

# Influence of whole blood donation (~ 470ml) on peak power outputs over a 96h period

## ABSTRACT

**PURPOSE:** Previous studies investigating the effects of blood donation (BD) on power output (PO) concerning all out sprints appear elusive, therefore this study determined the effects of BD (~ 470ml) over a period of up to 96 hours on power output during four repeated 15s sprints. **METHOD:** Following local institutional ethical approval 12 participants, 9 males (age  $31.2 \pm 12.6$  years, mass  $84.3 \pm 11.1$  Kg, height  $176.9 \pm 6.9$  cm) and 3 females (age  $34.7 \pm 10.3$  years, mass  $67.0 \pm 8.5$  Kg, height  $167.1 \pm 4.2$  cm) volunteered to participate. Testing was conducted in the morning over a two week block with a rest week between testing phases. Visit one on week 1 (W1) established haematological levels and  $\dot{V}O_{2max}$ . Subsequent visits during W1 were for Sprint Interval Testing (SIT), with a resistance of  $0.07w \cdot kg^{-1}$  of body mass, with 90s of unloaded pedalling prior to each effort using a Lode Excalibur Sport cycle ergometer. Week 2 (W2) was identical except the participant donated blood on visit 1 post haematological testing only. Additionally throughout testing  $\dot{V}O_2$ , cardiac output, stroke volume and heart rate using thoracic impedance cardiography was computed, while Near Infrared Spectroscopy measured  $O_2$  delivery at the muscle. **RESULTS:** Hb on W2 day 1 ( $Hb=14.58 \pm 0.69g \cdot dL^{-1}$ ,  $Hct=42.83 \pm 2.04\%$ ) compared to day 2 post BD ( $Hb=13.52 \pm 0.95g \cdot dL^{-1}$ ,  $Hct=39.75 \pm 2.93\%$ ) reduced by 7.3% ( $P = 0.001$ ) Hb percentage decreases continued over SIT testing days 2-3 (2.3%) ( $P = 0.003$ ) and days 3-4 (2.1%) ( $P = 0.001$ ), a percentage increase (1.5%) ( $P < 0.001$ ) occurred between days 4-5.  $\Delta PPO$  (W) pre-BD on day 1 ( $73.8 \pm 182.5$ ), 2 ( $46.6 \pm 143.8$ ), 3 ( $25.8 \pm 75.3$ ) and 4 ( $35.7 \pm 95.6$ ) compared to post BD on day 1 ( $156.3 \pm 153.4$ ), 2 ( $147.25 \pm 123.8$ ), 3 ( $83.2 \pm 103.4$ ) and 4 ( $80.4 \pm 71.0$ ) revealed significance between pre-BD and post BD on day 2 ( $P = 0.01$ ). Mean PPO values reduced after each sprint on each testing day, with post BD values being generally higher than pre-BD values, however significance was only detected pre to post BD on day 2 ( $P = 0.02$ ) and 3 ( $P = 0.002$ ) in the first sprints. **CONCLUSIONS:** The data suggests that BD has significant effects on Hb and Hct up to 96 hours post BD. PPO appears most effected 48 and 72 hours following BD, possible explained by the decrement in Hb being greater 48-96-h post BD, this produced an effect of recruiting more high-threshold motor units due to the lack of circulating  $O_2$ . These data have possible ramifications for NHS guidelines relating to exercise post BD.

