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MILK: Sports Recovery Drink?

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Performance & Physiological Stress

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- **Strenuous exercise can result in:**
  - Muscle Damage (CK, LDH, Mb, sTnI)
  - Inflammation (IL-6, CRP)
  - Oxidative Stress (LOOH, PC)

- **Athletes experience:**
  - Muscle soreness
  - Reduced force output

- **Recovery Interventions**

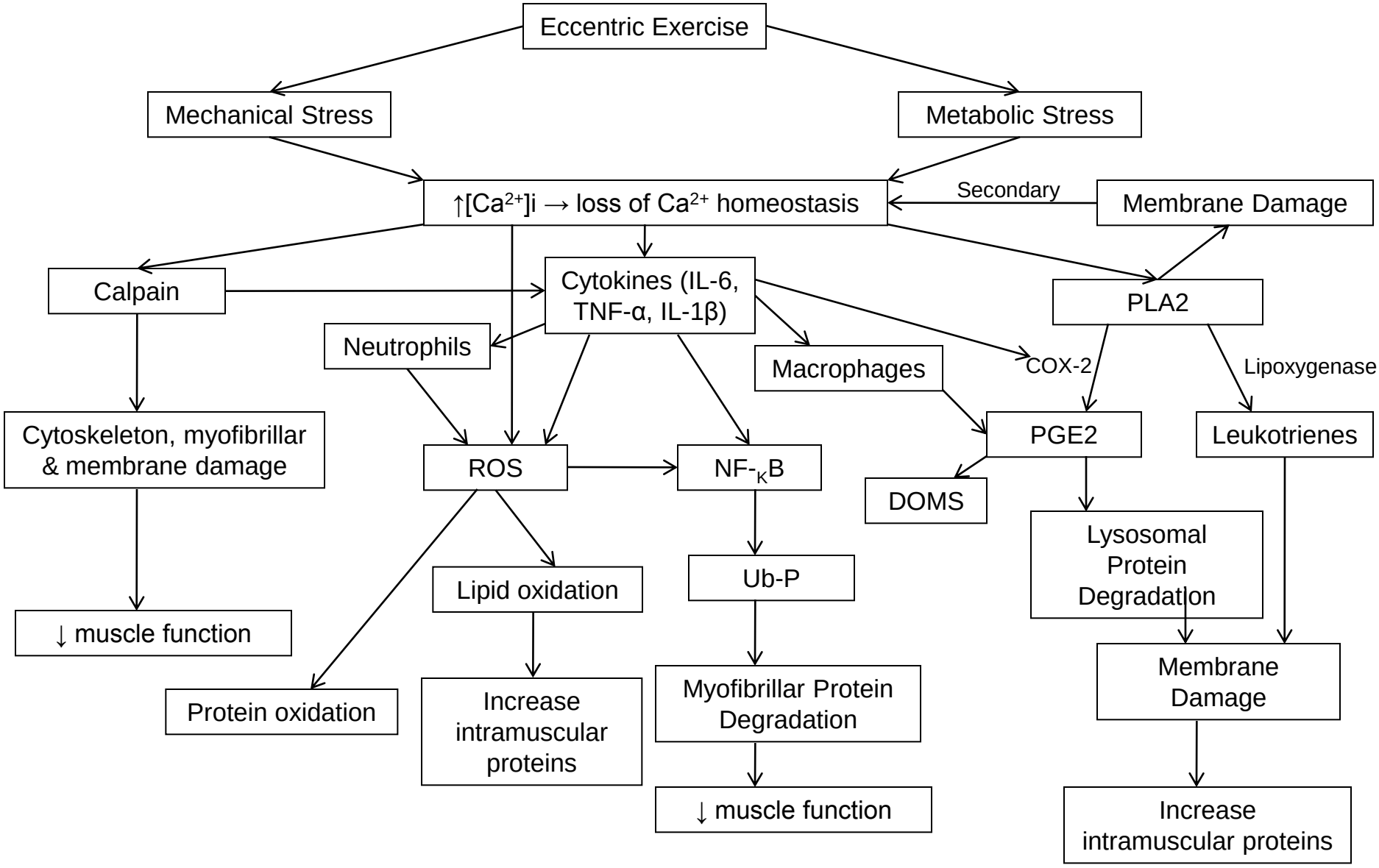
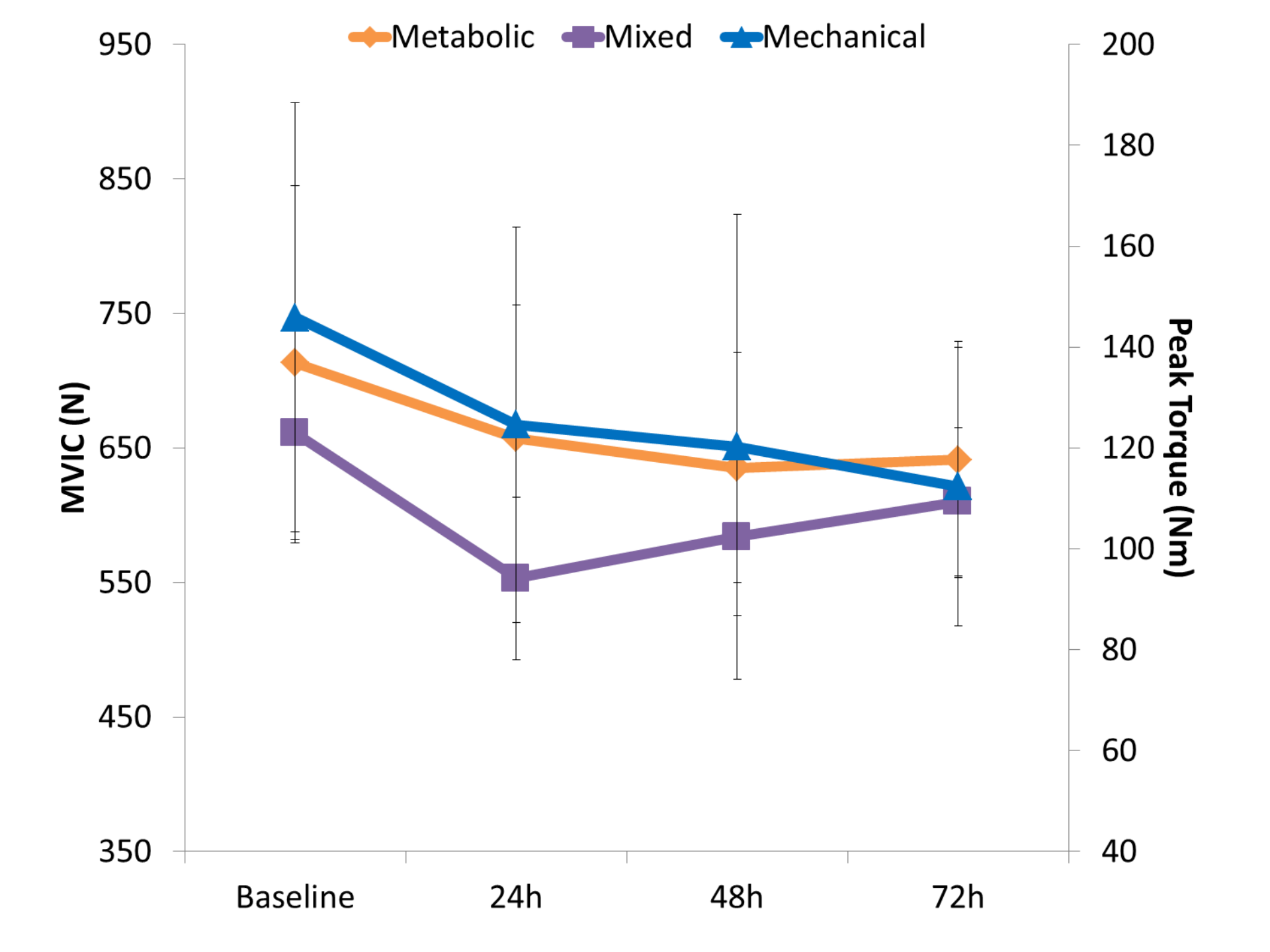
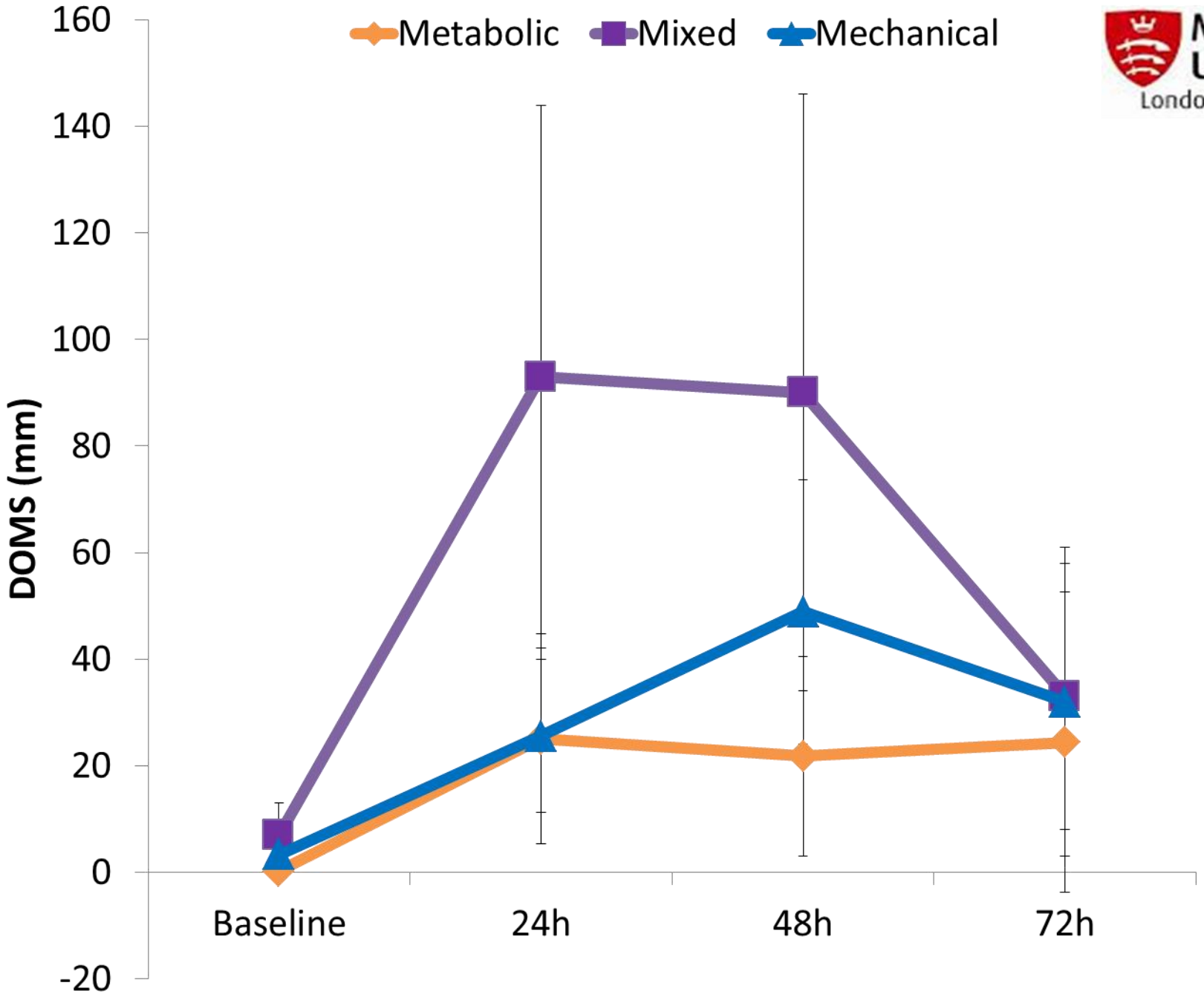


