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CYWS20

Monitoring of stress and recovery in junior cross-country skiers during training camp: Means for finding the optimal training load

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4th Cross-Country FIS Point List 2019/20

Age group 2000 - 2004

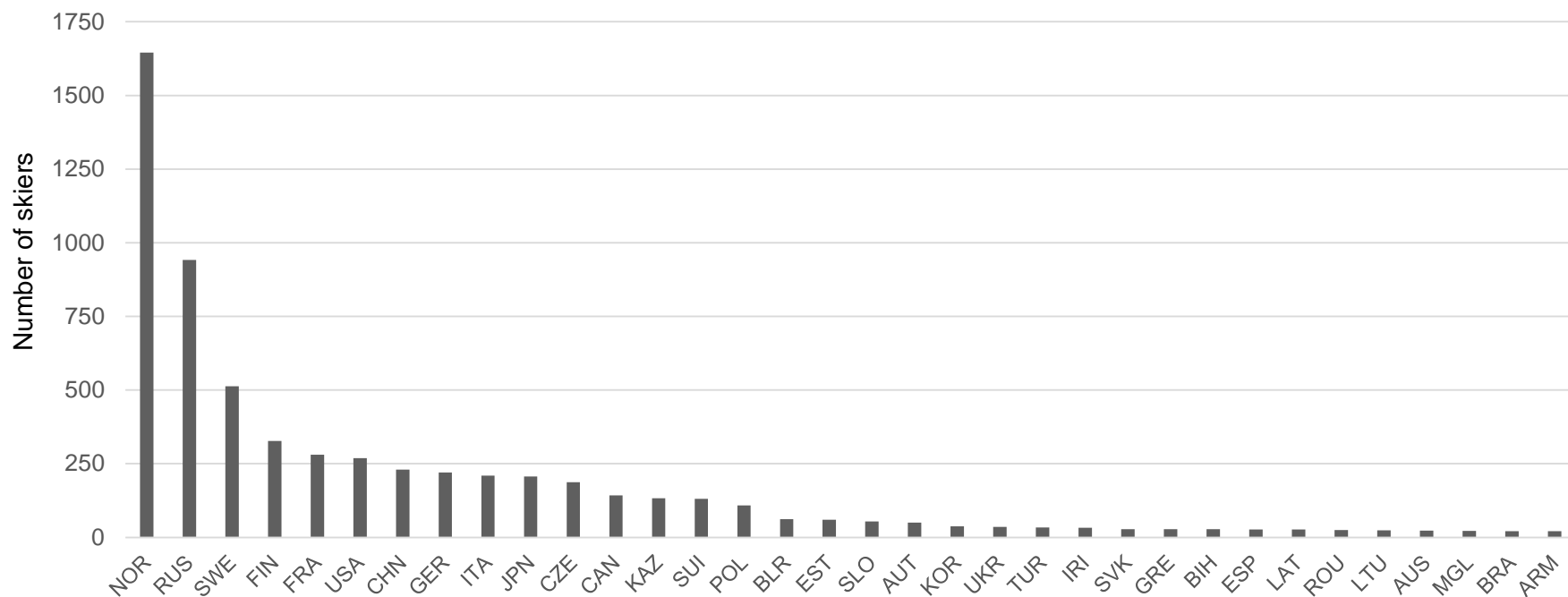


Figure 1. Number of FIS licenced female and male junior skiers (age group 2000 – 2004) as of January 4, 2020.



4th Cross-Country FIS Point List 2019/20

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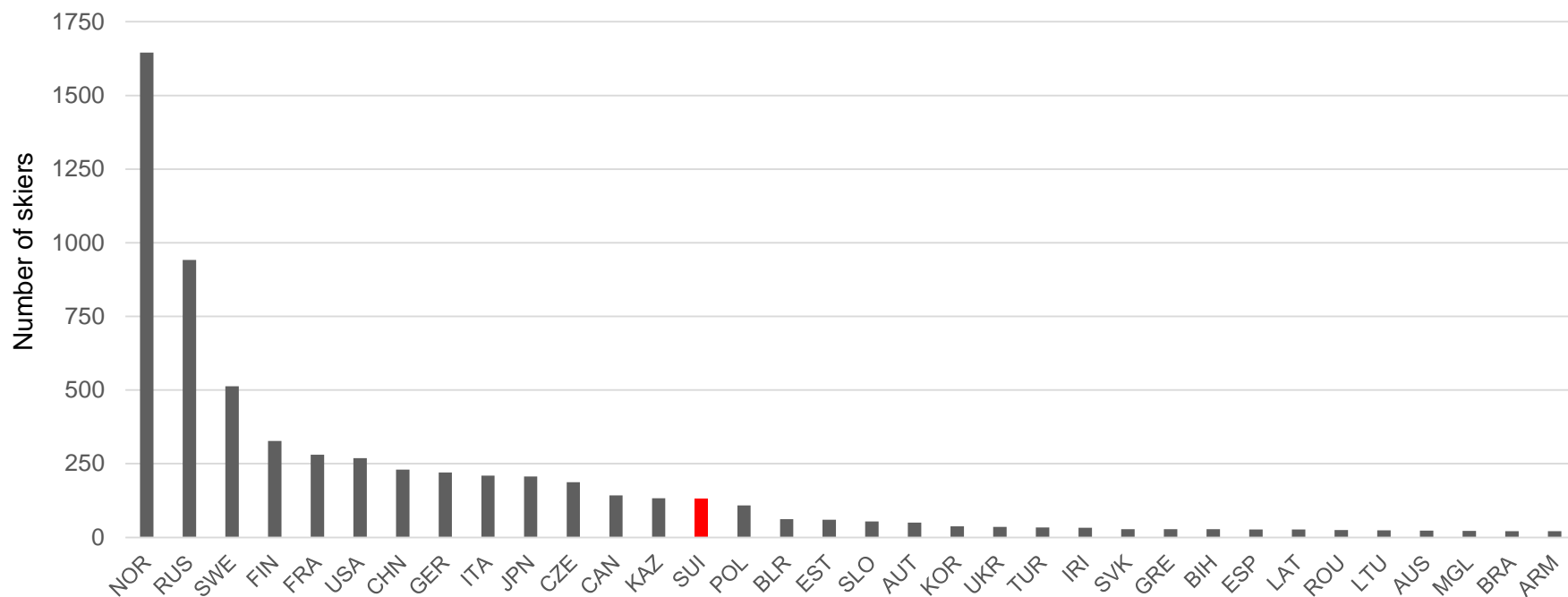


Figure 1. Number of FIS licenced female and male junior skiers (age group 2000 – 2004) as of January 4, 2020.



