ISAKOS CONGRESS 2025 | MUNICH GERMANY June 8–11

Detecting Muscle Strain In Professional Football Players Through Plasma Myoglobin Levels

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Faculty Disclosure Information

- This work was supported by the **Sysmex Corporation**, which provided the portable myoglobin (MB) measurement devices.

Portable Myoglobin measuring device

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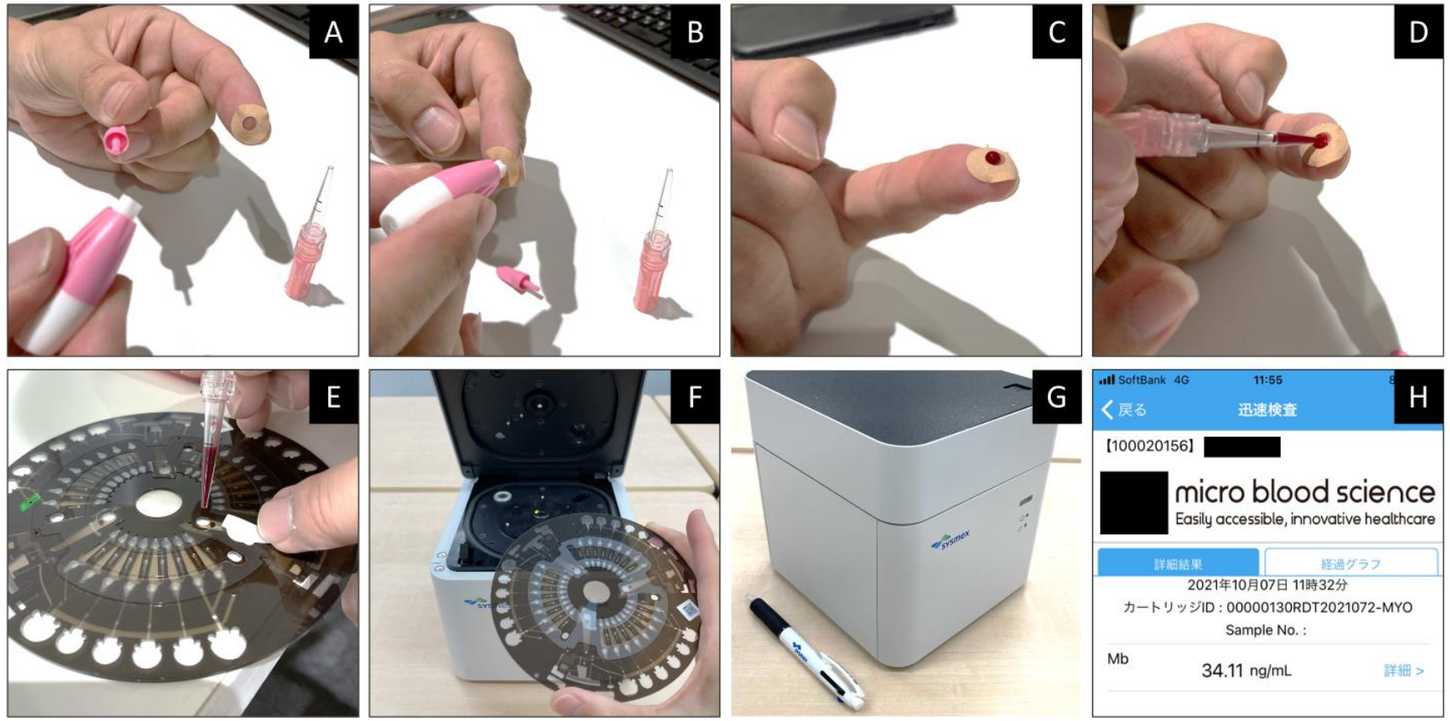
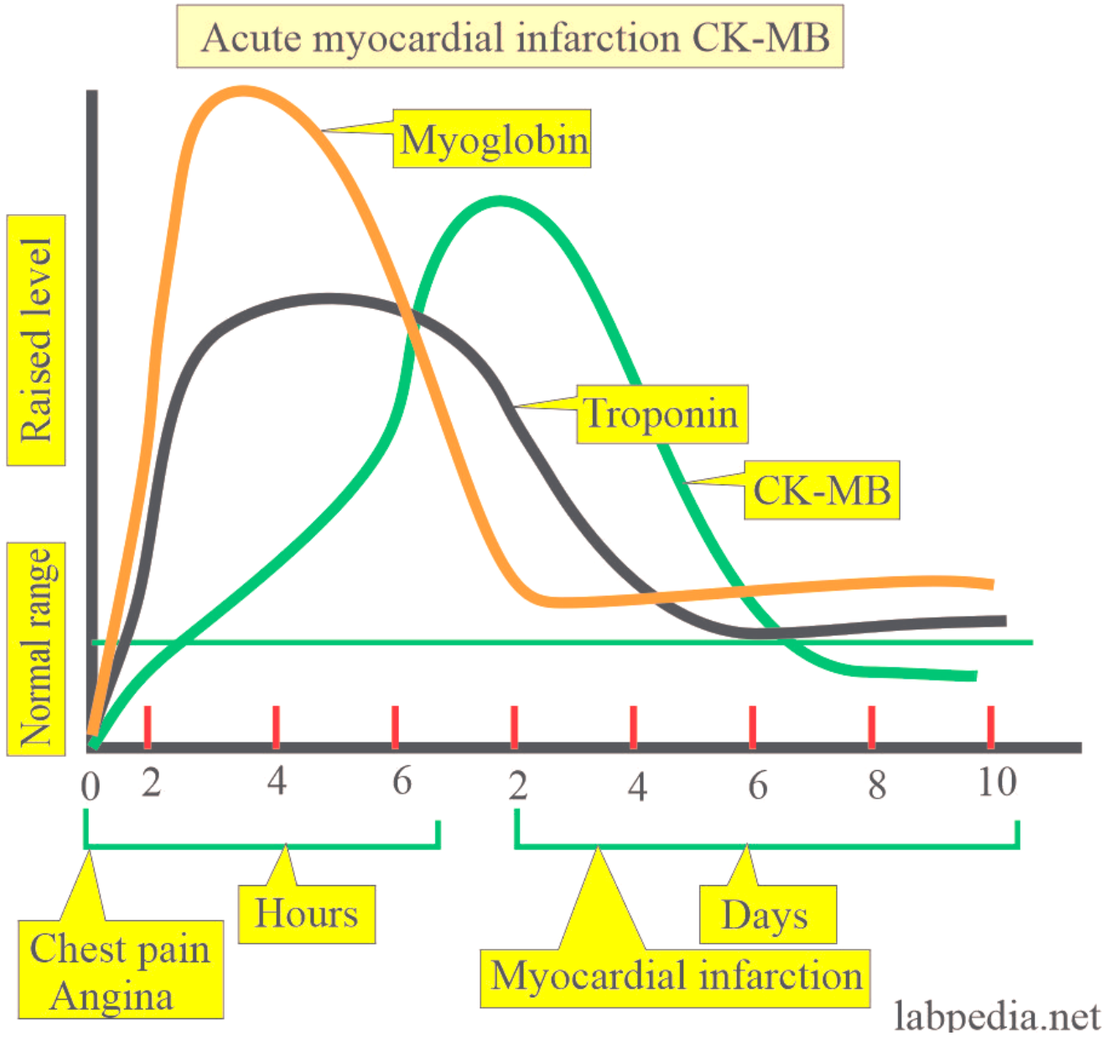


