

## CHAPTER IV

### RESULTS

Physical characteristics of the subjects are showed in the Table 3. The means ( $\pm$ SD) of age, height, weight, body fat percentage and  $VO_2$ max value for the players were  $22\pm 5$  yrs,  $159\pm 7$  cm,  $54.6\pm 4.9$  kg,  $23.5\pm 3.5$  % and  $41.5\pm 5.1$  ml/kg/min, respectively.

Table 4 shows means ( $\pm$ SD) of all subjects (pool) and playing position responses to match-play; mean HR, mean  $VO_2$ , %  $VO_2$ max and energy expenditure (kcal/min and MJ) were  $140\pm 8$  beats/min,  $22.2\pm 4.7$  ml/kg/min,  $53.6\pm 9.9$  %  $VO_2$ max and  $6\pm 1.2$  kcal/min, respectively. The mean HR during match-play was  $143\pm 1$  beat/min in the Back-group,  $146\pm 3$  beat/min in the Right inside-group, and  $130\pm 5$  beat/min in the Left inside-group. The mean  $VO_2$  during match-play was  $24.6\pm 5.6$  ml/kg/min in the Back-group,  $23.7\pm 2.4$  ml/kg/min in the Right inside-group,  $18.2\pm 2.9$  ml/kg/min in the Left inside-group. The means ( $\pm$ SD) of exercise intensity (%  $VO_2$ max) during match-play was  $61.9\pm 5.9$  % in the Back-group,  $54.4\pm 7.5$  % in the Right inside and  $44.5\pm 7.8$  % in the Left inside-group. The energy expenditure demanded of Back, Right inside and Left inside playing position are  $6.4\pm 1.1$  kcal/min,  $6.7\pm 0.9$  kcal/min and  $5.0\pm 0.7$  kcal/min, respectively. In term of physiological strain, the averaged values of HR of each group were converted to the estimated energy expenditure as showed in table 4. The results indicated that the Right inside-group demanded the greatest degree of energy expenditure (7 kcal/min), while

The Left inside-group demanded the least (5 kcal/min). An entire match (45 min) required players to expenditure approximately  $271 \pm 52$  kcal ( $1.1 \pm 2$  MJ.)

Figure 9 shows the mean HR of the Back and Right inside-group were significantly higher than the Left inside-group ( $p < 0.05$ ).

Figure 10 shows the mean  $VO_2$  (ml/kg/min) of the Back and Right inside-group were significantly higher than the Left inside-group ( $p < 0.05$ ).

Figure 11 shows the value of  $\%VO_{2max}$  of the Back-group was significantly higher than the Right and Left inside-group ( $p < 0.05$ ) and the Right inside-group was significantly higher than the Left inside-group ( $p < 0.05$ ).

Figure 12-15 show the energy expenditure (kcal/min, kJ/min, kcal and MJ) of the Right inside-group was significantly higher than the Left inside-group ( $p < 0.05$ ) but it was not significantly different from the value of the Back-group ( $p > 0.05$ ).

Figure 16 shows a typical heart rate trace recorded during data collection was  $45 \pm 5$  minutes (included two to three set) and the relationship between HR and oxygen uptake (HR-  $VO_2$  regression line) obtained during cycle ergometer pedaling for a female elite player. The means ( $\pm$ SD) HR are  $140 \pm 8$  beats/min for the entire match are converted to a  $VO_2$  of  $22.2 \pm 4.7$  ml/kg/min, or  $53.6 \pm 9.9\%VO_{2max}$ , which was calculated by HR- $VO_2$  regression line, corresponding to an energy production of about 1133 kJ (271 kcal).