Development of young athletes

«Survival of the fittest» approach in national talent development with large talent pool

→ Risk of applying adult-type prescription of training load (Murray, 2017)

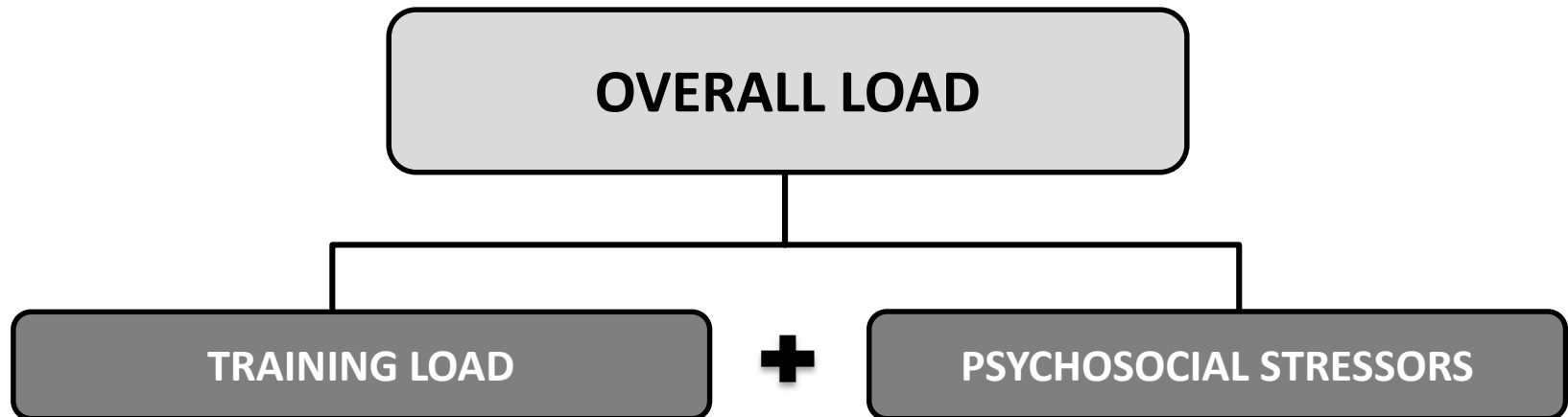
Relationship between training high loads and injury, illness & subsequent early retirement in young athletes (Drew & Finch, 2016; Huxley et al., 2014)

In limited talent pools, preservation of the best talents is crucial (Murray, 2017)



vs.







PSYCHOSOCIAL STRESSORS

Pressure to perform



Social: family, peer-groups, relationships



Athlete-coach relationship



Academic / School



Travel



↑ risk of illness
↑ risk of injury
↑ risk of overtraining
↑ days of missed training
... abandoning the sport



What to do?

Monitoring of training- and non-training related stress



Enhance the understanding of the training and stress response



Prevent the risk of maladaptation / illness / injury

(Foster, 1998; Halson, 2014)



- 1) what is the subjective recovery-stress balance of my athletes?
- 2) what is the relationship between training load and the subjective recovery-stress balance?