Figure 2.3 An overview of the postulated processes occurring during exercise-induced muscle damage.

COX-2 = cyclooxygenase-2; **DOMS** = delayed-onset of muscle soreness; **IL-6** = interleukin-6; **IL-1β** = interleukin-1beta; **NF-κB** = nuclear factor kappa-light-chain-enhancer of activated B cells; **PGE2** = prostaglandin E2; **PLA2** = phospholipase A2; **ROS** = reactive oxygen species; **TNF-α** = tumor necrosis factor-alpha; **Ub-P** = ubiquitin proteasome;


Metabolic
Mixed
Mechanical
950
850
750
650
550
450
350
MVIC (N)
200
180
160
140
120
100
80
60
40
Peak Torque (Nm)
Baseline
24h
48h
72h



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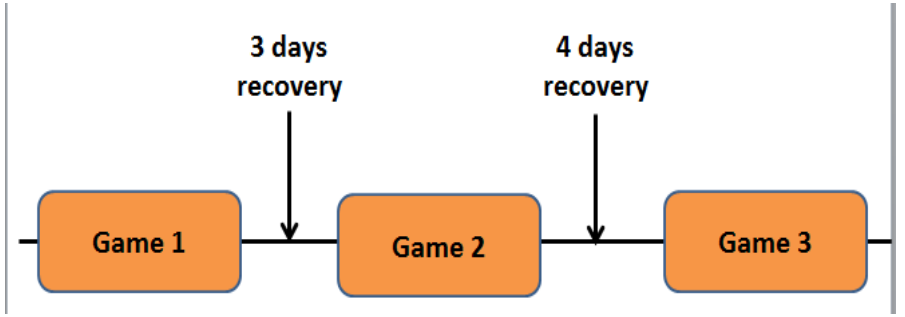
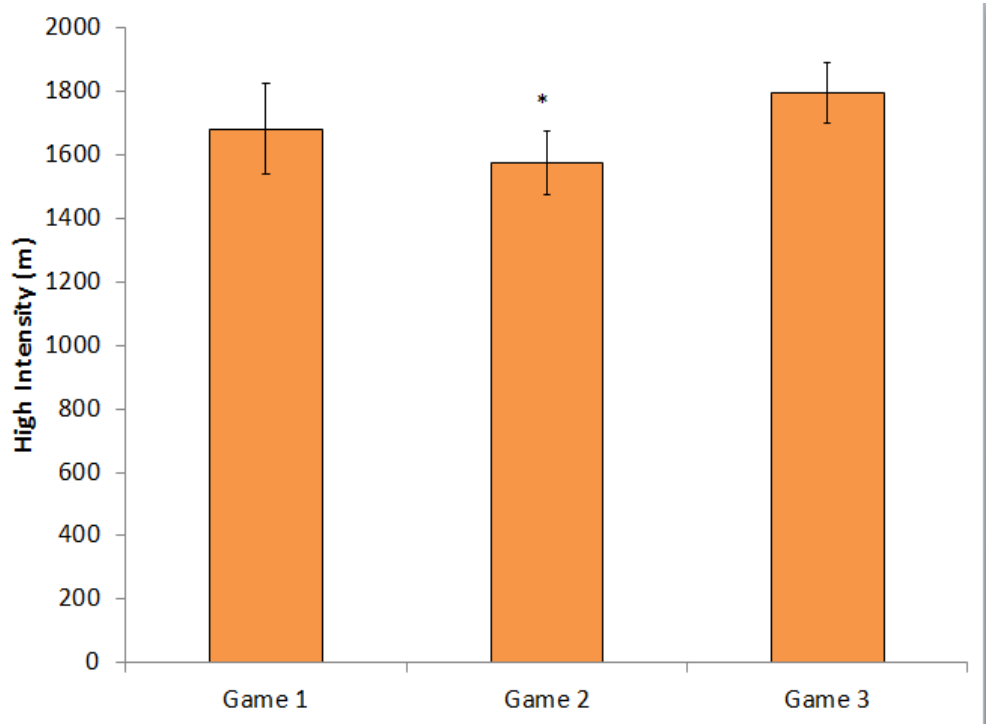
Bell *et al* (2014); Bell *et al* (2016) Cockburn *et al* (2011)

Repeating Optimal Performance

- **Olympic Schedule**
  - Women GB Team – 1 day recovery
- **Mohr et al (2015)**
  - DOMS, CK and oxidative stress increased after each game; greatest increase post G2; not returned to baseline levels post G2
  - RSA decreased 2 – 9% 3 days post game
  - Reduced high intensity running during G2





Mohr *et al* (2015)