Table 5 and Figures 17-18 show a mean percentage energy expenditure contribution responses to match-play of all subjects playing position. The energy contribution of anaerobic system (LA), anaerobic-aerobic system (LA-O<sub>2</sub>), and aerobic system (O<sub>2</sub>) are 25%, 43%, and 32%, respectively. The mean LA, LA-O<sub>2</sub>, and O<sub>2</sub> during match-play of the Back-group are 28%, 52%, and 20%, respectively. The mean LA, LA-O<sub>2</sub>, and O<sub>2</sub> during match-play of the Right inside-group are 30%, 40%, and 30%, respectively. The mean LA, LA-O<sub>2</sub>, and O<sub>2</sub> during match-play of the Left inside-group are 15%, 38%, and 47%, respectively. (see in chapter 2 and 3 on page 23 and 30, respectively).

Table3. Physical characteristics of the subjects.

| N.cases | Age<br>(years) | Height<br>(cm) | Weight<br>(kg) | %<br>body fat | VO <sub>2</sub> max<br>(ml/kg/min) | AT<br>(bpm) | HRmax<br>(bpm) |
|---------|----------------|----------------|----------------|---------------|------------------------------------|-------------|----------------|
| 15      | 22<br>±5       | 159<br>±7      | 54.6<br>±4.9   | 23.5<br>±3.5  | 41.5<br>±5.1                       | 147<br>±8   | 179<br>±7      |

Values are means ± SD.

Table 4. Playing position responses to competitive match play.

| Playing<br>Position                 | Pool<br>(N=15) | Back<br>(n=5) | Right Inside<br>(n=5) | Left Inside<br>(n=5) |
|-------------------------------------|----------------|---------------|-----------------------|----------------------|
| Mean HR<br>(beats/min)              | 140±8          | 143±1         | 146±3                 | 130±5                |
| Mean VO <sub>2</sub><br>(ml/kg/min) | 22.2±4.7       | 24.6±5.6      | 23.7±2.4              | 18.2±2.9             |
| % VO <sub>2</sub> max               | 53.6±9.9       | 61.9±5.9      | 54.4±7.5              | 44.5±7.8             |
| Exp. (kcal/min)                     | 6.0±1.2        | 6.4±1.1       | 6.7±0.9               | 5.0±0.7              |
| Exp. (kJ/min)                       | 25.1±4.8       | 26.7±4.6      | 28.0±3.6              | 20.7±3.0             |
| Exp. (kcal(total))                  | 271±52         | 287±50        | 302±39                | 223±33               |
| Exp. (MJ(Total))                    | 1.1±0.2        | 1.2±0.2       | 1.3±0.2               | 0.9±0.1              |

Values are means ± SD.

Table 5. The energy expenditure contribution responses to match-play.

| Playing Position   | Anaerobic System (LA) (%) | Anaerobic-Aerobic system (LA-O <sub>2</sub> ) (%) | Aerobic system (O <sub>2</sub> ) (%) |
|--------------------|---------------------------|---|--------------------------------------|
| Pool (N=15)        | 25±8                      | 43±8  | 32±9                                 |
| Back (n=5)         | 28±9                      | 52±10   | 20±7                                 |
| Right inside (n=5) | 30±10                     | 40±8  | 30±9                                 |
| Left inside (n=5)  | 15±7                      | 38±8  | 47±6                                 |

The data analysis from Polar software (Polar Precision Performance 2.0).

