CHAPTER IV

RESULTS

Characteristics of the Subjects

The physical characteristics of the subjects in each study group are shown in Table 4.1. Mean and SD values of age, weight, height , heart rate and blood lactate concentration at rest of passive recovery (PR) group were 21.68 ± 2.06 yrs, 65.82 ± 8.18 kg, 172.74 ± 5.58 cm, 65.32 ± 7.95 bpm and 1.11 ± 0.43 mmol/l , respectively. Massage recovery (MR) group were 20.95 ± 1.99 yrs, 69.59 ± 9.01 kg, 175.80 ± 6.65 cm, 64.25 ± 7.93 bpm and 1.12 ± 0.31 mmol/l , respectively. Active recovery (AR) group were 21.50 ± 2.63 yrs, 66.78 ± 9.32 kg, 174.06 ± 4.28 cm, 63.89 ± 7.40 bpm and 1.15 ± 0.38 mmol/l , respectively. Mean and SD values of maximum heart rate, peak oxygen consumption, maximum workload and exercise time during test of PR group were 185.26 ± 9.81 bpm, 48.09 ± 5.71 ml/kg/min, 235.79 ± 24.11 watts and 13.63 ± 1.78 min, respectively. MR group were 181.55 ± 8.38 bpm, 50.47 ± 7.05 ml/kg/min, 238.25 ± 29.92 watts and 13.74 ± 1.55 min, respectively. AR group were 180.94 ± 7.30 bpm, 49.51 ± 7.07 ml/kg/min, 236.94 ± 26.46 watts and 13.52 ± 2.24 min, respectively. The subjects in all 3 groups were not significantly different.

Blood lactate concentration and time during recovery in various modes

Blood lactate concentration of PR and AR were not significantly different at 0 (9.68 ± 1.46 and 9.39 ± 1.62 mmol/l) and 5 min (12.17 ± 1.93 and 10.73 ± 1.95 mmol/l) similar to between PR and MR but both two comparing groups, PR and AR, PR and MR were significantly different at 10 min (11.43 ± 2.18 and 9.11 ± 2.07 , 11.43 ± 2.18 and 9.37 ± 1.45 mmol/l) , 15 min (9.75 ± 1.91 and 7.56 ± 1.93 , 9.75 ± 1.91 and 8.05 ± 1.32 mmol/l), 20 min (7.98 ± 1.68 and 5.95 ± 1.68 , 7.98 ± 1.68 and 6.62 ± 1.08 mmol/l), and 30 min(5.98 ± 1.42 and 3.56 ± 1.26 , 5.98 ± 1.42 and 4.95 ± 0.83 mmol/l) at $p < 0.01$ and $p < 0.05$, respectively. Between AR and MR blood lactate concentrations were significantly different only at 30 min ($p < 0.05$) as shown in Table 4.1 and Figure 4.1.

Half life of PR AR and MR were significantly different at $p < 0.05$ (28.21 ± 4.85, 21.72 ± 4.38 and 25.75 ± 4.67 min) as shown in Table 4.2.

Heart rate and time during recovery in various modes

Figure 4.2 illustrates the changes in heart rate following various modes of recovery. Immediately, post exercise of all 3 groups (PR, AR and MR) showed the highest heart rate (185.26 ± 9.81, 180.94 ± 7.30 and 181.55 ± 8.38 bpm, respectively) were not significantly different. It was found that the mean of heart rate decreased rapidly at 5 min and slowly decreased untill 30 min (89.37 ± 10.30, 111.11 ± 11.80 and 78.60 ± 8.17 bpm, respectively). The heart rate of PR, AR and MR groups were significantly different at $p < 0.05$.

Oxygen consumption following various modes of recovery

Figure 4.3 illustrates the oxygen consumption following various modes of recovery. Immediately, post exercise of all 3 groups (PR, AR and MR) showed the mean of VO_2 decreased rapidly at 5 min and slowly decreased untill 30 min (0.25, 0.75 and 0.35 l/min., respectively). The oxygen consumption of PR and MR group were not significantly different but both two groups were significantly different with AR at $p < 0.05$.