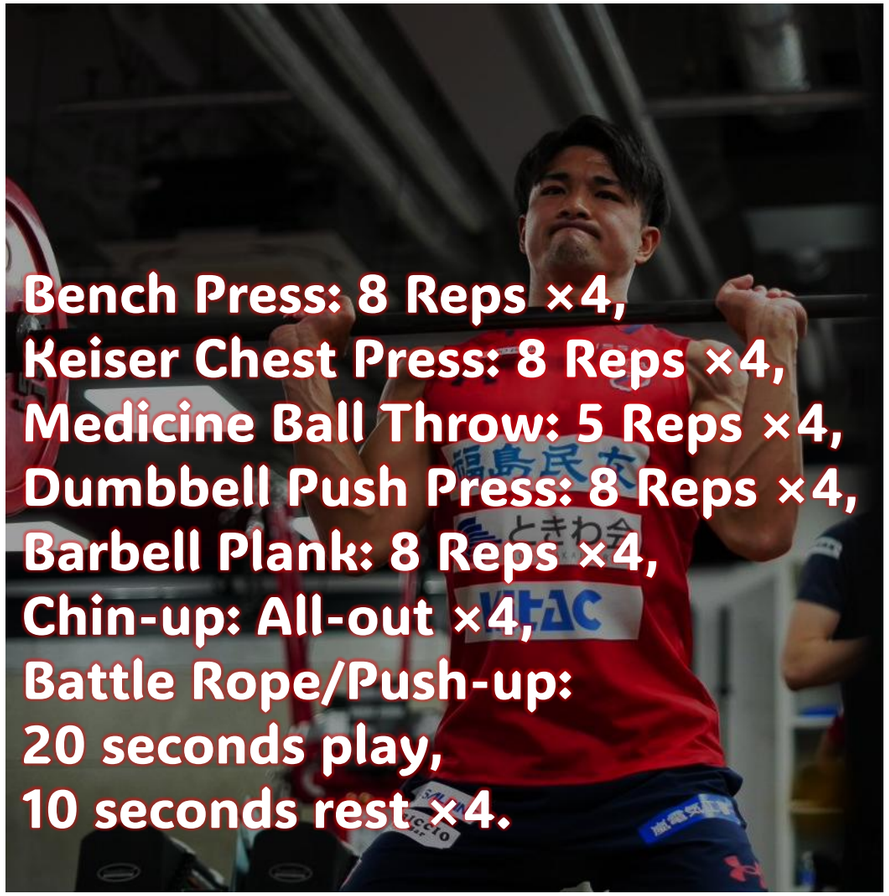
Figure 1. Myoglobin measurement using the portable IA-100 immunoassay system.
A–D: The method of fingertip blood sampling. The fingertip is pricked with 21-gauge lancets after which blood is drawn by the capillary phenomenon. E: A volume of 35 μL of a whole blood sample is dropped into the reagent cartridge. F: The cartridge is put into the portable IA-100 system. G: Image of a centrifuge for spinning the blood sample. H: The data are sent to the athletes' smartphone application.