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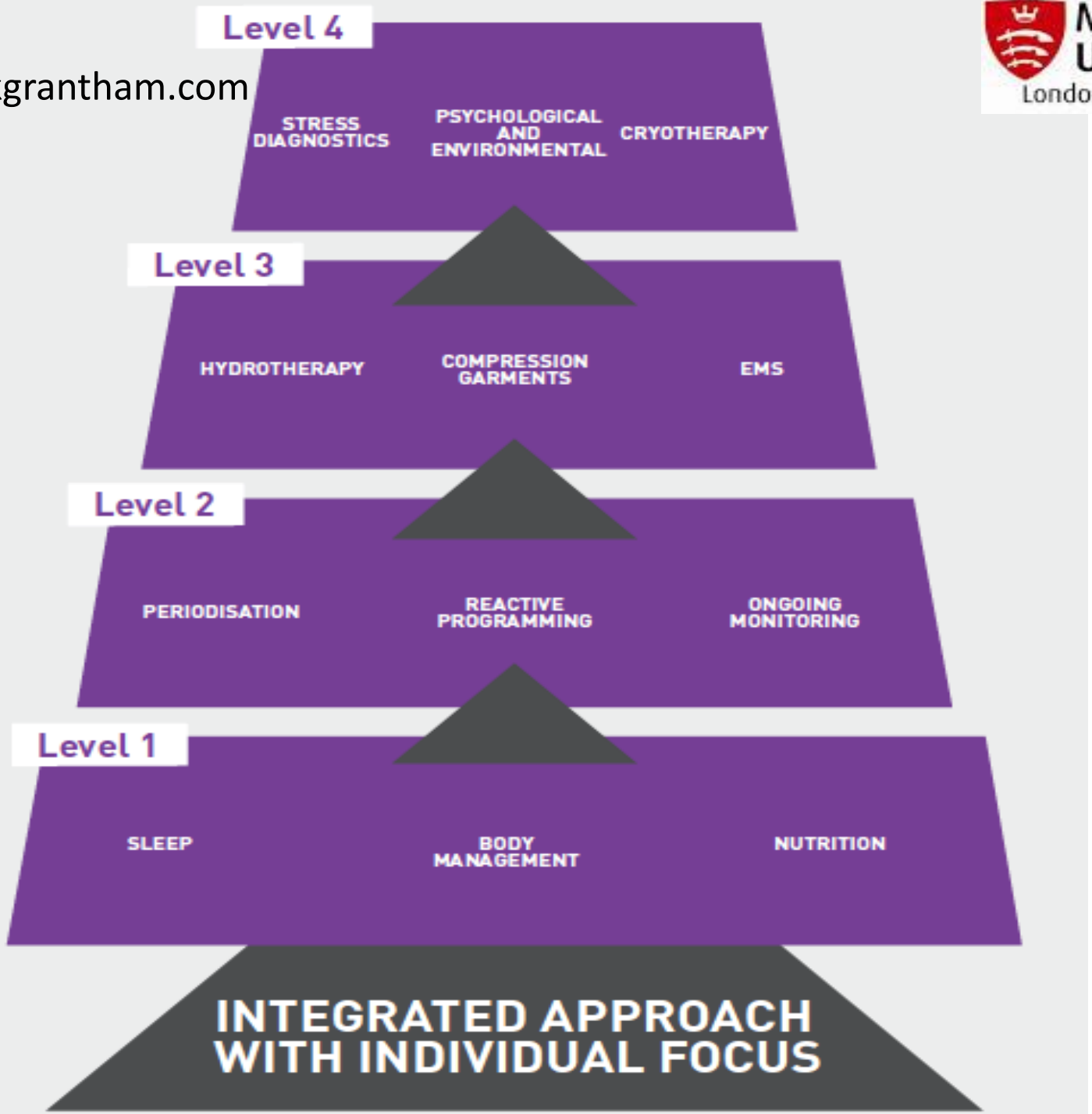
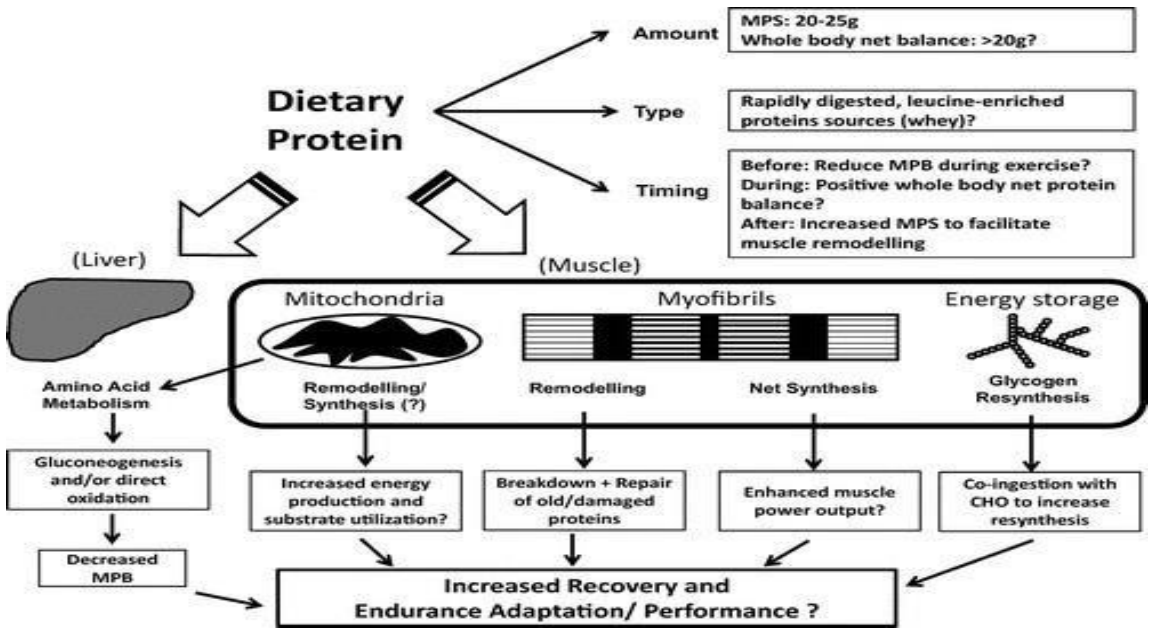


Why Milk?

- **What happens to protein balance after strenuous exercise, and the impact of protein intake?**

- **Pasiakos et al (2014)**
  - "benefits of protein supplementation on post-exercise muscle anabolism…….but to date when protein supplements are provided…….not resulted in measurable reductions in muscle damage and enhanced recovery of muscle function"
- **However……..**
  - Milk is a good source of protein & CHO
  - Evidence that milk leads to positive protein balance (Lunn et al, 2012; Elliot et al, 2006)