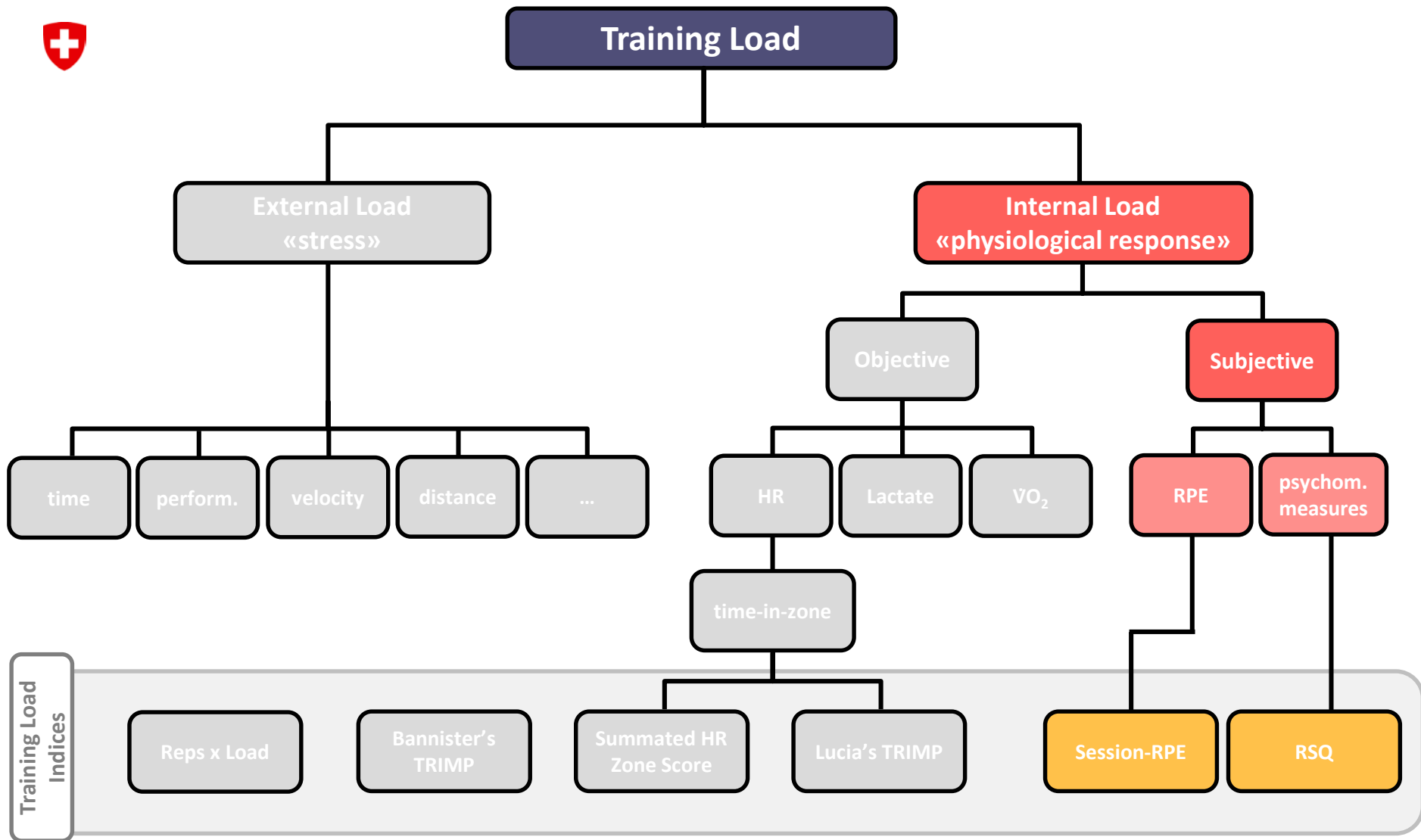
Nordic Week Training Camp

Date: August 5 - August 11, 2019
Location: Andermatt, SUI



Day	Monday				Tuesday				Wednesday				Thursday				Friday				Saturday				Sunday							
	HIT								HIT												HIT											
Morning	Meeting @ 11:00 45 min LIT run + Quiz-OR				Workshop Training 1 100 min Z.1-2 Running Form Bounding				HIT II: run w. poles 1 x 10 min Z.4; 5 min break 4 x 6 min Z.5; 2 min recovery + 1 x 6 min x 30- 30s				Workshop Training 4 strength training 15 min warmup 15 min mobilisation 15 min barbell technique 60 min max. strength				3-pass long tour Z.1-2 Part I Run; MTB; Rollerski CL; MTB; Rollerski CL				HIT III: Rollerski Skating 4 - 5 x 7 - 8 min Z.4-5; 2-3 min breaks				Recovery Day							
Load	45	2	90		100	2	200		90	8	720	1	105	6	630		240	2	480		120	7	840	1								
Afternoon	HIT I: Ski Classic 8 x 2 min Z.5 6 - 7 min recovery				Workshop Training 2 30 min Basic Instinct 90 min Rollerski Classic Z.1- 2 Double Poling				Workshop Training 3 90 min MTB Z.1-2 Technique Parcour				Workshop Training 5 30 min Basic Instinct 90 min Rollerski Skating Z.1- 2 Technique & Sprints				3-pass long tour Z.1-2 Part II Run; MTB; Rollerski CL; MTB; Rollerski CL				Departure Andermatt											
Load	115	6	690	1	120	3	360		90	2	180		90	4	360		180	2	360													
Evening	40 min Game - Hockey				Regeneration: Stretching, Blackroll								40 min Game - soccer																			
Load	40	3	120										40	3	120																	
Load	200	11	900	1	220	5	560	0	180	10	900	1	235	13	1110	0	420	4	840	0	120	7	840	1	0	0	0	0				
	Min	RPE	Load	HIT																					Total Volume (h)				22.9			
																									Total Load (au)				5150			

N = 22 female and 24 male junior cross-country skiers included (age: 17.5 ± 1.1 years)





Methods

Training Load
Indices

Session-RPE



Recovery-Stress
Questionnaire (RSQ)



Methods

Training Load
Indices

Session-RPE



Recovery-Stress
Questionnaire (RSQ)

How was your workout?

Foster RPE Scale (0-10)	
	Rating
Rest	0
Very, Very Easy	1
Easy	2
Moderate	3
Somewhat Hard	4
Hard	5
	6
Very Hard	7
	8
	9
Maximal	10

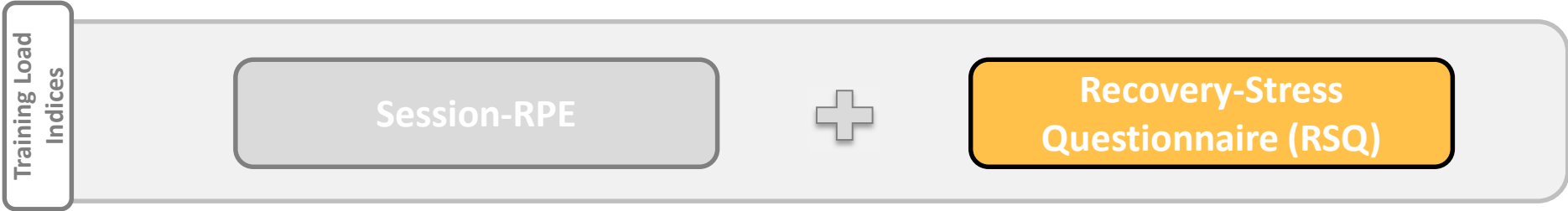
- Simple and easy to use
- Application across all types of training
- within 30 min after each training

→ Summated Daily Foster-Load

Duration (min)		RPE		Load
60	x	7	=	420



Methods



- Online Short-form of Recovery-Stress Questionnaire for athletes (Kellmann & Kallus, 2001)
- 7 items regarding stress, mood, muscle soreness, recovery & sleep
- 7-point Likert scale
- Completion in < 2 min

→ **Result: Recovery-stress «balance score»**

In the past (3) days/nights...

	never	seldom	sometimes	often	more often	very often	always
...I did not get enough sleep.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 2. Example of short-form RSQ item.