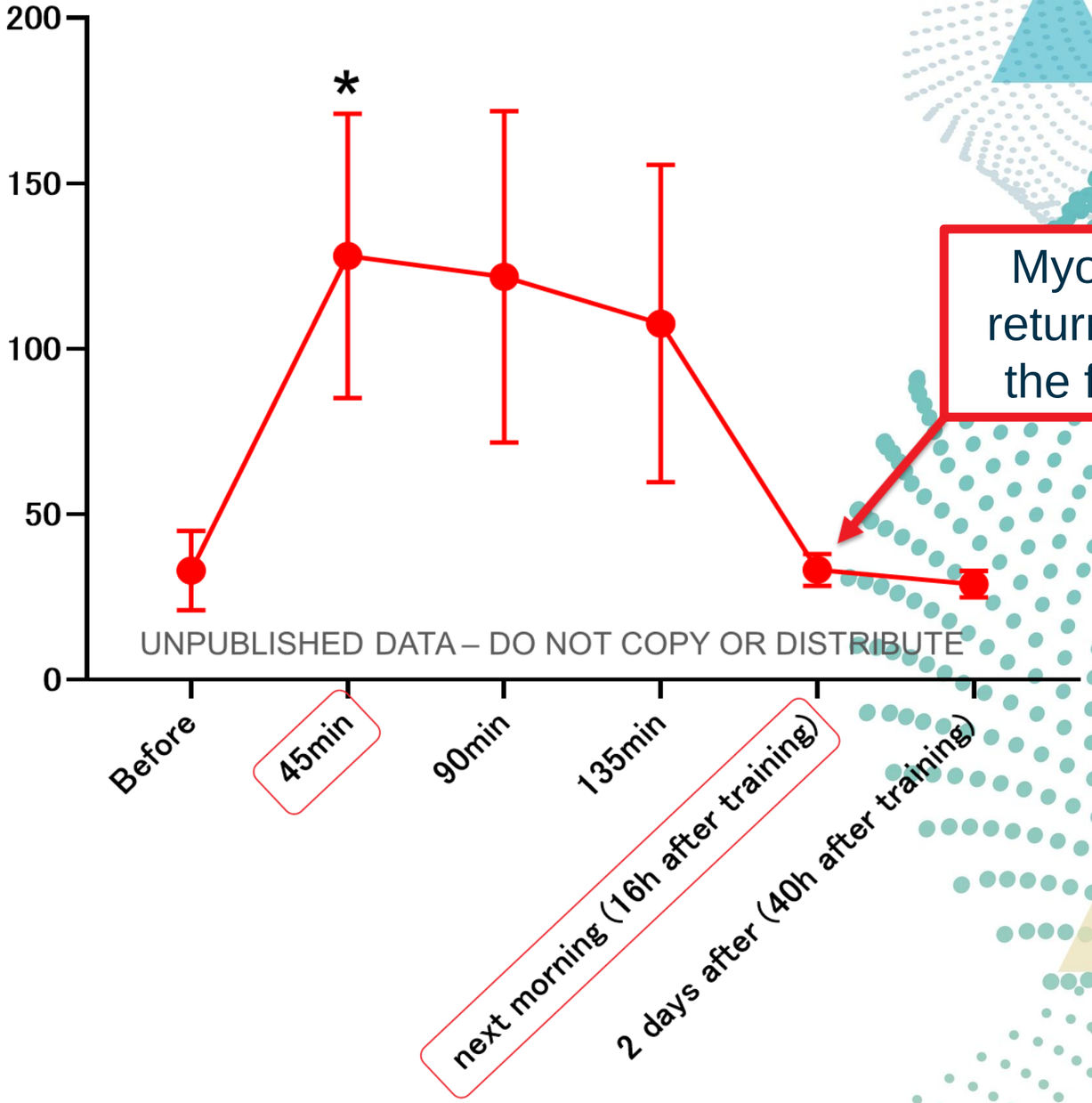
Marker of Muscle Damage

Myoglobin is a **sensitive marker** of muscle damage, but its association with **muscle strain** remains unclear.



The changes in myoglobin levels after intense training





Myoglobin levels return to normal by the following day.