Carbon dioxide production following various modes of recovery

Figure 4.4 illustrates the carbon dioxide production following various modes of recovery. Immediately, post exercise of all 3 groups (PR, AR and MR) showed the mean of VCO_2 decreased rapidly at 5 min and slowly decreased untill 30 min (0.21, 0.66 and 0.28 l/min., respectively). The carbon dioxide production of PR and MR group were not significantly different but both two groups were significantly different with AR at $p < 0.05$.

Respiratory exchange ratio following various modes of recovery.

Figure 4.5 illustrates the changes in respiratory exchange ratio following various modes of recovery. Immediately, post exercise of all 3 groups (PR, AR and MR) showed the mean of RER (VCO_2/VO_2) increased rapidly between 0-5 min and decreased untill 30 min. The respiratory exchange ratio of PR and MR group were not significantly different but both two groups were significantly different with AR at $p < 0.05$.

Table 4.1. The characteristics data of the subjects (n = 57).

Group	Passive recovery n = 19	Massage recovery n = 20	Active recovery n = 18
Age (Year)	21.68 ± 2.06	20.95 ±1.99	21.50 ±2.63
Weight (kg)	65.82 ± 8.18	69.59 ± 9.01	66.78 ± 9.32
Height (cm)	172.74 ± 5.58	175.80 ± 6.65	174.06 ± 4.28
HRrest (bpm)	65.32 ±7.95	64.25 ± 7.93	63.89 ± 7.40
[LA] rest (mmol/l)	1.11 ± 0.43	1.12 ± 0.31	1.15 ± 0.38
HR max (bpm)	185.26 ± 9.81	181.55 ± 8.38	180.94 ± 7.30^{NS}
VO_2max (ml/kg/min)	48.09 ± 5.71	50.47 ± 7.05	49.51 ± 7.07^{NS}
WLmax (Watts)	235.79 ± 24.11	238.25 ± 29.92	236.94 ± 26.46^{NS}
ET (min)	13.63 ± 1.78	13.74 ± 1.55	13.52 ± 2.24^{NS}

NS = No significant difference at $p > 0.05$.

Data are expressed as mean ± SD. Maximum heart rate (HRmax), peak oxygen consumption (VO_2max), maximum workload (WLmax) and exercise time (ET) were recorded during test.

Table 4.2. Blood lactate concentration following various modes of recovery.

Modes of recovery	Recovery blood lactate (mmol/l)						
	0 min	5 min	10 min	15 min	20 min	30 min	Half life (min)
Passive recovery	9.68 ± 1.46	12.17 ± 1.93	11.43 ± 2.18	9.75 ± 1.91	7.98 ± 1.68	5.98 ± 1.42	28.21 ± 4.85
Active recovery	9.39 ± 1.62^{NS}	10.73 ± 1.95^{NS}	9.11 ± 2.07**	7.56 ± 1.93**	5.95 ± 1.68**	3.56 ± 1.26**	21.72 ± 4.38*
Massage recovery	9.47 ± 1.23^{NS}	11.03 ± 1.72^{NS}	9.37 ± 1.45*	8.05 ± 1.32*	6.62 ± 1.08*	4.95 ± 0.83*	25.75 ± 4.67*