Methods

Statistical Analysis

Repeated measures ANOVA for identification of differences in recovery-stress balance across time-points

Pearson product-moment correlations between training load and next day recovery-stress balance

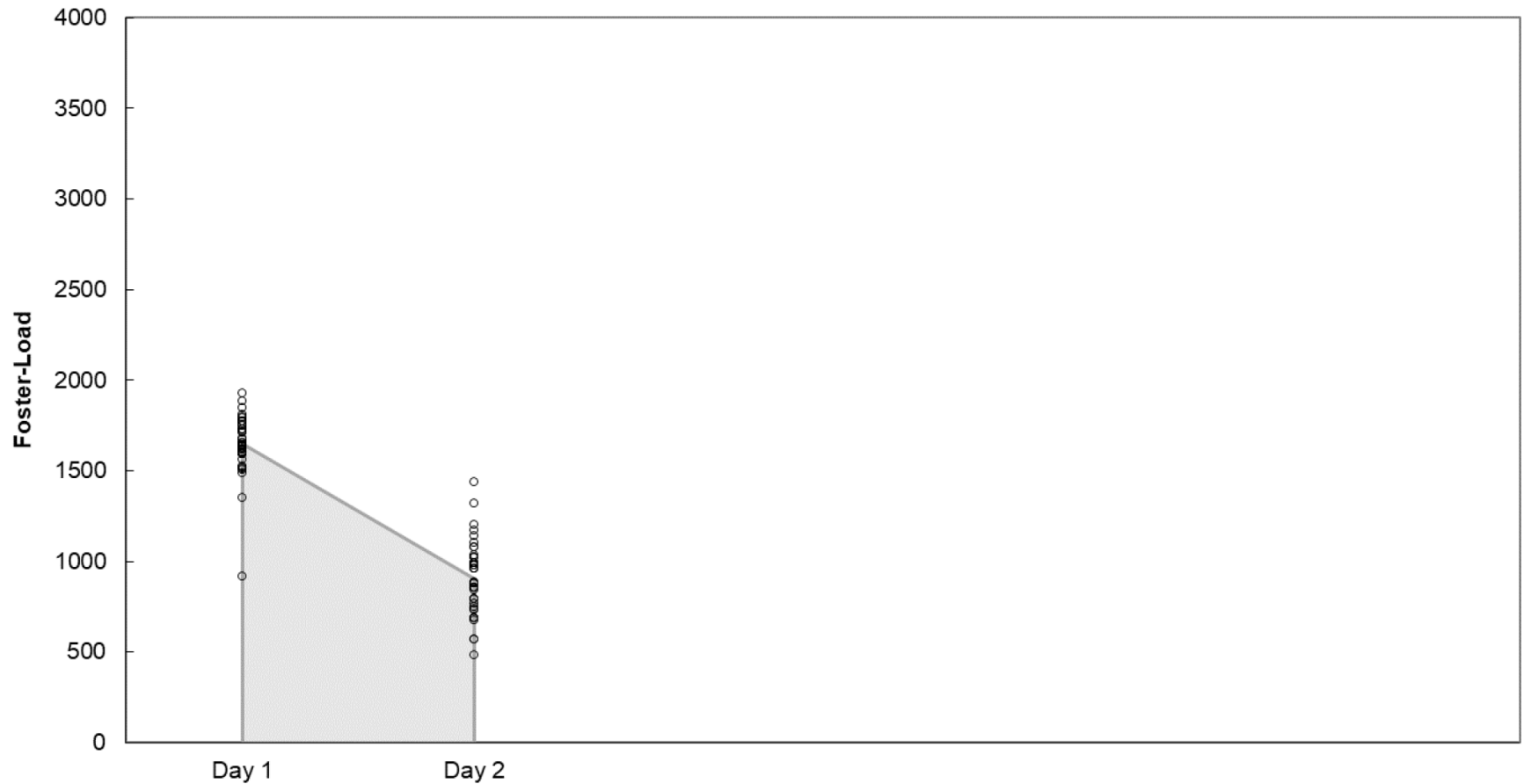


Results – Foster-Load