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ORIGINAL ARTICLE
EPIDEMIOLOGY AND CLINICAL MEDICINE

Plasma myoglobin indicates muscle damage associated with acceleration/deceleration during football

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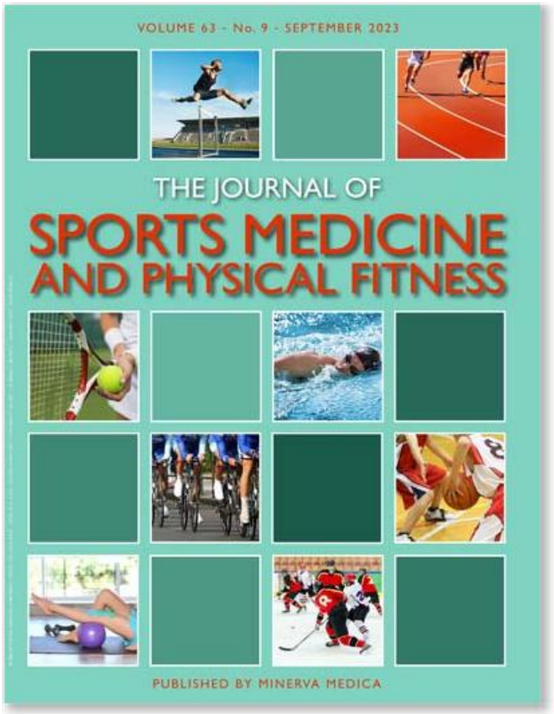
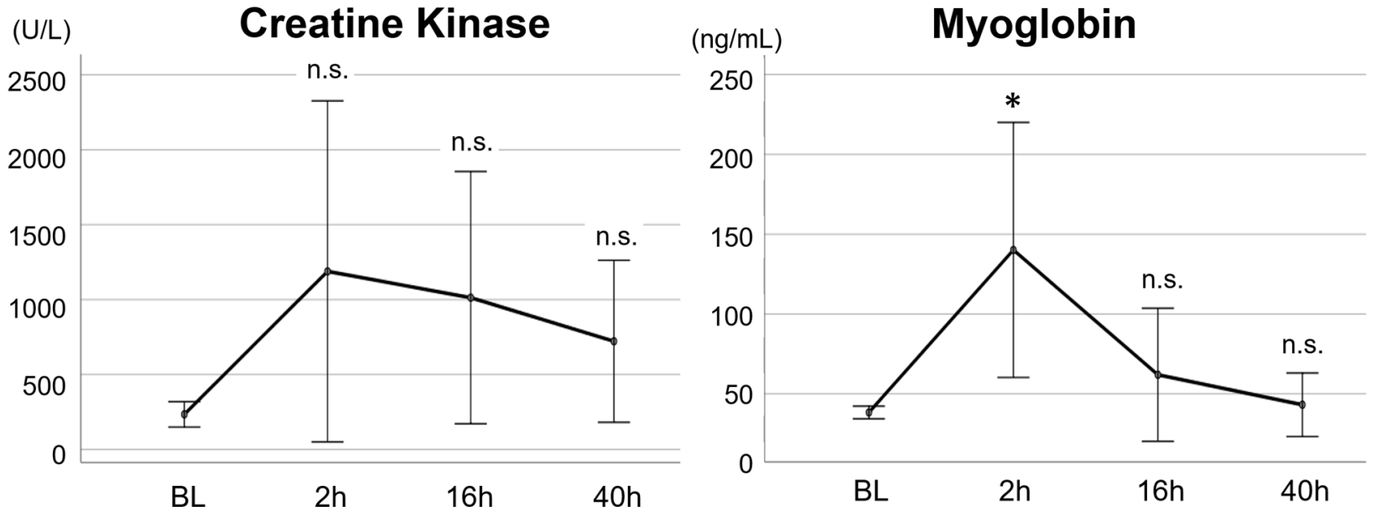