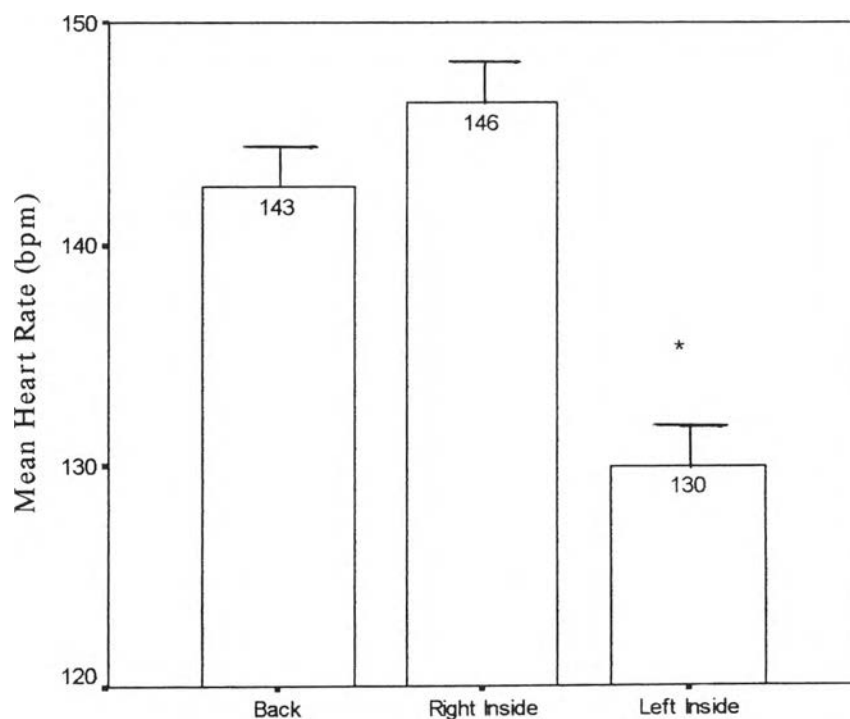


Figure 9. Means±SD of HR of all playing positions are showed.

\* Significant difference from the Back and Right inside group (p<0.001).

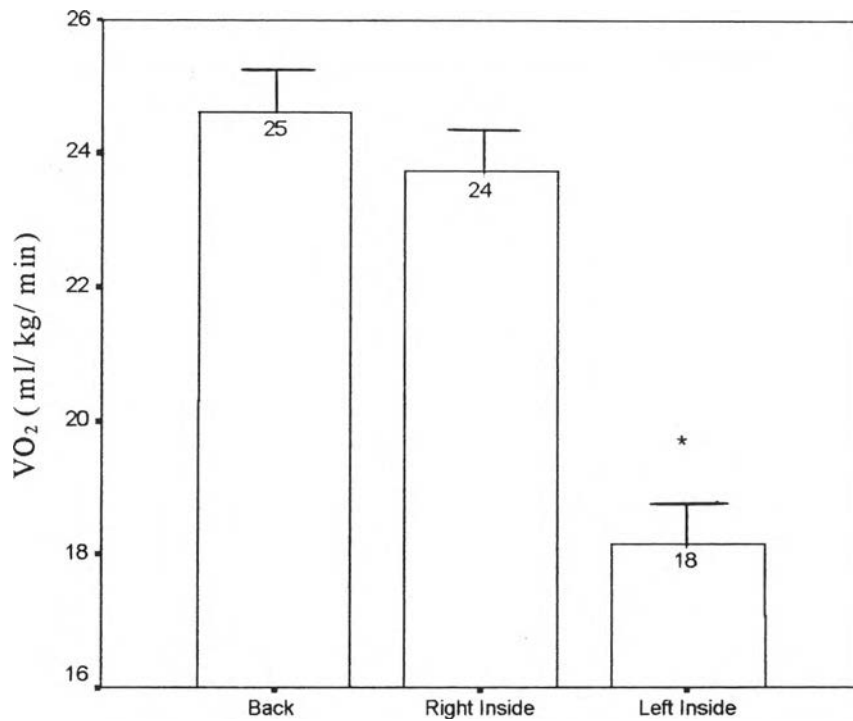


Figure 10. Means $\pm$ SD of VO<sub>2</sub> of all playing positions are showed.

\* Significant difference from the Back and Right inside-groups ( $p = 0.001$ ).