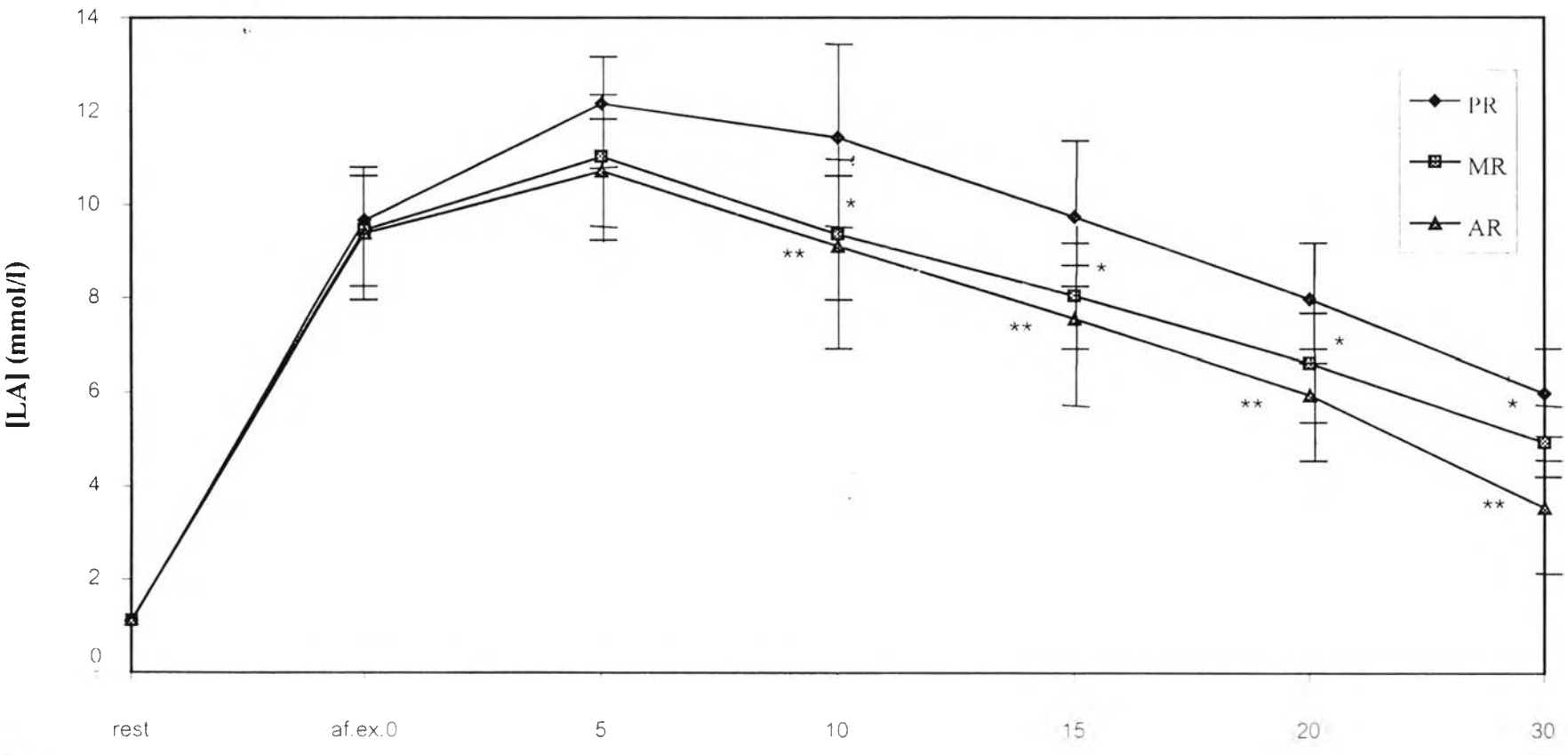
Values are expressed as mean ± SD.