Changes in MB and CK concentrations post-match.



BL, baseline; CK, creatine kinase; MB, myoglobin.
*Significant difference versus all other time points (P < .05).

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Research Question

Could the measurement of myoglobin serve as a supplementary diagnostic tool for muscle injury?

Study design

- Professional football club
- 2022-23 season

Training/Match

Muscle

✓ Pain

✓ Stiffness

Next Morning

Suspected muscle strain

MRI

Muscle strain

Yes **No**

Comparison of Myoglobin

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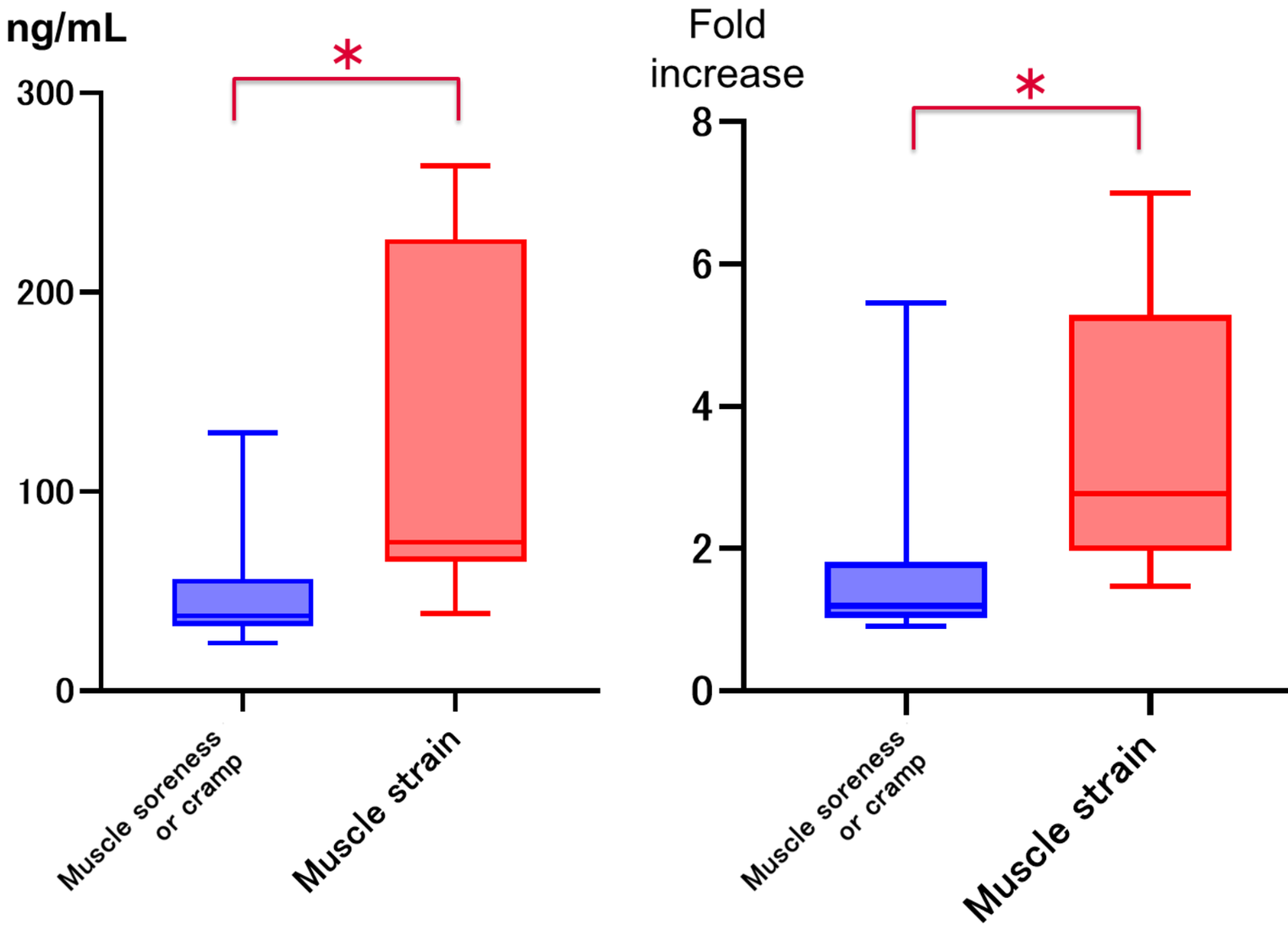
Players who had muscle issues and had their myoglobin levels measured