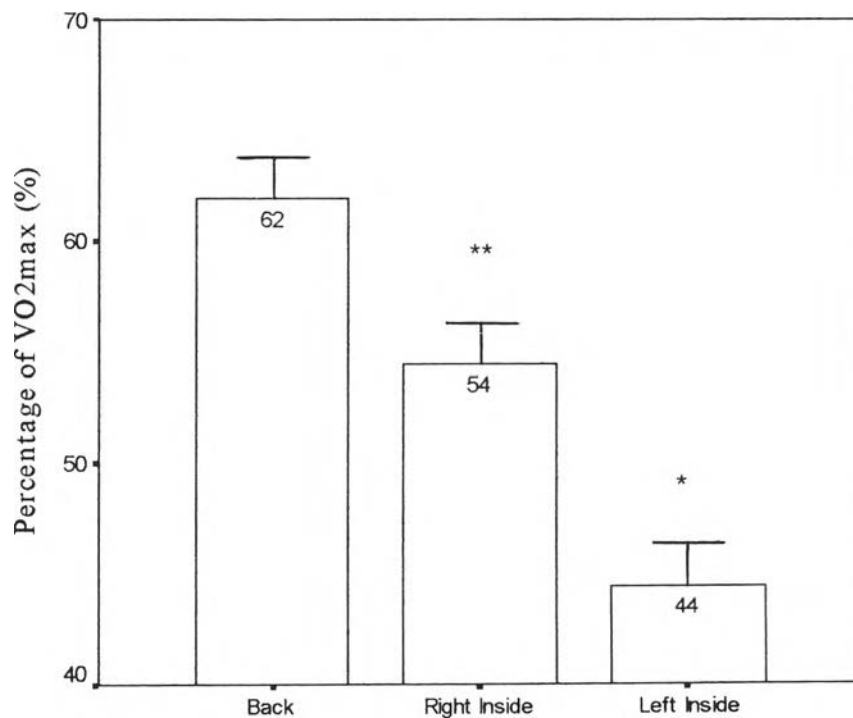


Figure 11. The value of % VO<sub>2</sub>max of all playing positions are showed.

\* Significantly difference from the Back ( $p < 0.001$ ) and Right inside-group ( $p = 0.03$ ). \*\* Significantly difference from the Back group ( $p = 0.028$ ).

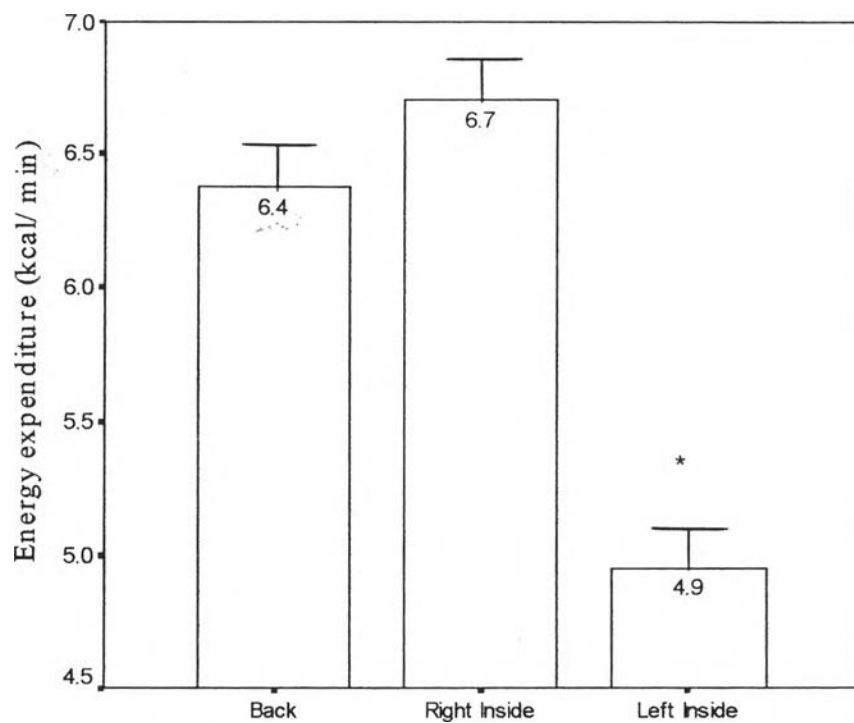


Figure 12. Means $\pm$ SD energy expenditure (kcal/min) of all playing positions are showed. \* Significant difference from the Right inside and Back group ( $p < 0.001$ ).