NS = No significant difference

* = Significant difference ($P < 0.05$)

** = Significant difference ($P < 0.01$)

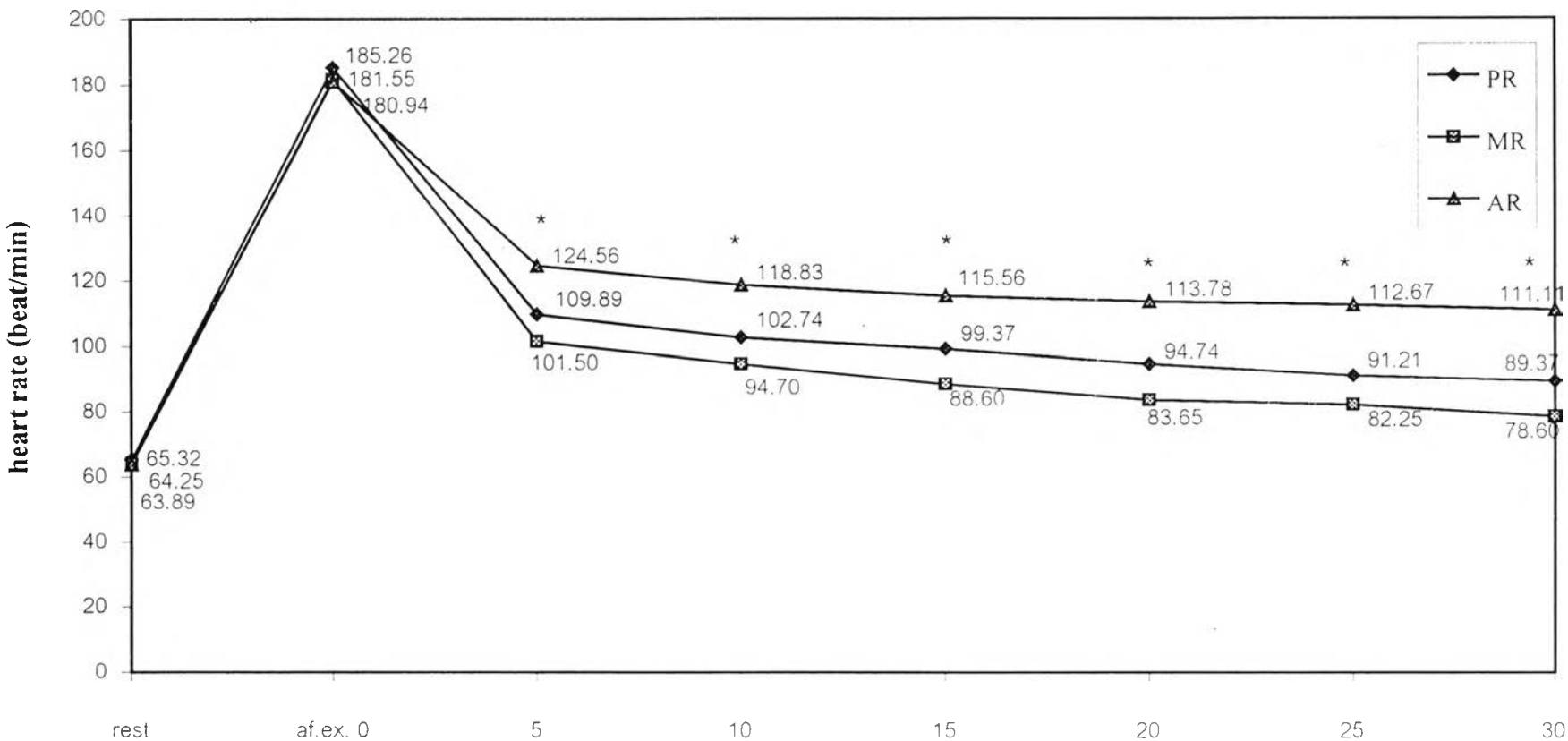
Figure 4.1. Blood lactate concentration following various modes of recovery.



* = Significant difference (P < 0.05).

** = Significant difference (P< 0.01).

Figure 4.2. Changes in heart rate following various modes of recovery.



* = significant difference ($p < 0.05$)

Figure 4.3. Changes in oxygen consumption following various modes of recovery.