Case number	Age of player	Site of symptom	Diagnosis	BAMIC classification	time loss	Injury pattern	Myoglobin (baseline)	Myoglobin (next day morning)	Fold increase from baseline
1	23	Hamstring	Muscle soreness	N/A	0	Non-contact	30.2	27.4	0.91
2	22	Calf	Muscle soreness	N/A	0	Non-contact	23.5	23.9	1.02
3	23	Calf	Muscle soreness	N/A	0	Non-contact	30.2	34.3	1.14
4	20	Hamstring	Muscle soreness	N/A	0	Non-contact	31.8	97.3	3.06
5	20	Hamstring	Muscle soreness	N/A	0	Non-contact	31.8	42.5	1.33
6	25	Buttock	Muscle soreness	N/A	0	Non-contact	31.4	32.0	1.02
7	22	Calf	Muscle cramp	N/A	0	Non-contact	31.4	37.6	1.20
8	21	Calf	Muscle cramp	N/A	0	Non-contact	31.0	34.8	1.13
9	23	Calf	Muscle cramp	N/A	0	Non-contact	30.2	35.6	1.18
10	24	Hamstring	Muscle cramp	N/A	0	Non-contact	23.7	129.4	5.45
11	21	Calf	Muscle cramp	N/A	0	Non-contact	31.0	38.0	1.23
12	25	Calf	Muscle cramp	N/A	0	Non-contact	31.4	32.5	1.03
13	21	Quad	Muscle cramp	N/A	0	Non-contact	31.0	56.1	1.81
14	26	Hamstring	Muscle cramp	N/A	0	Non-contact	28.2	48.6	1.72
15	22	Calf	Muscle cramp	N/A	0	Non-contact	37.6	79.0	2.10
16	23	Hamstring	**Muscle strain**	3c	39	Non-contact	35.3	64.5	1.83
17	20	Hamstring	**Muscle strain**	3c	80	Non-contact	31.0	65.1	2.10
18	23	Hamstring	**Muscle strain**	1b	18	Non-contact	26.4	38.7	1.47
19	22	Hamstring	**Muscle strain**	2b	31	Non-contact	26.8	71.8	2.68
20	23	Hamstring	**Muscle strain**	2a	19	Non-contact	42.9	220.4	5.14
21	22	Hamstring	**Muscle strain**	3c	67	Non-contact	26.8	74.4	2.78
22	19	Adductor	**Muscle strain**	2a	19	Non-contact	29.3	84.8	2.90
23	22	Hamstring	**Muscle strain**	2a	20	Non-contact	37.6	263.4	7.00
24	23	Hamstring	**Muscle strain**	2a	21	Non-contact	42.9	232.9	5.43

Comparison of plasma myoglobin levels

Myoglobin levels showed a significant increase in the **muscle strain** group.