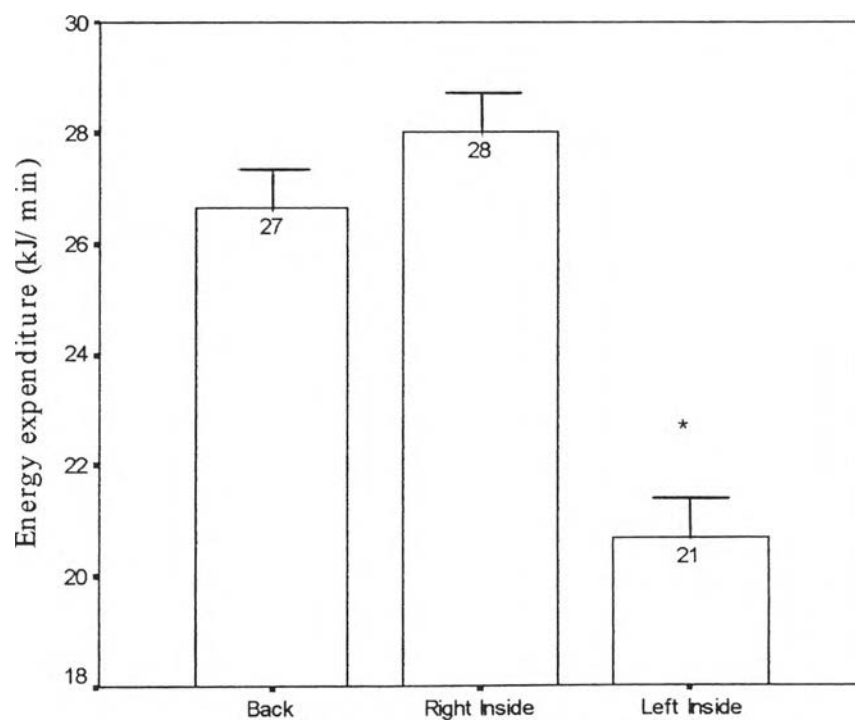


Figure 13. Means $\pm$ SD energy expenditure (kcal/min) of all playing positions are showed. \* Significant difference from the Right inside and Back group ( $p < 0.001$ ).

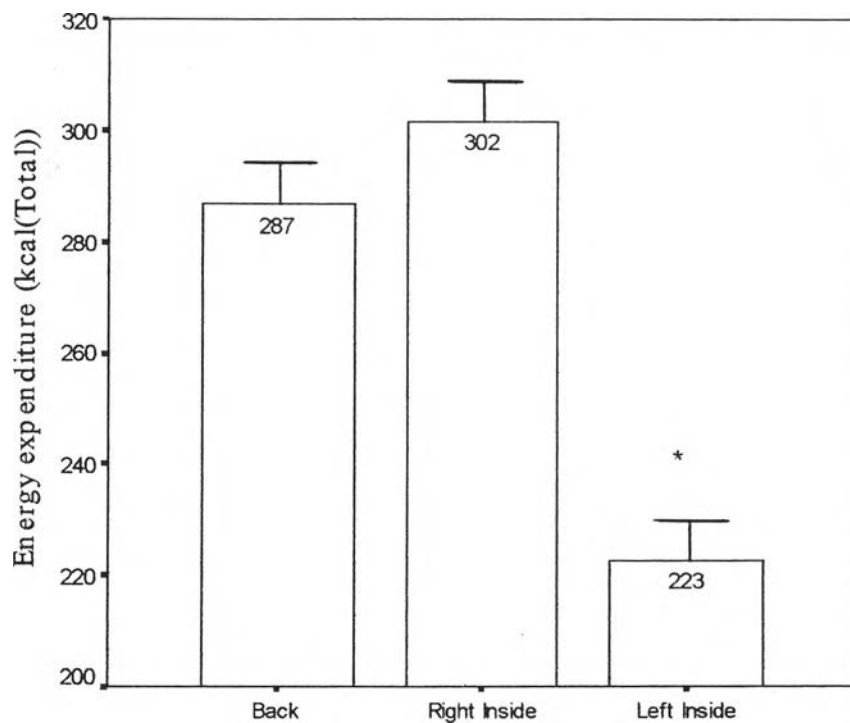


Figure 14. Means $\pm$ SD energy expenditure (kcal (Total)) of all playing positions are showed. \* Significant difference from the Right inside and Back group ( $p < 0.001$ ).