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Strenuous Exercise

Baseline Measures

24h Post Measures

48h Post Measures

72h Post Measures

E.g. DOMS; Blood markers; Muscle function

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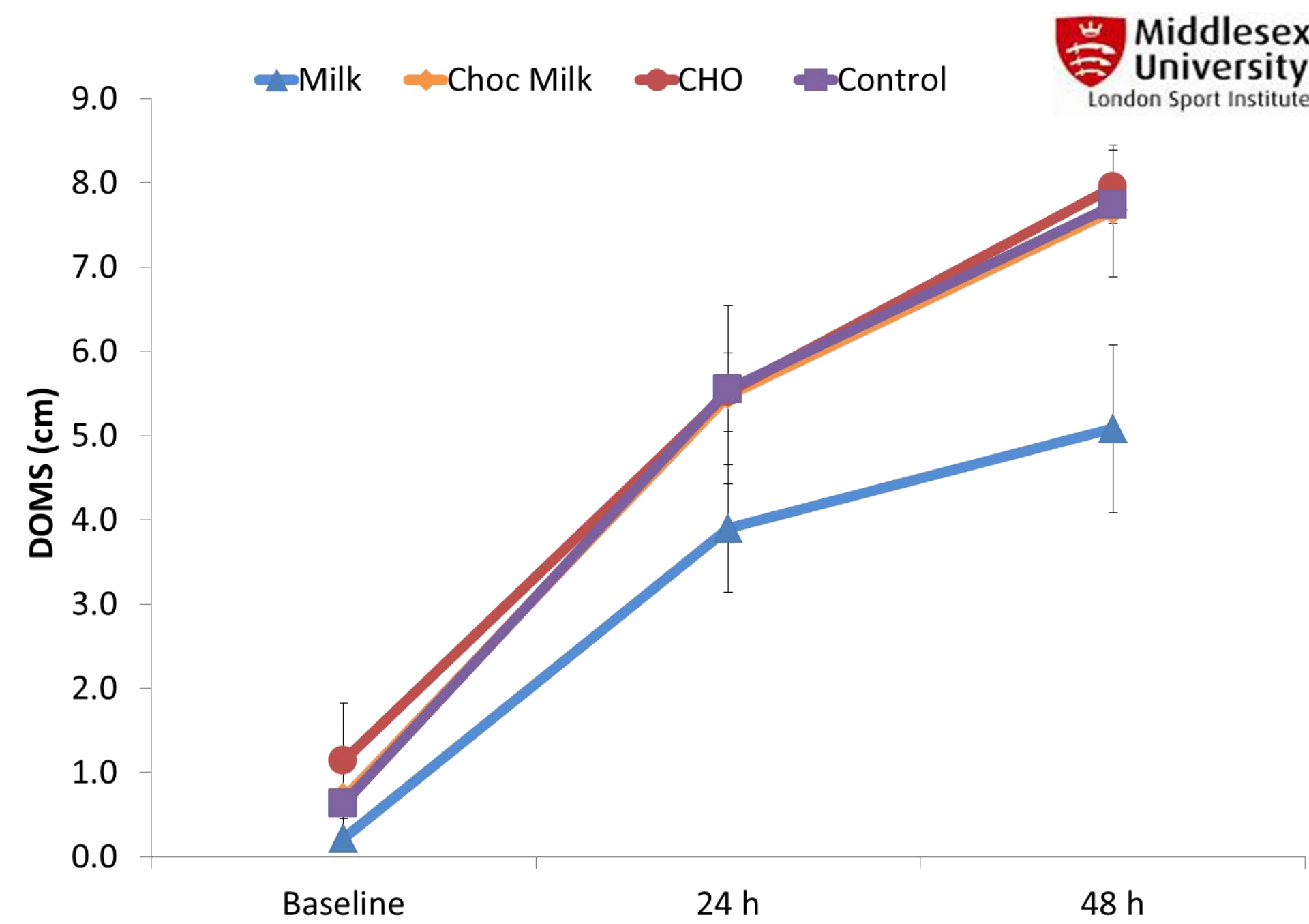
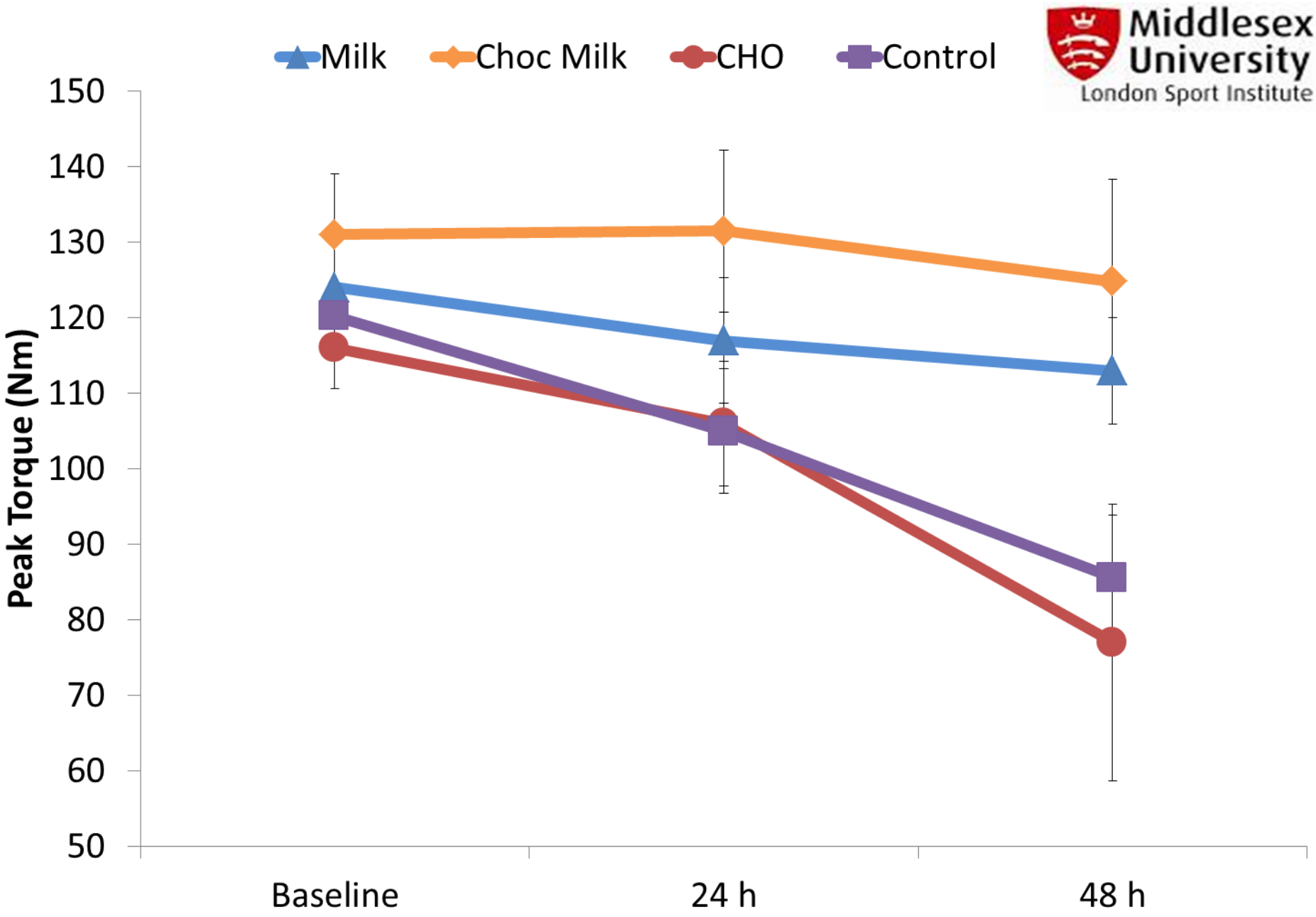
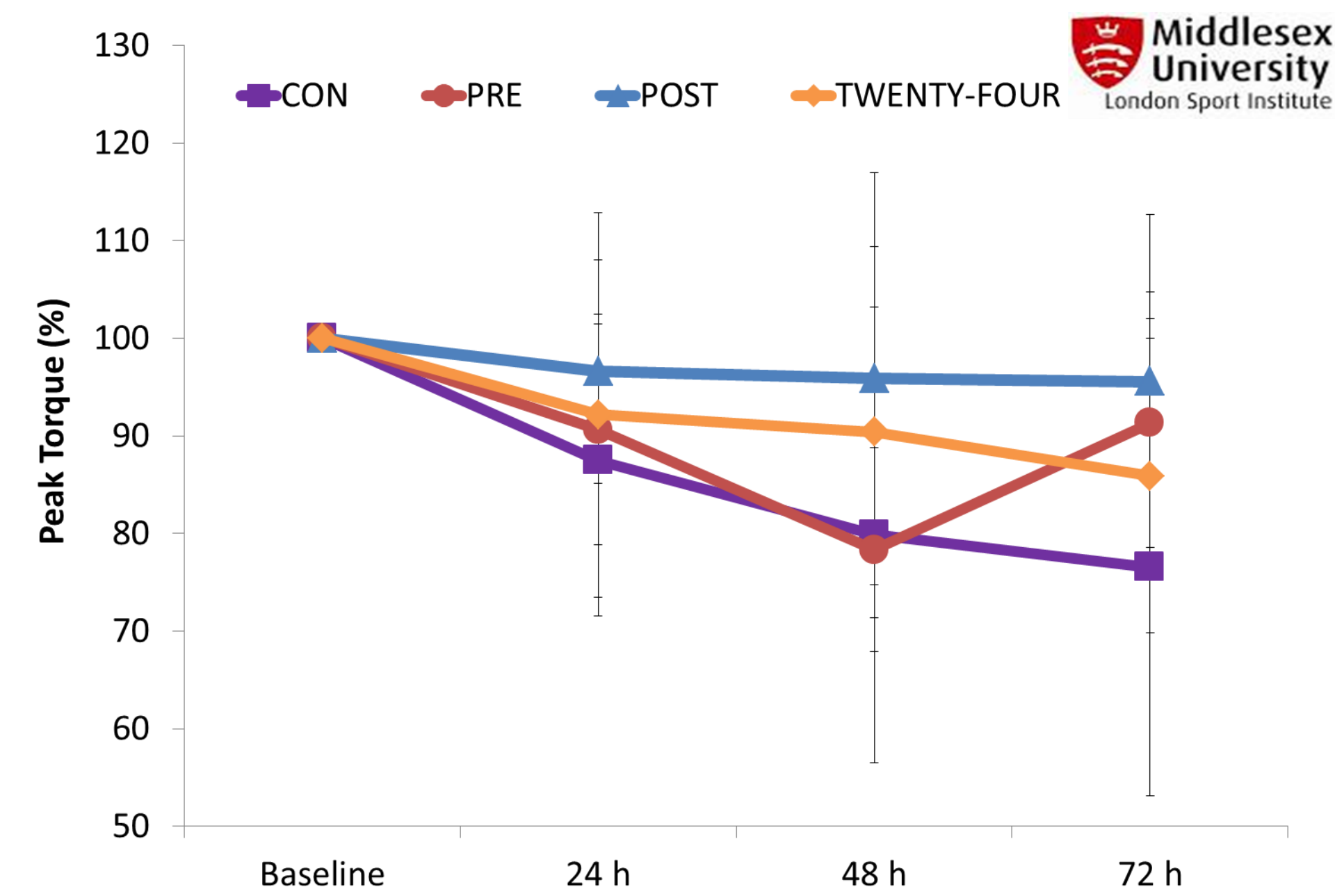


