were again taken and the investigations were repeated.

RESULTS

Table I shows the effect of Master's two step exercise test in 70 healthy males. The MCD, MCV, MCHC, monocyte %, polymorph count and eosinophil count were not significantly affected ($P > 0.05$), while MCH and colour index were significantly affected ($P < 0.05$). In contrast to above the Hb gm %, total red cell count, haematocrit %, total leucocyte count, polymorph %, lymphocyte %, eosinophil %, lymphocyte count and monocyte count were significantly changed ($P < 0.01$)

TABLE I: Showing haematological changes during exercise in 70 healthy males.

S. No.	Item	Mean value (\pm S.D.) before exercise	Mean value (\pm S.D.) after exercise	% Change	P value
1.	Mean cell diameter in μ	7.3 \pm 0.03	7.34 \pm 0.03	+ 0.8	> 0.05
2.	Hb in gm %	14.3 \pm 1.2	15.3 \pm 1.4	+ 6.9	< 0.01
3.	RBC in million/cu mm	4.9 \pm 0.2	5.1 \pm 0.3	+ 4.1	< 0.01
4.	Colour index	0.9 \pm 0.01	1.0 \pm 0.01	+ 3.1	< 0.05
5.	Hct %	44.7 \pm 4.2	47.0 \pm 5.2	+ 5.0	< 0.01
6.	MCV in cu μ	91.3 \pm 9.2	92.1 \pm 7.6	+ 0.9	> 0.05
7.	MCH in $\mu\mu$ gm	29.2 \pm 2.1	30.0 \pm 2.5	+ 2.8	< 0.05
8.	MCHC in gm/100 ml.	31.9 \pm 1.8	32.5 \pm 1.8	+ 1.9	> 0.05
9.	Total leucocyte count/ cu mm	6900 \pm 202.5	8196 \pm 282.3	+18.8	< 0.01
10.	Polymorph %	61.5 \pm 3.2	52.7 \pm 3.2	-14.2	< 0.01
11.	Lymphocyte %	27.9 \pm 2.8	37.9 \pm 3.9	+33.4	< 0.01
12.	Monocyte %	8.7 \pm 1.8	8.8 \pm 1.9	+ 1.1	> 0.05
13.	Eosinophil %	1.9 \pm 0.2	1.5 \pm 0.3	-19.6	< 0.01
14.	Polymorph/cu mm.	4152 \pm 887.9	4138 \pm 908.2	- 0.31	> 0.05
15.	Lymphocyte/cu mm.	1910 \pm 523.2	3122 \pm 769.2	+63.7	< 0.01
16.	Monocyte/cu mm	606 \pm 122.3	723 \pm 202.5	+17.6	< 0.01
17.	Eosinophil/cu mm	143 \pm 53.3	137 \pm 50.3	- 4.9	> 0.05

At P — 0.05 level of significance (1.99)

Table II shows the effect of Master's two step exercise test in 30 healthy females. The MCD, MCV, MCHC, colour index, monocyte %, eosinophil %, polymorph count and eosinophil count were not significantly affected ($P > 0.05$), while MCH was significantly affected ($P \leq 0.05$). In contrast to above the Hb gm %, total red cell count, haematocrit %, total leucocyte count, polymorph %, lymphocyte count and monocyte count were significantly changed ($P < 0.01$)

DISCUSSION

Exercise increases the Hb gm %, total red cell count, colour index, haematocrit %, MCH, total leucocyte count etc. in both the sexes. Some amount of formed elements of blood always remain stored in an animal body in liver, lungs, spleen, and bone marrow. They do not normally form the part of general circulation. When there is a greater demand for oxygen during exercise this reserve is put into circulation. In animals like dogs, cats etc. spleen actually contracts during exercise and on adrenaline injection, thus ejecting the stored blood in the general circulation. In the case of human beings this reserve is put into circulation by the flushing action of augmented haemodynamic state of circulation. There is loss of water from the blood during muscular work which reduces the total blood volume and increases the concentration of blood. It has been reported that in man the spleen can expel 110 to 258 ml of blood into the general circulation (2). The blood in the spleen is more concentrated and contains as much as 40% more red blood cells than normal blood. Exercise

TABLE II: Showing haematological changes during exercise in 30 healthy females.

Sl. No.	Item	Mean value (\pm S.D.) before exercise	Mean value (\pm S.D.) after exercise	% changes	p Value
1.	Mean cell diameter in μ	7.4 \pm 0.4	7.6 \pm 0.4	+2.1	>.05
2.	Hb in gm %	13.3 \pm 1.2	14.3 \pm 0.8	+7.7	<.01
3.	RBC in million/cu mm	4.6 \pm 0.2	4.8 \pm 0.2	+4.0	<.01
4.	Colour index	0.9 \pm 0.1	1.0 \pm 0.6	+3.1	>.05
5.	Hct %	42.0 \pm 3.2	44.5 \pm 3.3	+6.0	<.01
6.	MCV in cu μ	91.3 \pm 8.4	93.1 \pm 6.0	+2.0	>.05
7.	MCH in μ/μ /gm	28.9 \pm 1.8	29.9 \pm 1.7	+3.6	<.05
8.	MCHC in gm/100 ml	31.6 \pm 1.5	32.1 \pm 0.9	+1.6	>.05
9.	Total leucocyte count/cu mm	6790 \pm 154.6	8560.0 \pm 195.0	+26.00	<.01
10.	Polymorph %	61.5 \pm 3.0	50.5 \pm 2.8	-18.0	<.01
11.	Lymphocyte %	28.0 \pm 2.1	38.4 \pm 3.4	+37.1	<.01
12.	Monocyte %	8.5 \pm 1.4	9.4 \pm 1.3	+10.6	>.05
13.	Eosinophil %	2.0 \pm 0.7	1.7 \pm 0.6	-15.0	>.05
14.	Polymorph/cu mm	4341 \pm 987.0	4166 \pm 1098.2	-4.0	>.05
15.	Lymphocyte/cu mm	1913 \pm 512.0	3296 \pm 774.2	+70.0	<.01
16.	Monocyte/cu mm	575.4 \pm 172.0	768.8 \pm 247.0	+33.6	<.01
17.	Eosinophil/cu mm	145.1 \pm 52.5	138.0 \pm 70.7	-4.8	>.05

At $p = 0.05$ level of significance (2.042)

also produces leucocytosis and the same can again be explained due to the "washing out" of the white blood corpuscles from the storage places of bone-marrow, lungs, spleen and liver (4).

Egoroff *et al.* (3) subdivided blood changes during exercise into three phases : (1) the lymphocyte phase characterised by an increase in circulating lymphocyte upto 55%, (2) the neutrophil phase characterised by an increase in circulating neutrophils, sometimes to 78% and (3) intoxication phase, during which the neutrophil % may rise to 90% and lymphocytes may drop to 5%. They also suggested that this classification could be used to find the degree of physical fitness of an individual. Considered in this light, the significant increase in lymphocyte count (63.7% in males and 70% in females $P < 0.01$) suggests that Master's two step exercise test is a mild physical exertion for normal healthy individuals. The decrease in eosinophil count though statistically insignificant ($P > 0.05$) suggests that the physical exercise is also a mild stress.

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