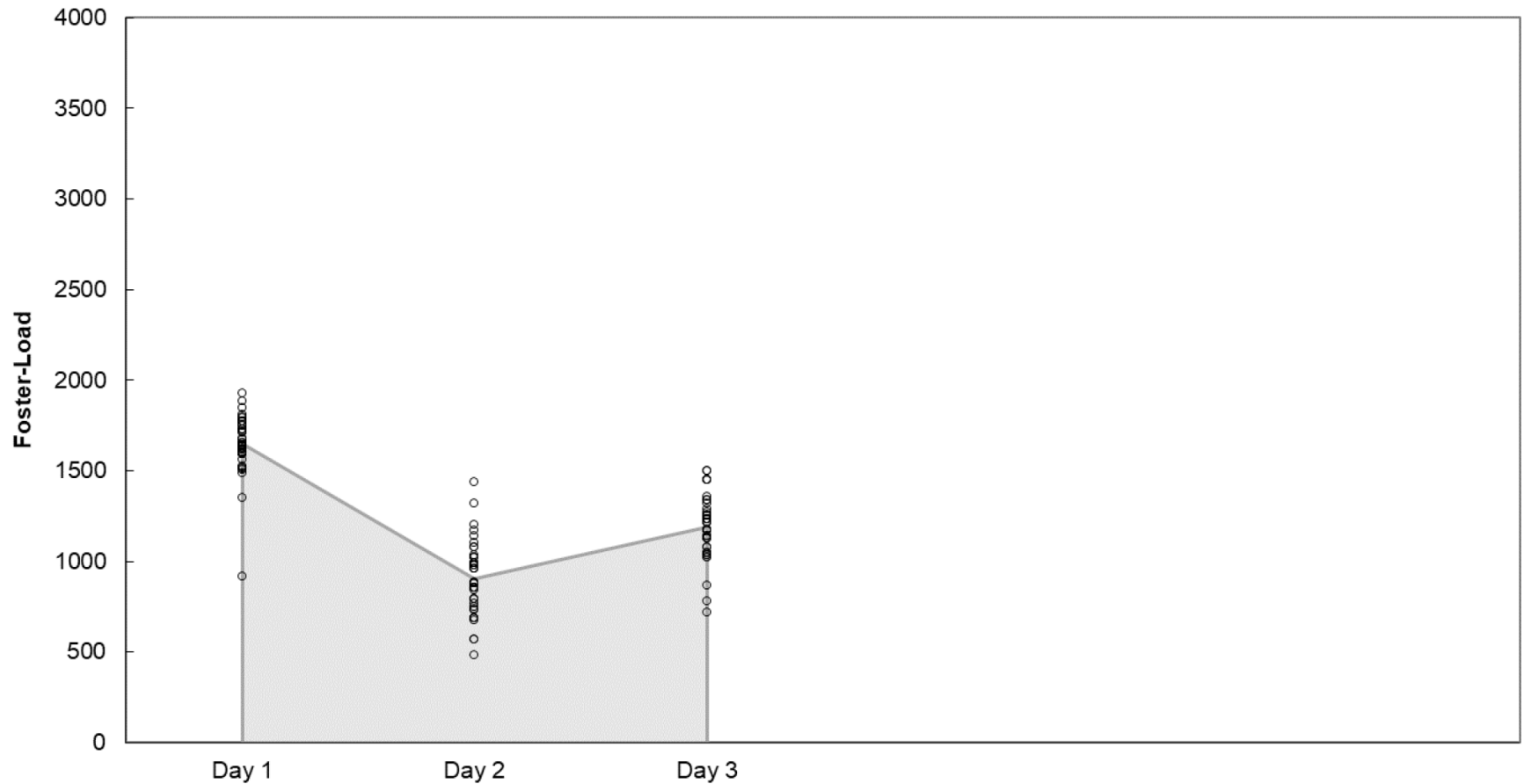


Results – Foster-Load



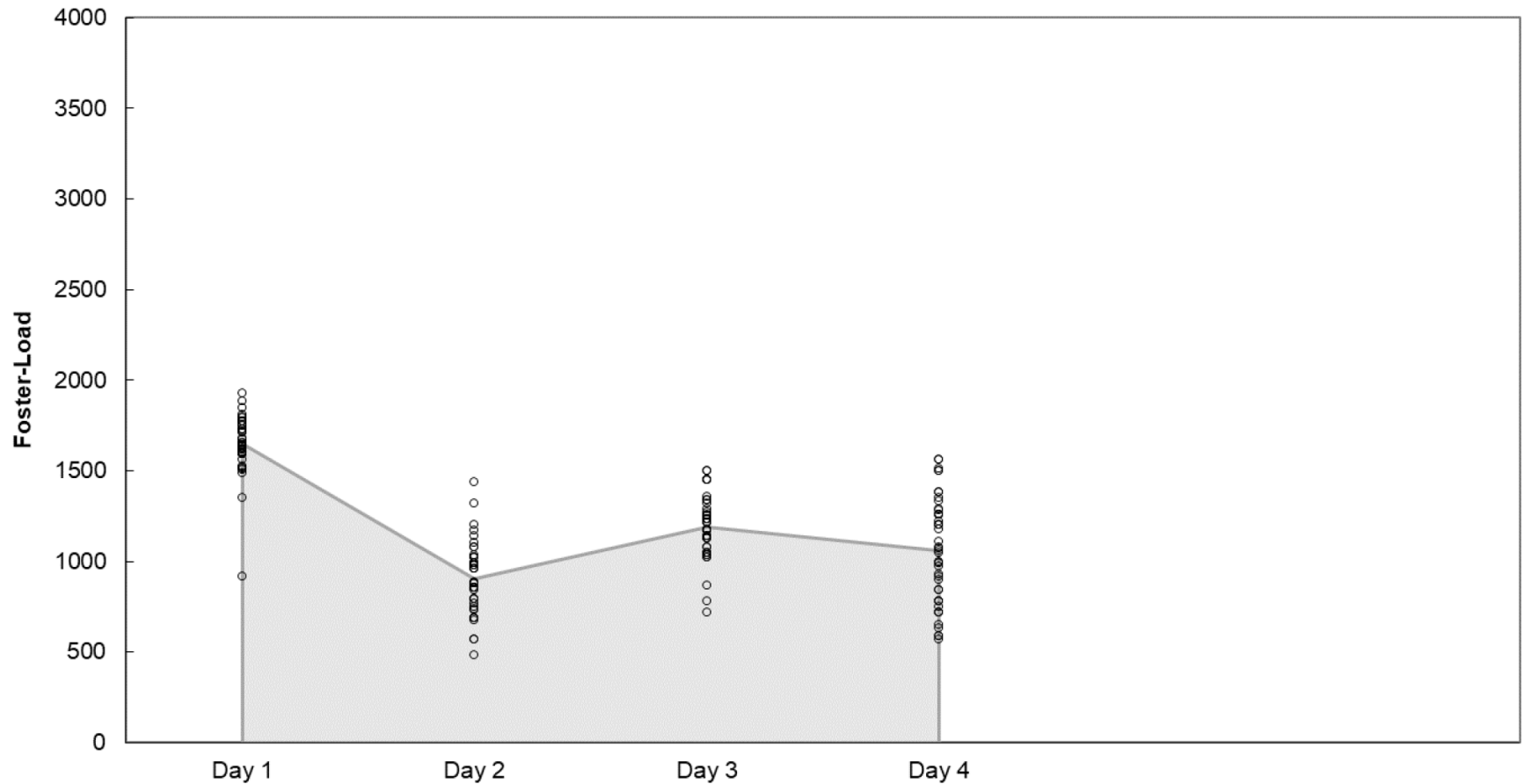


Results – Foster-Load



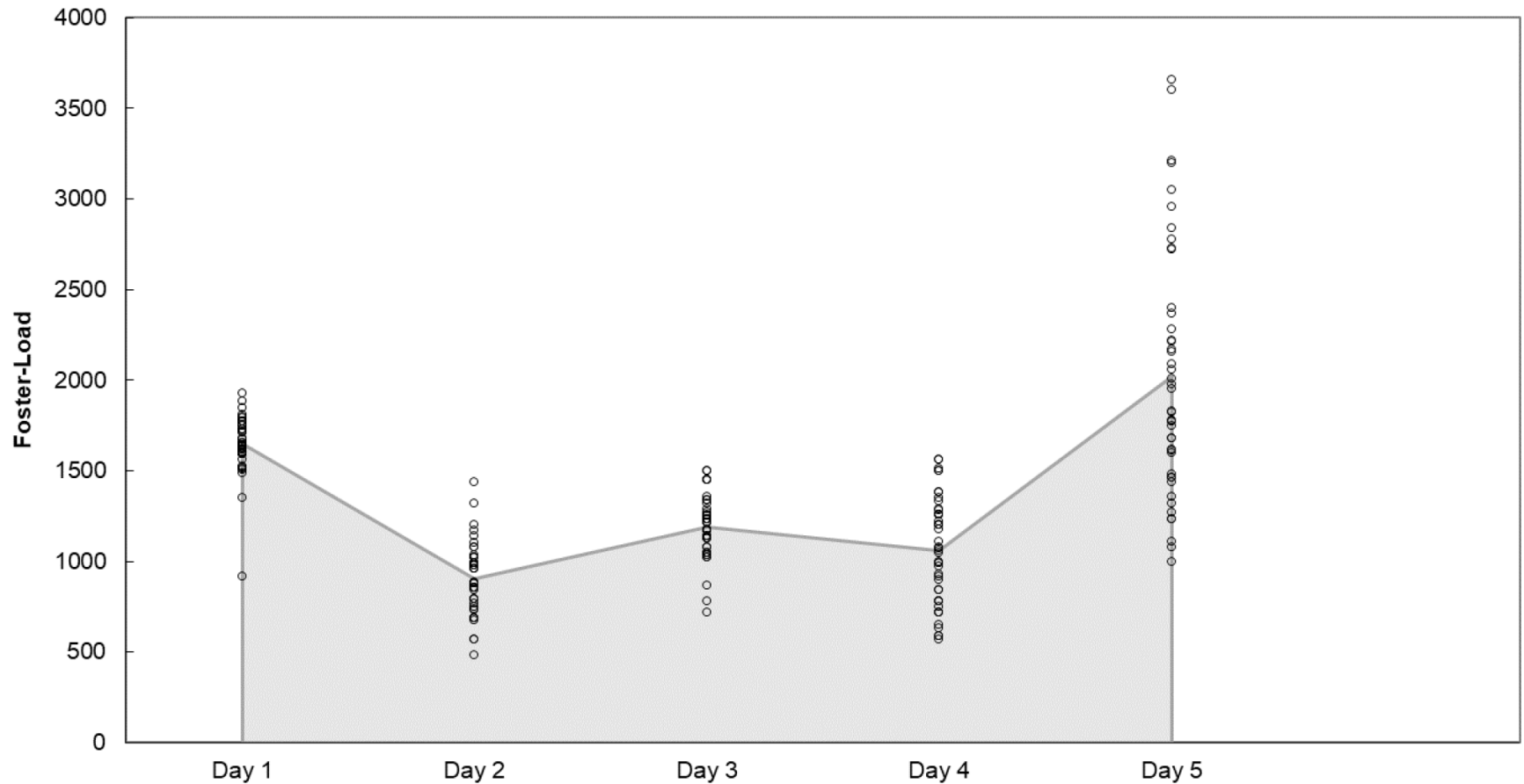