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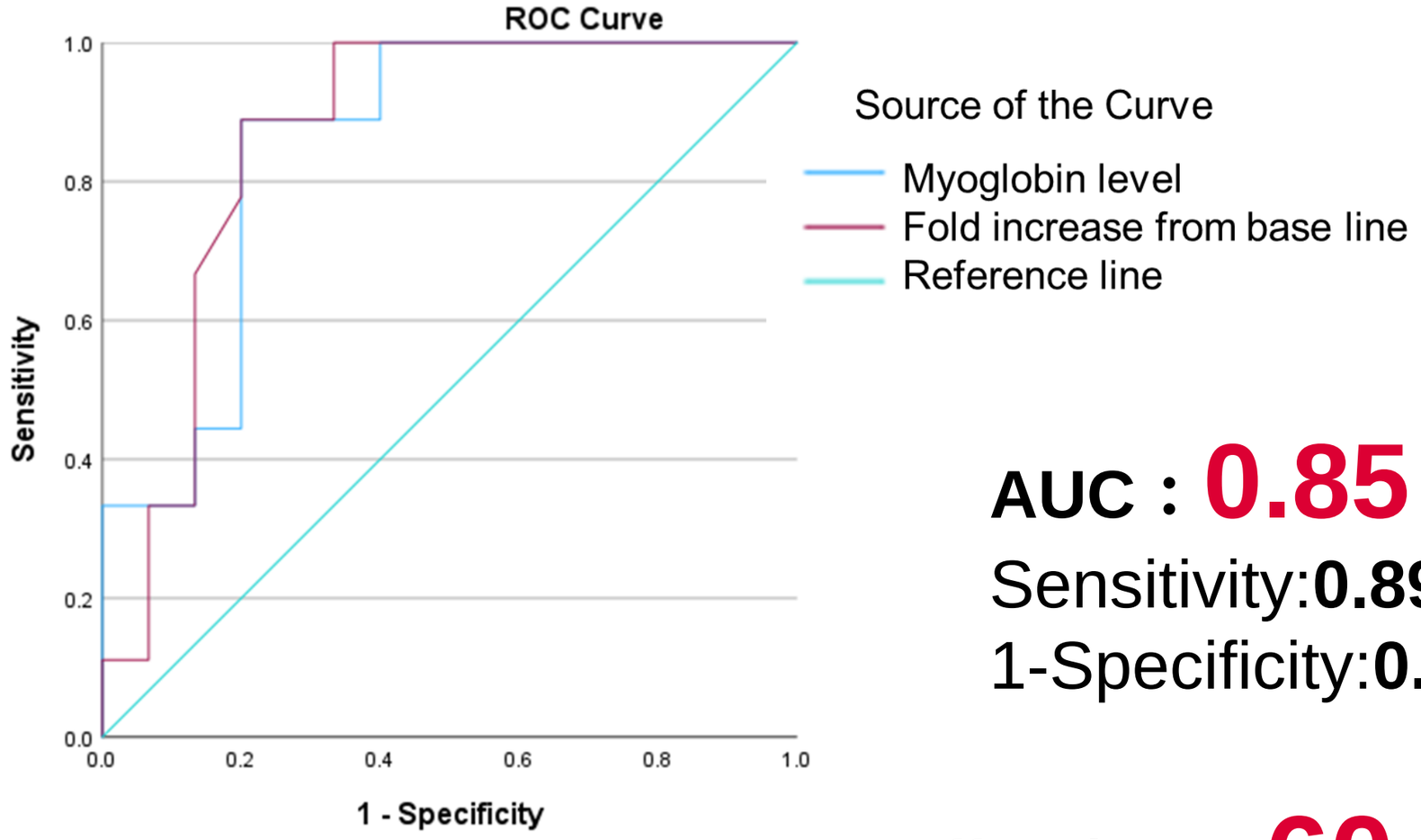
Muscle Strain Likelihood Analysis Based on Myoglobin Levels