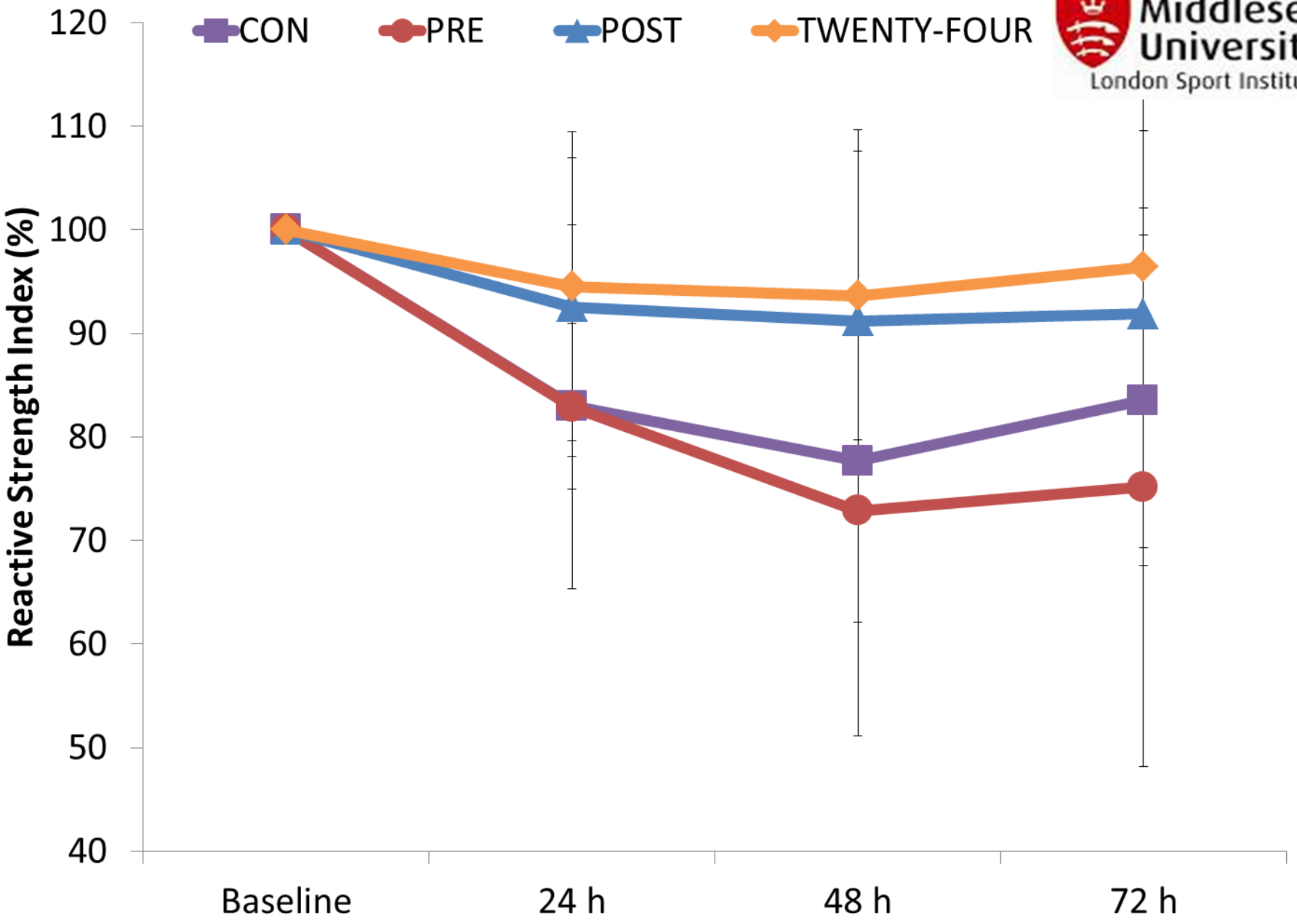
Effect of milk on DOMS following a mechanical exercise stress (Cockburn *et al,* 2008)



Effect of milk on peak torque following a mechanical exercise stress (Cockburn *et al,* 2008)



Effect of timing of milk ingestion on peak torque following a mechanical exercise stress (Cockburn *et al,* 2010)