Results – Foster-Load



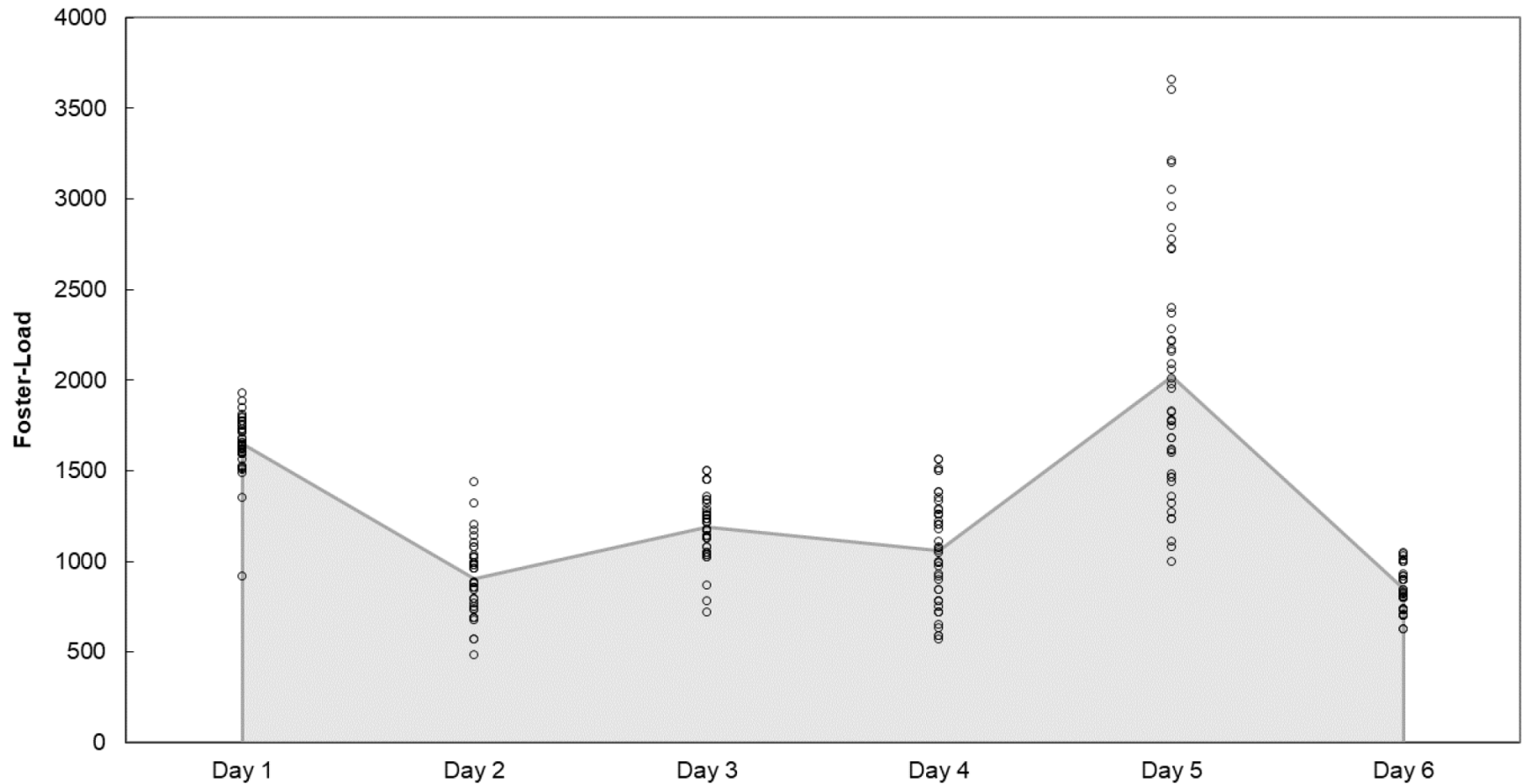


Results – Foster-Load



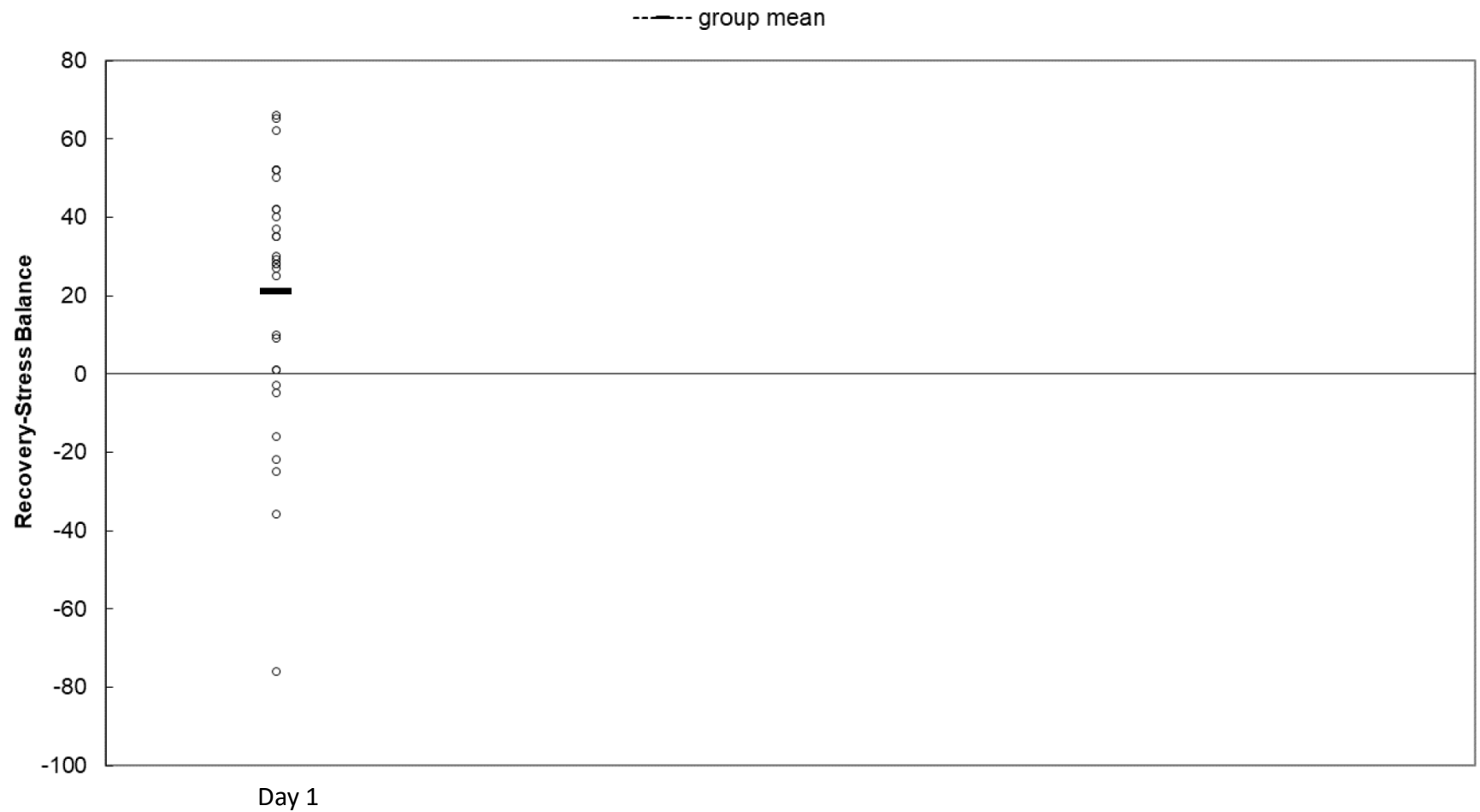


Results – Foster-Load