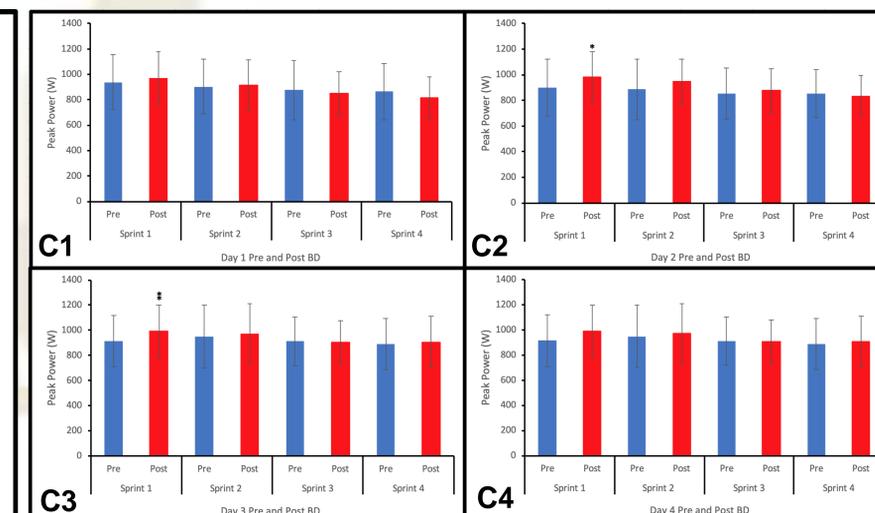
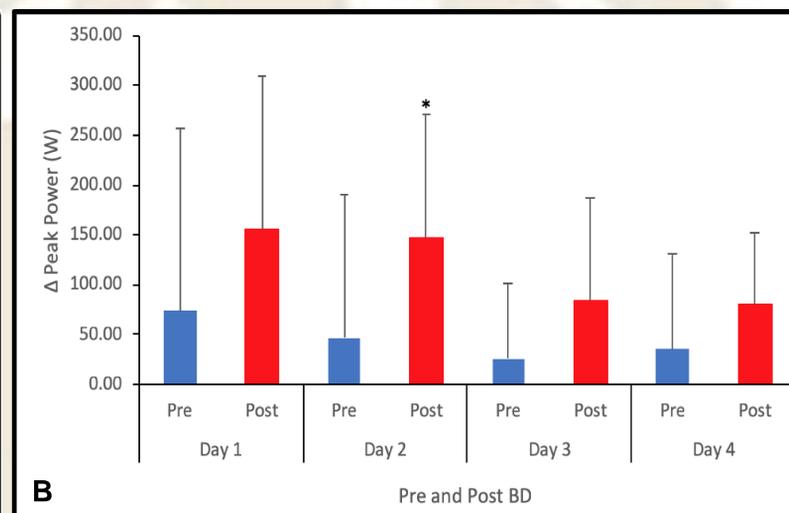
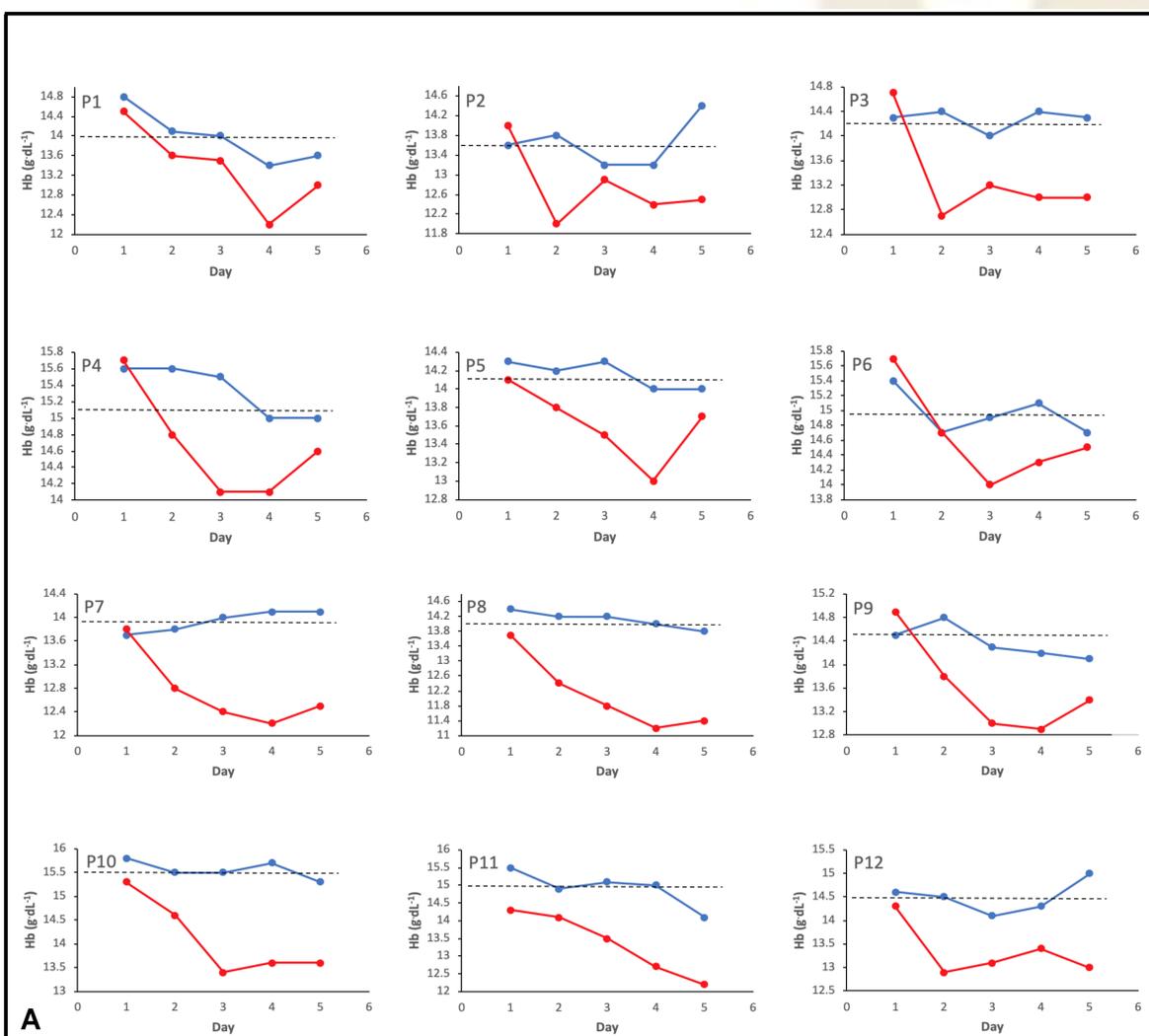
## INTRODUCTION