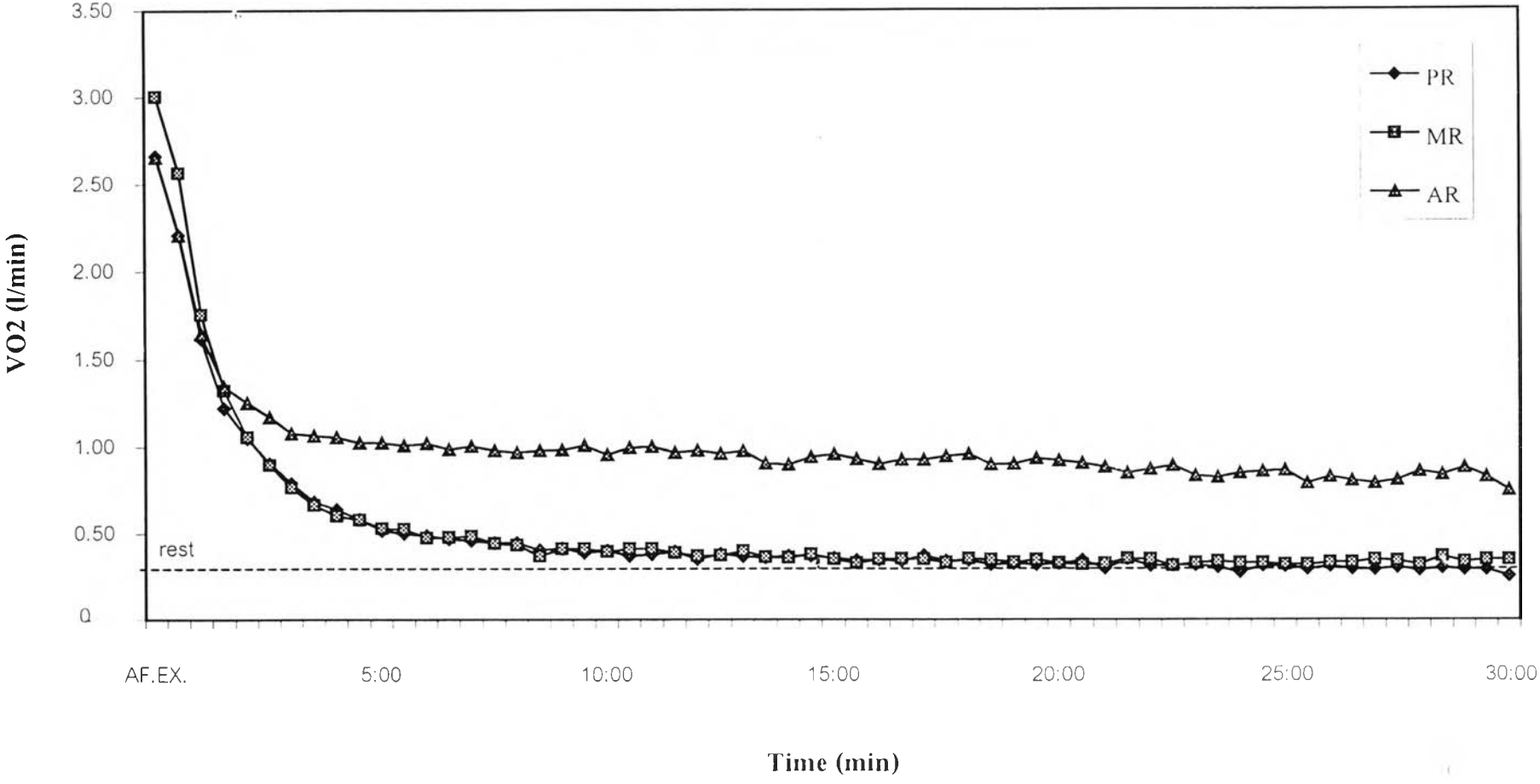


Figure 4.4. Changes in carbon dioxide production following various modes of recovery