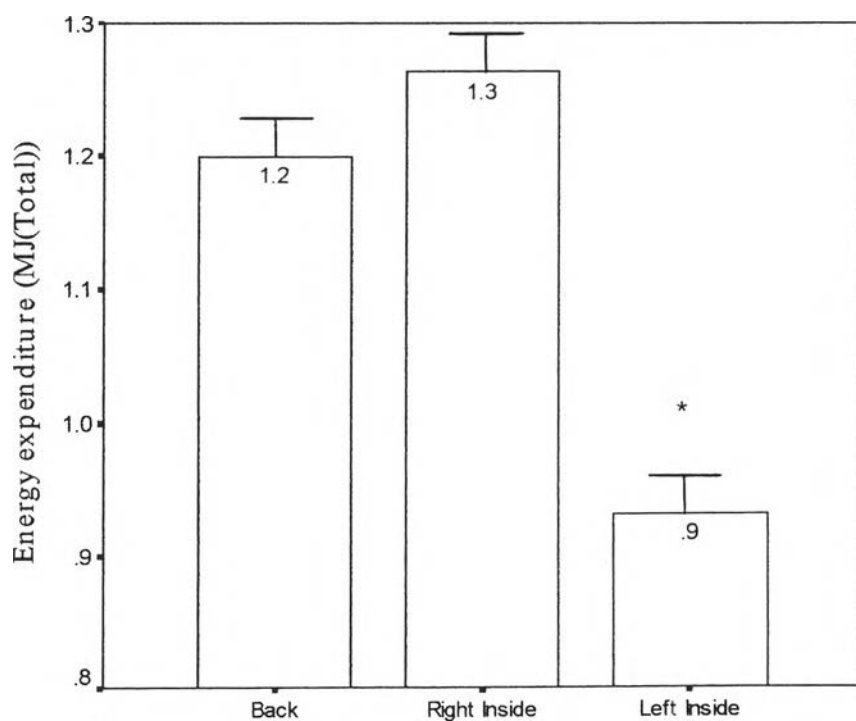


Figure 15. Means $\pm$ SD energy expenditure (MJ (Total)) of all playing positions are showed. \* Significant difference from the Right inside and Back group ( $p < 0.001$ ).