AUC : 0.85

Sensitivity:**0.89**

1-Specificity:**0.20**

Cut-off value : **60.3** ng/mL

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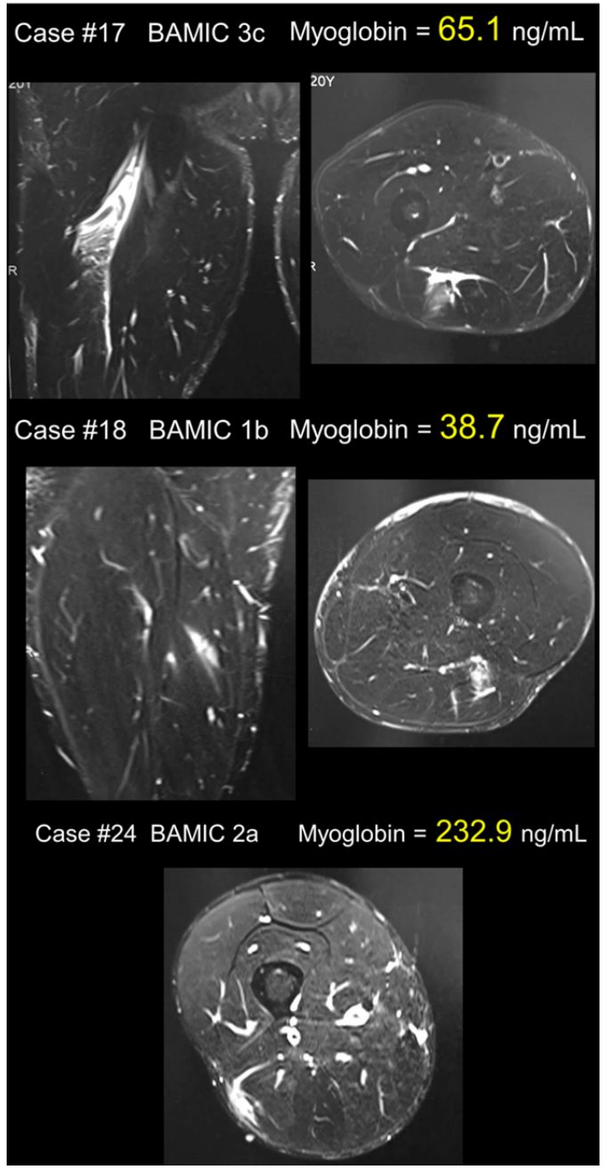
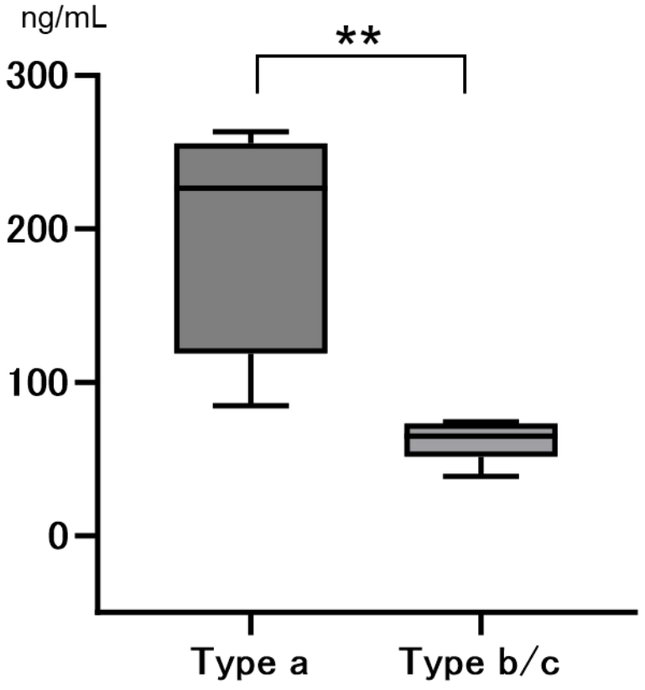
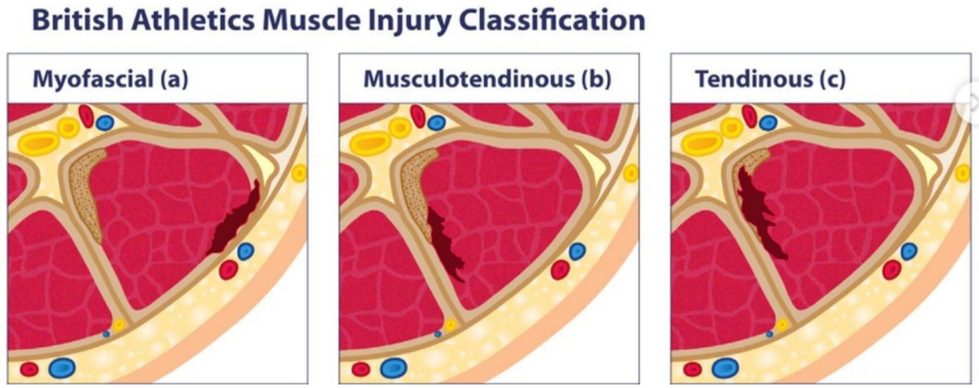
Cases of HSIs and MB levels



BAMIC classification and MB levels





The MB levels were significantly **higher** in **Type a** (myofascial tear) compared to **Type b/c** (muscle tendon junction or intratendinous tear)

Conclusion

- Plasma myoglobin measurement shows promise as a quick and practical tool for detecting muscle strains in athletes.
- It could empower athletes to monitor muscle damage even without medical staff.
- Further research is needed to confirm its effectiveness and feasibility in real-world sports settings.

Limitations

- MRI was performed only in players with suspected muscle strain, not all with symptoms.
- Limited sample size due to missing MB data for some cases.
- Factors like hydration, circadian rhythm, and individual variation may affect MB levels.

Reference

- Saita Y *et al.* Plasma myoglobin indicates muscle damage associated with acceleration/deceleration during football.
  J Sports Med Phys Fitness. 2023 63(12):1337-1342.
  doi: 10.23736/S0022-4707.23.15203-0. PMID: 37712927.