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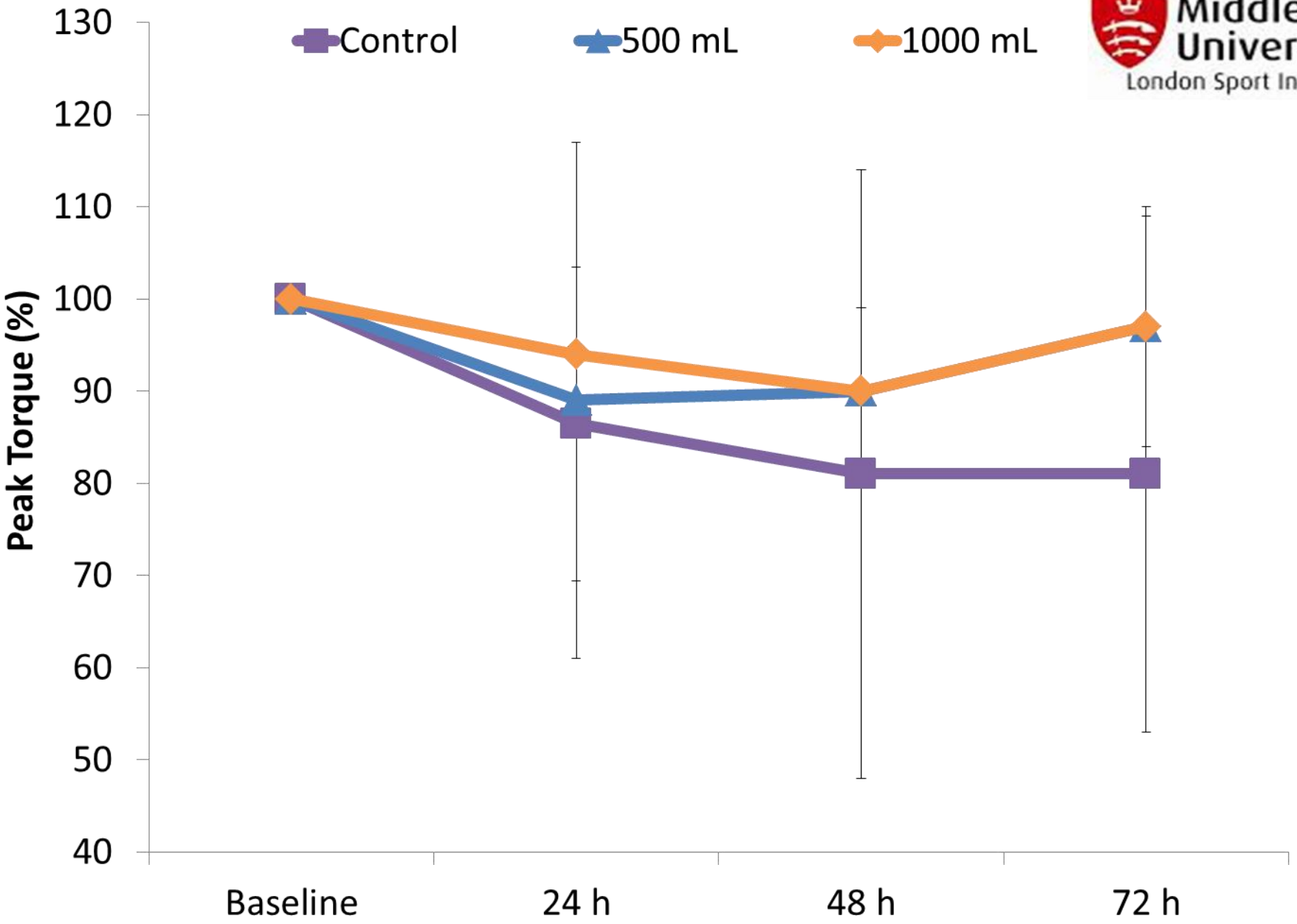
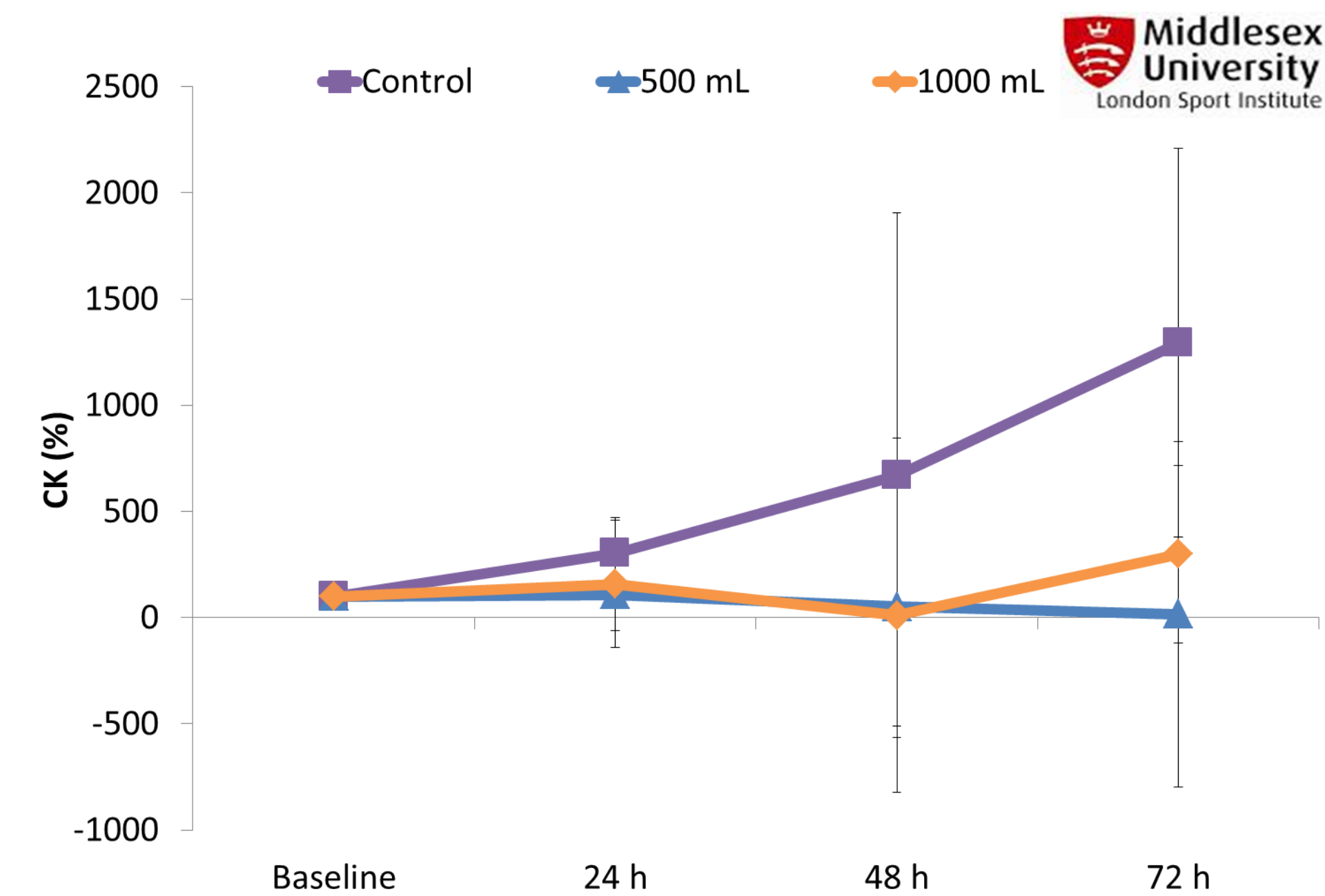
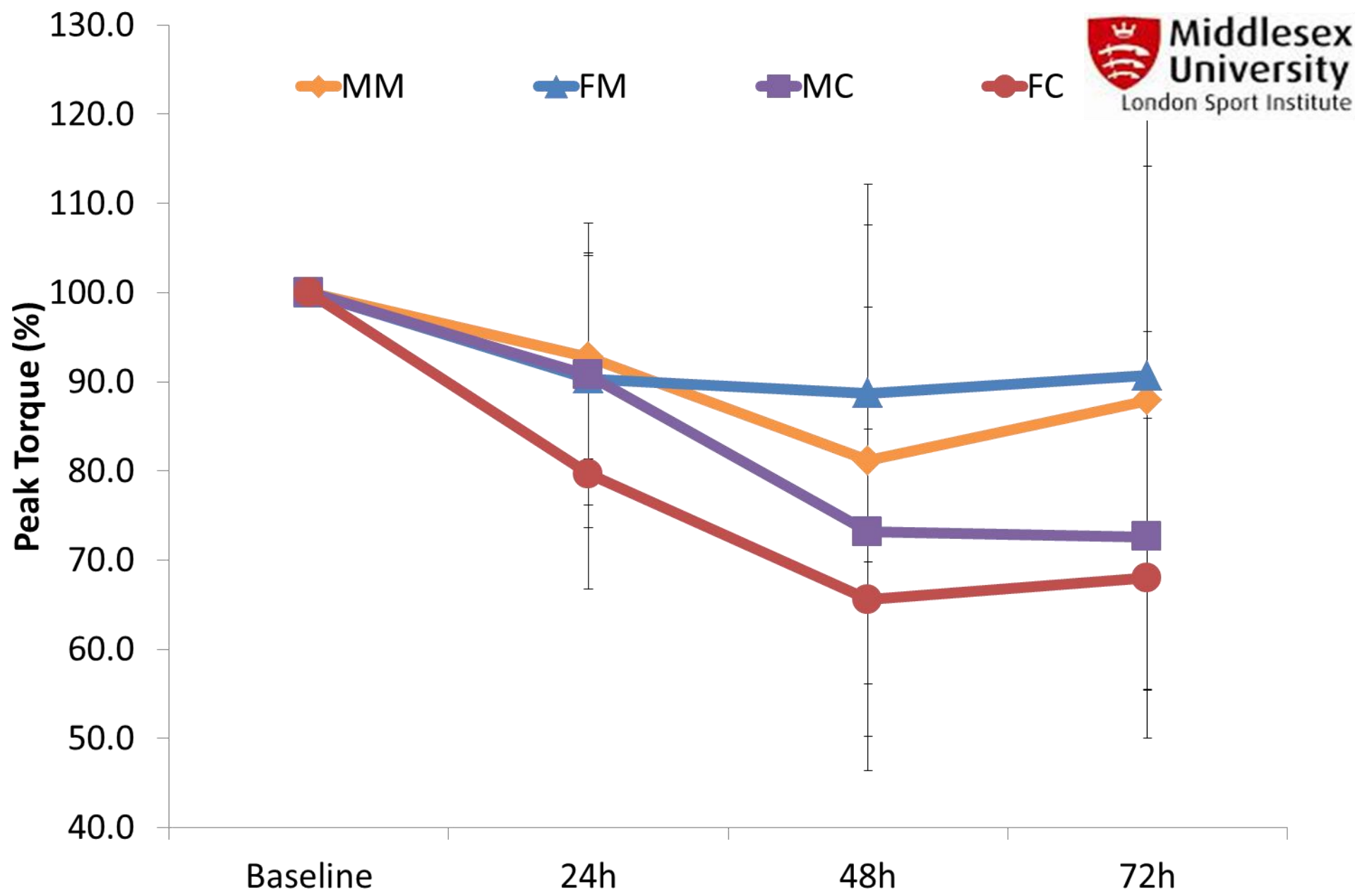
Effect of timing of milk ingestion on RSI following a mechanical exercise stress (Cockburn *et al,* 2010)