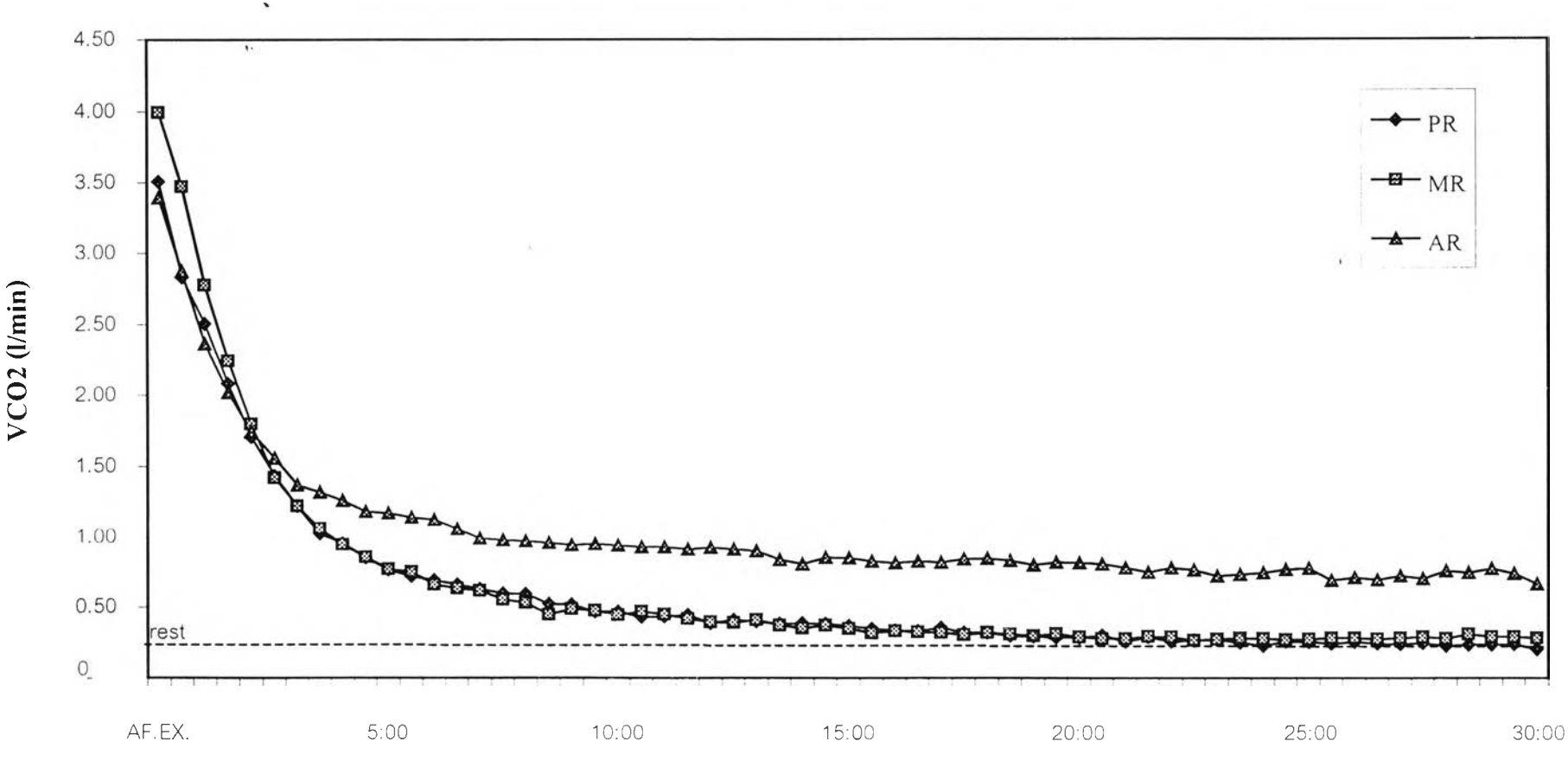


Figure 4.5. Changes in respiratory exchange ratio following various modes of recovery.