Haemoglobin (Hb) decreases following blood donation (BD) and post BD advice is to avoid strenuous exercise particularly in the first 12-24 hours. However, Hb levels appear to continue to decrease beyond the first 24 hours post BD, while high intensity interval type classes appear ever popular amongst the exercising population research is justified. Thus, this study determines the effects of BD over a period of up to 96 hours on Peak Power Output (PPO) during 4 repeated 15s sprints in a moderately trained population.

Following local institutional ethical approval 12 participants, 9 males, 3 females volunteered to participate. Testing was conducted in the morning over a two week period with a rest week between testing phases. Week one (W1) was pre-BD and week two (W2) was post BD (through NHS BD services). Visit one on W1 established haematological levels and  $\dot{V}O_{2max}$ . Subsequent visits during W1 were for Sprint Interval Testing (SIT) (4 x 15s with 90s of unloaded pedalling prior to each effort), with a resistance of  $0.07w \cdot kg^{-1}$  of body mass. W2 was identical except the participant donated blood on visit 1 post haematological testing only.

## METHOD

## RESULTS



## CONCLUSION

**Panel A** shows the heterogeneous Hb pre (blue) and post (red) BD for all participants, with the dotted line indicating the mean value for week 1. The mean Hb pre to post BD significantly ( $P = 0.01$ ) reduced, impacting the  $O_2$  carrying capacity of Hb up to 96 hours post BD. **Panel B** signifies  $\Delta PPO$  (from sprint 1 to 4) was significantly influenced up to 48 hours pre to post BD ( $P = 0.01$ ). The mean PPO values for sprints (**panels C1 to C4**) show reduced PPO throughout the course of the sprints conceivably indicating that with each sprint PCr restoration time is insufficient. However, 24 and 96 hours post BD (**panel C1 and C4**) an impairment of  $O_2$  availability was not affecting PPO ( $P > 0.05$ ), while PPO for sprint-1, 48 and 72 hours post BD was significantly ( $P = 0.001$  and  $P = 0.02$  respectively) increased. A possible explanation to the responses for PPO is that as the decrement in Hb was greater 48-96-h post BD, this produced an effect of recruiting more high-threshold motor units due to the lack of circulating  $O_2$ . These data have ramifications for NHS guidelines relating to exercise post BD because it appears that the continual fall in Hb is affecting physiology longer than 24 hours, which is the period suggested to be approached with caution regarding exercise.