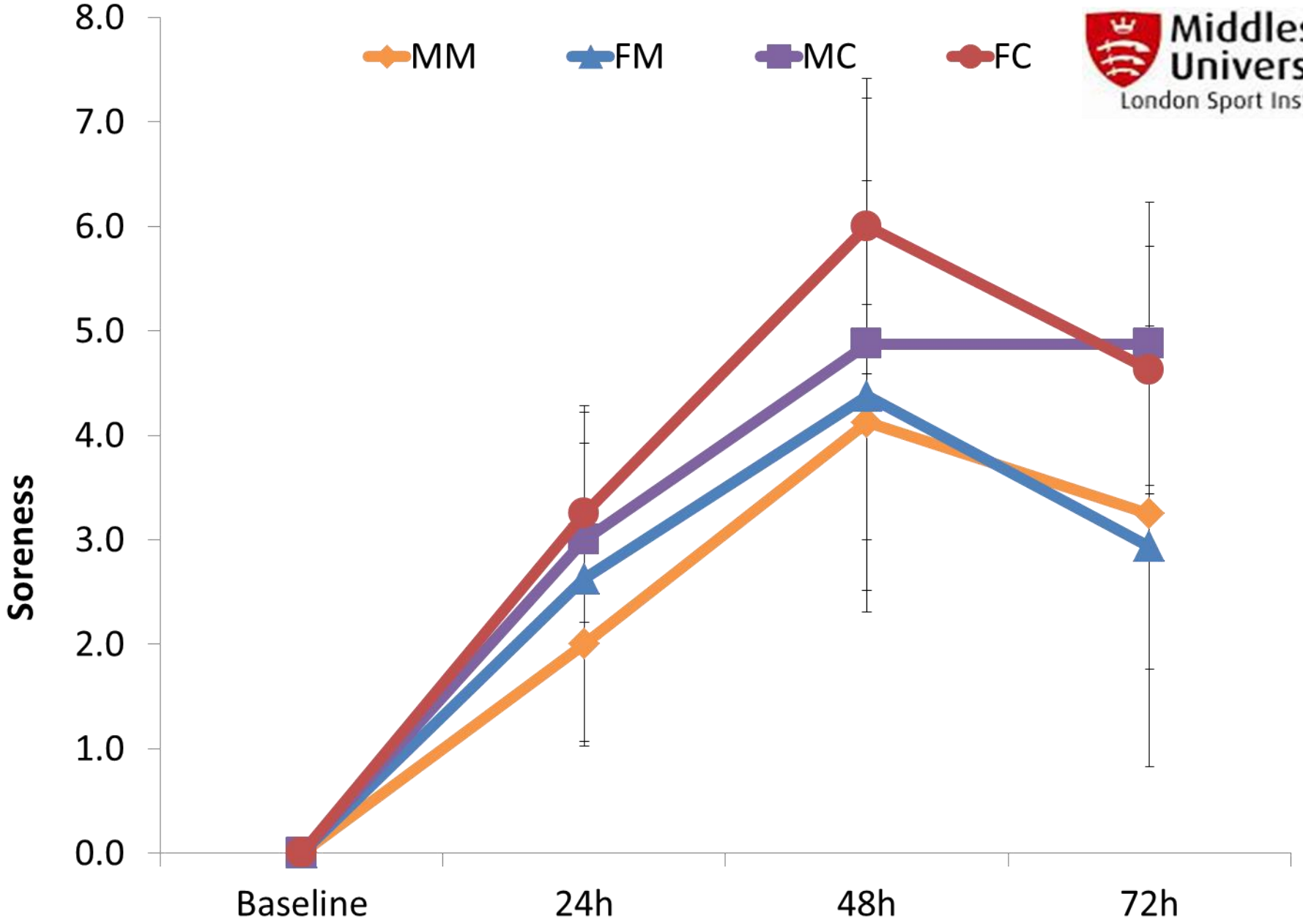
Effect of volume of milk on peak torque following a mechanical exercise stress (Cockburn *et al,* 2011)



Effect of volume of milk on CK following a mechanical exercise stress (Cockburn *et al,* 2011)



Effect of milk on peak torque following a mechanical exercise stress in males and females (Rankin *et al,* 2015)