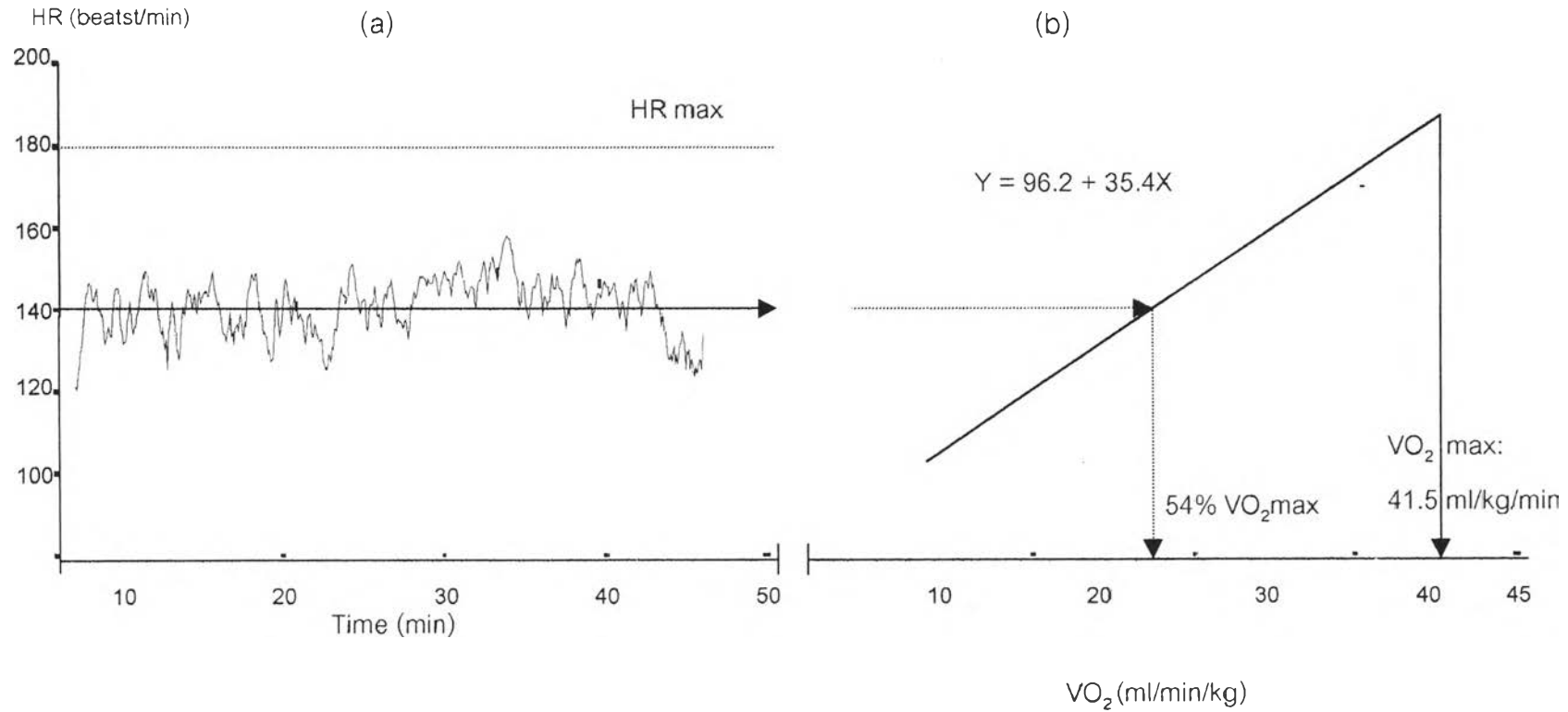


Figure 16 (a) Heart rate (HR) during a ST match and (b) the relationship between HR and oxygen uptake ( $VO_2$ ) obtained during cycle pedaling for female elite players.