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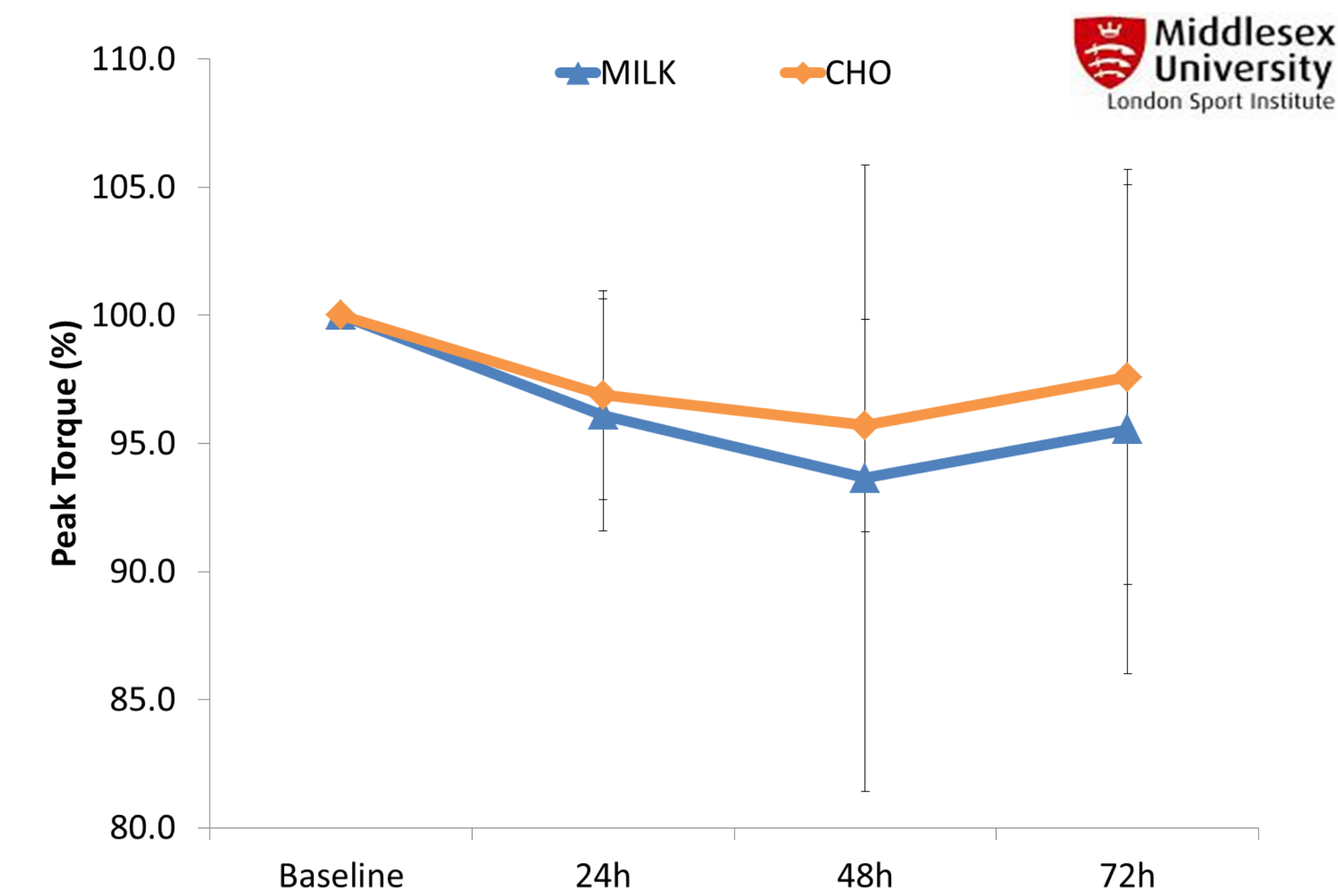
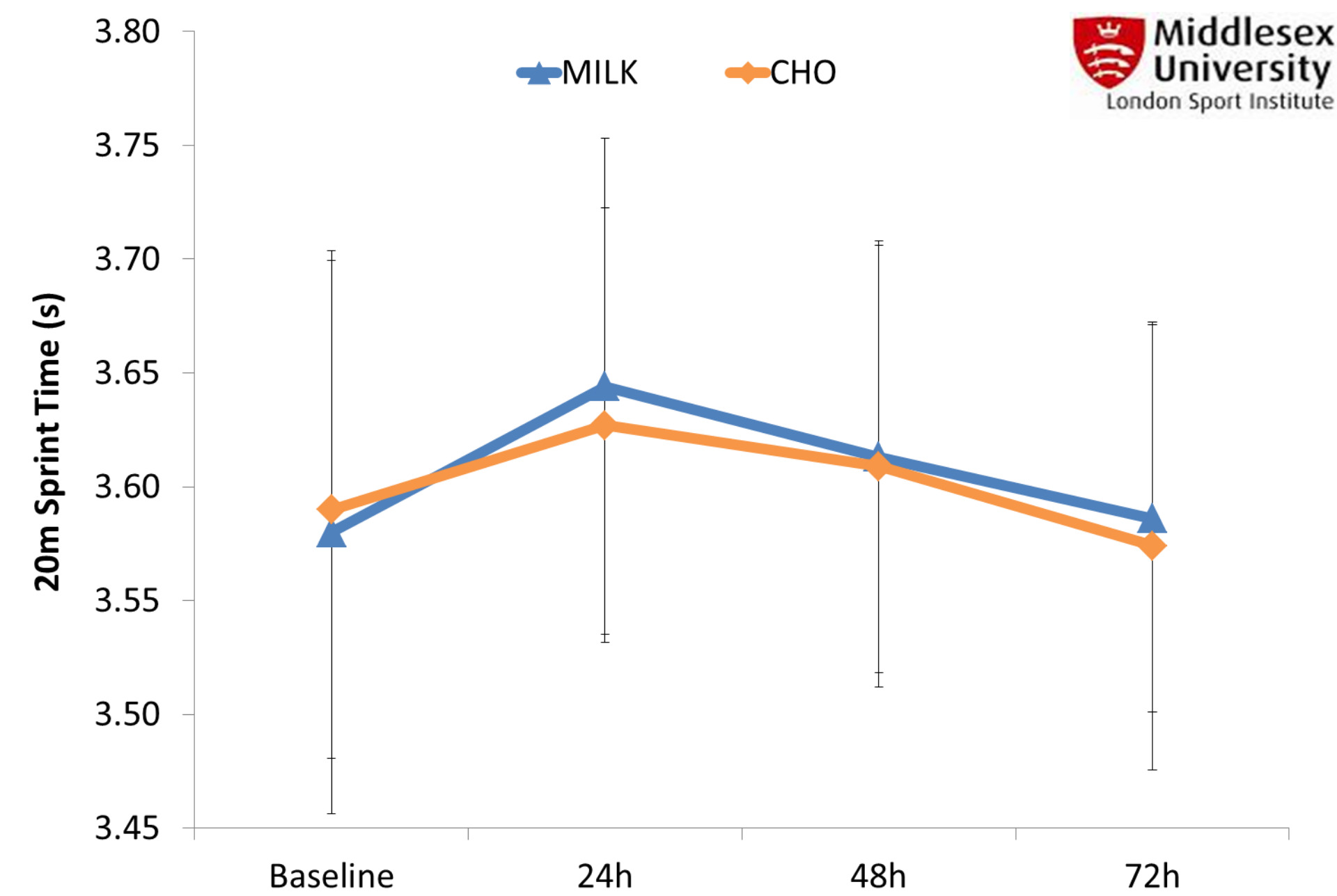
Effect of milk on DOMS following a mechanical exercise stress in males and females (Rankin *et al,* 2015)



Effect of milk on peak torque following a metabolic exercise stress in females (Unpublished Data)



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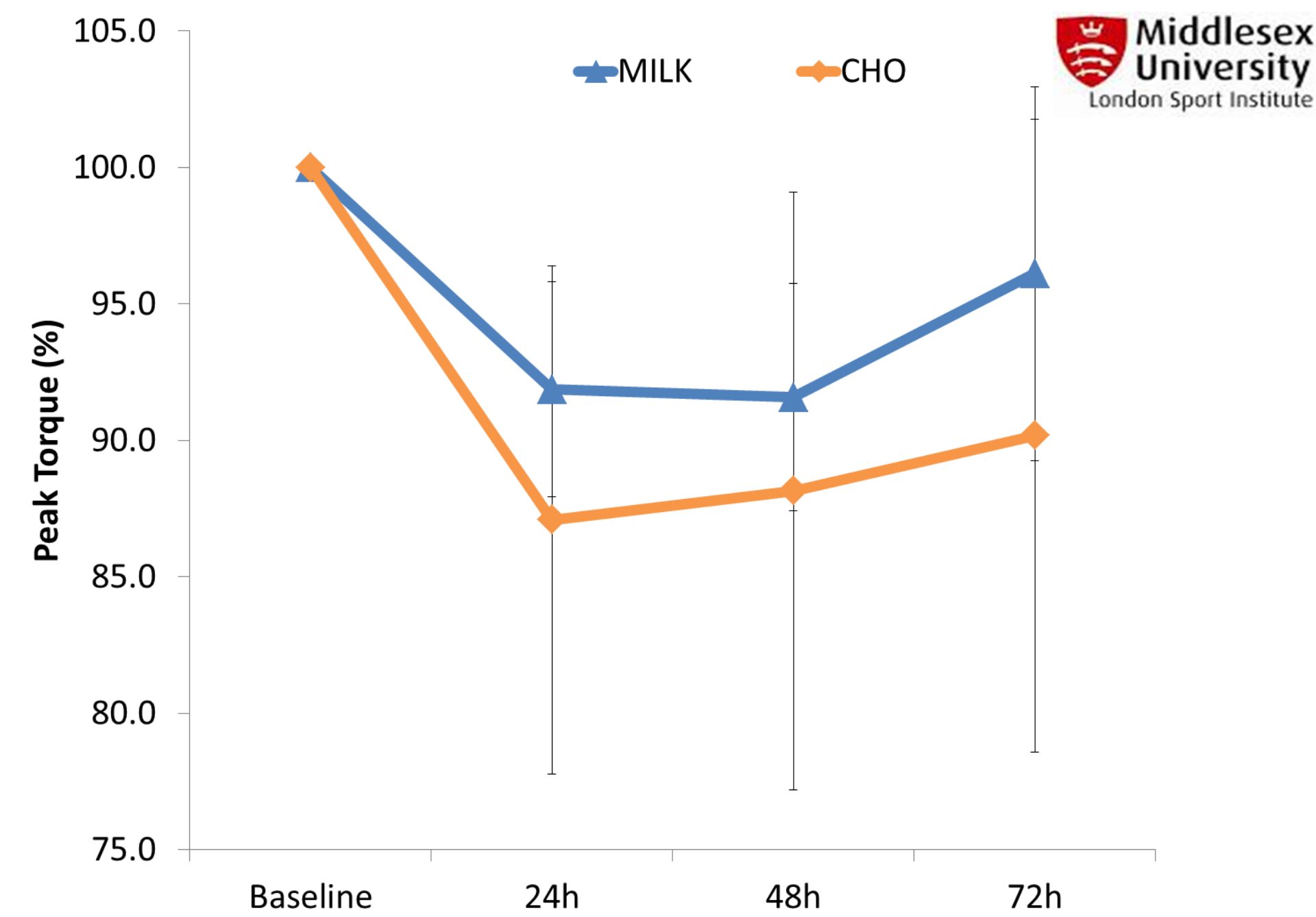
Effect of milk on 20m sprint time following a metabolic exercise stress in females (Unpublished Data)



Effect of milk on peak torque following a mixed exercise stress (Unpublished Data)

Current Thoughts

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- **Mode of Exercise**
  - Mechanical
  - Metabolic
  - Mixed

- **Gender**
  - Males
  - Females

- **Mechanisms**
  - Damage to protein structures
  - Inflammation
  - Oxidative Stress

Conclusion

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