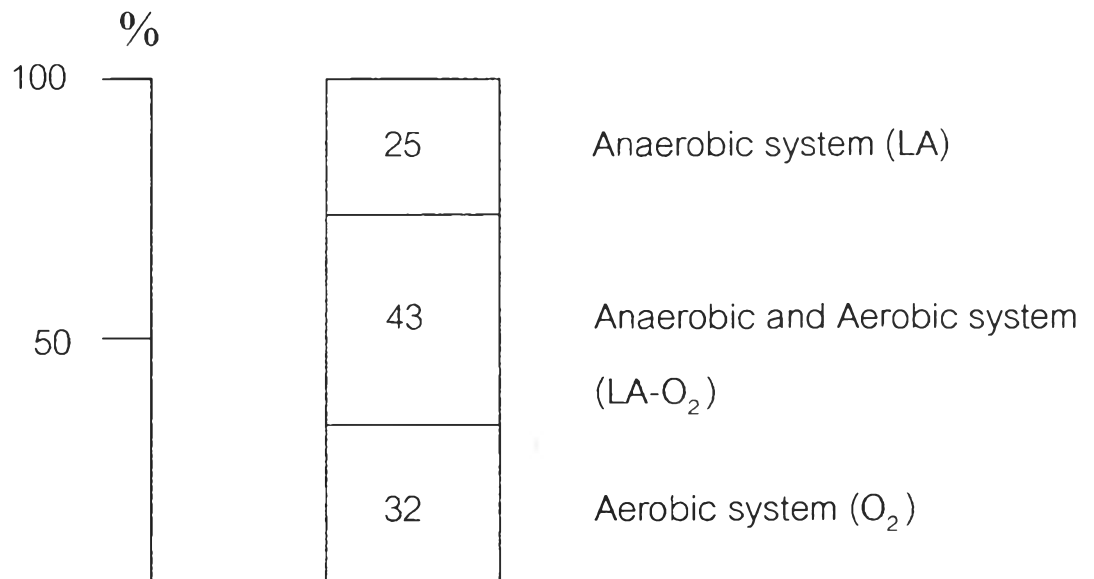


Figure 17 shows a mean energy contribution of all subjects.

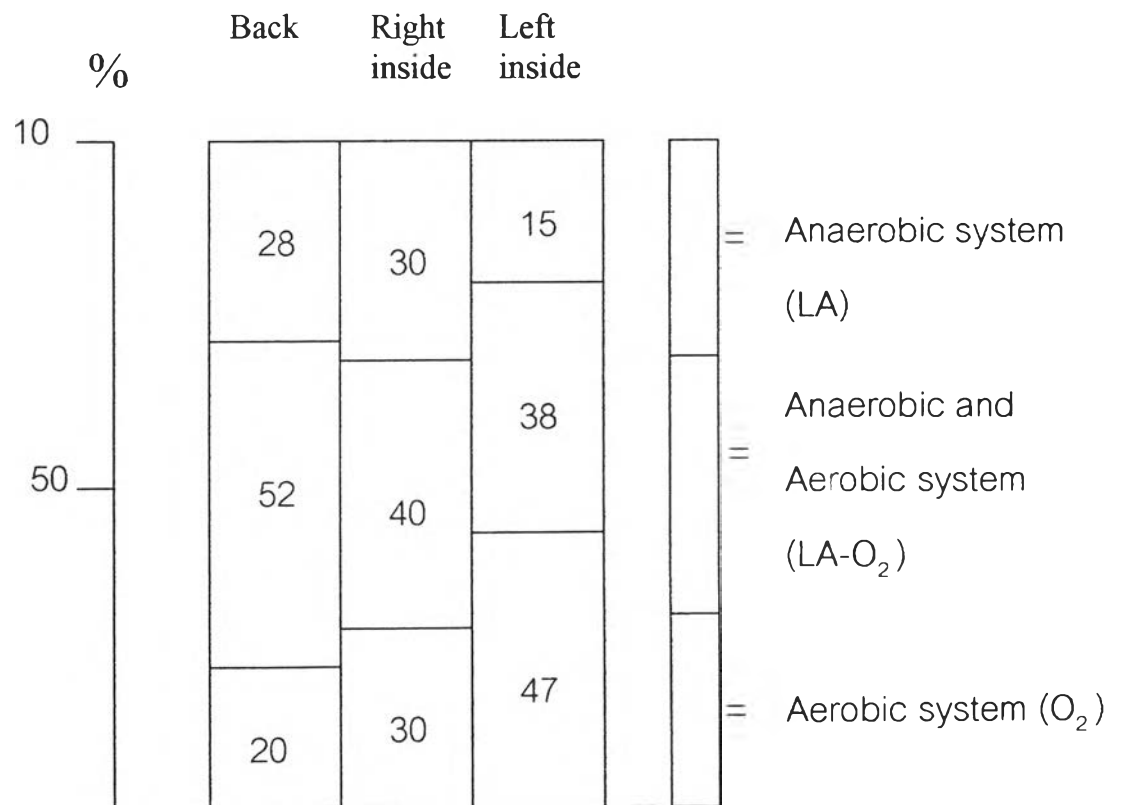


Figure 18 shows a mean energy contribution of each playing position player.