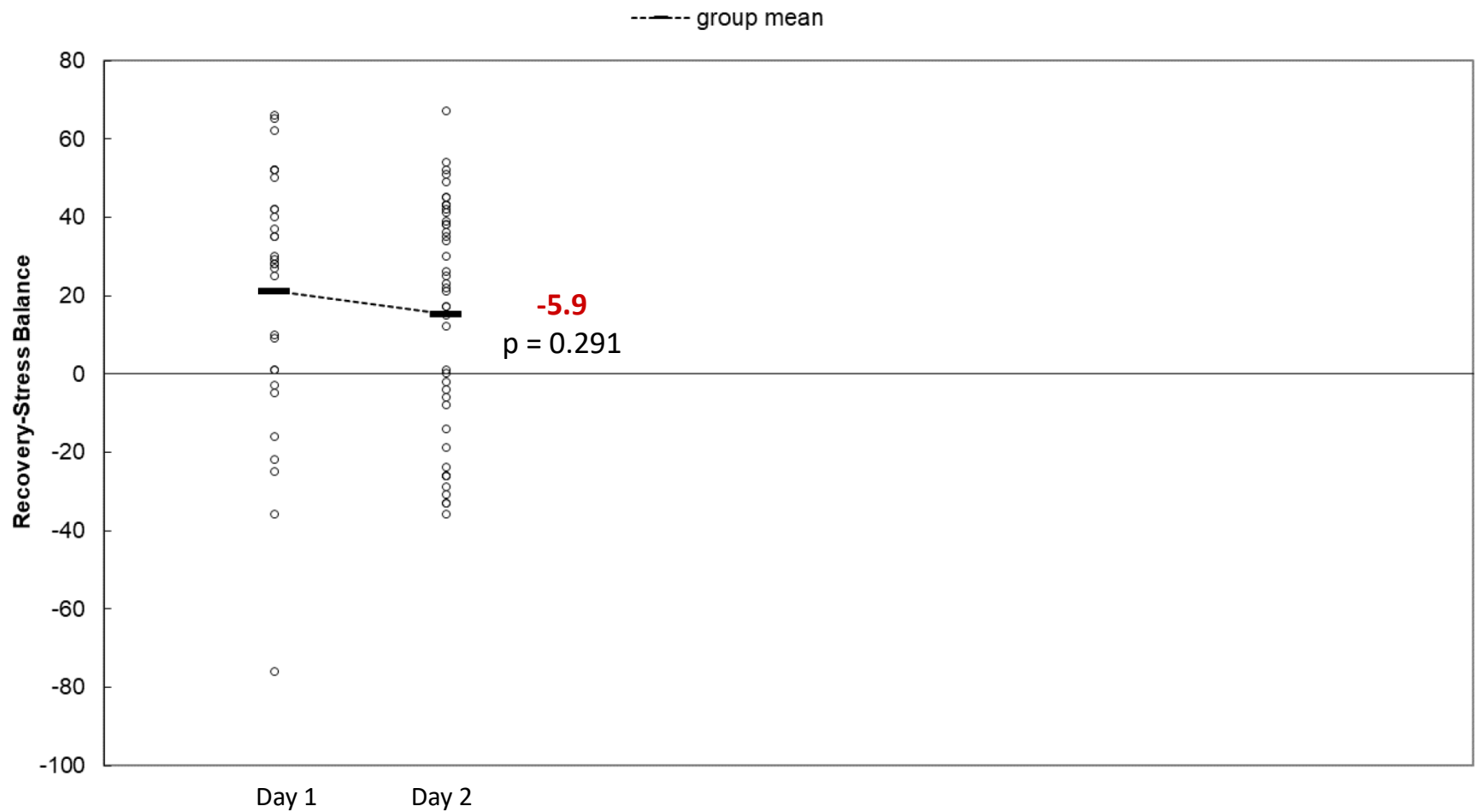


Results – Recovery-Stress balance



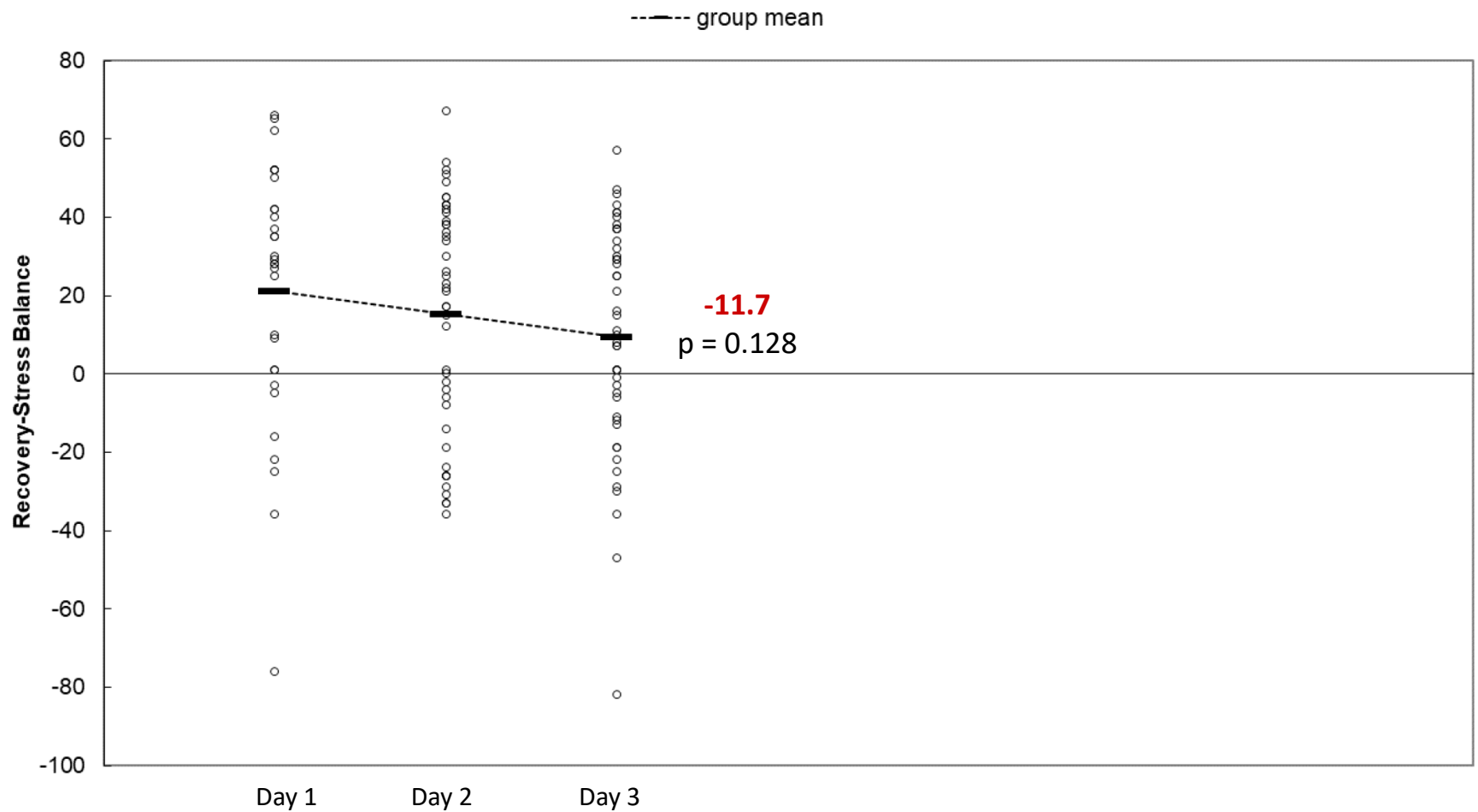


Results – Recovery-Stress balance



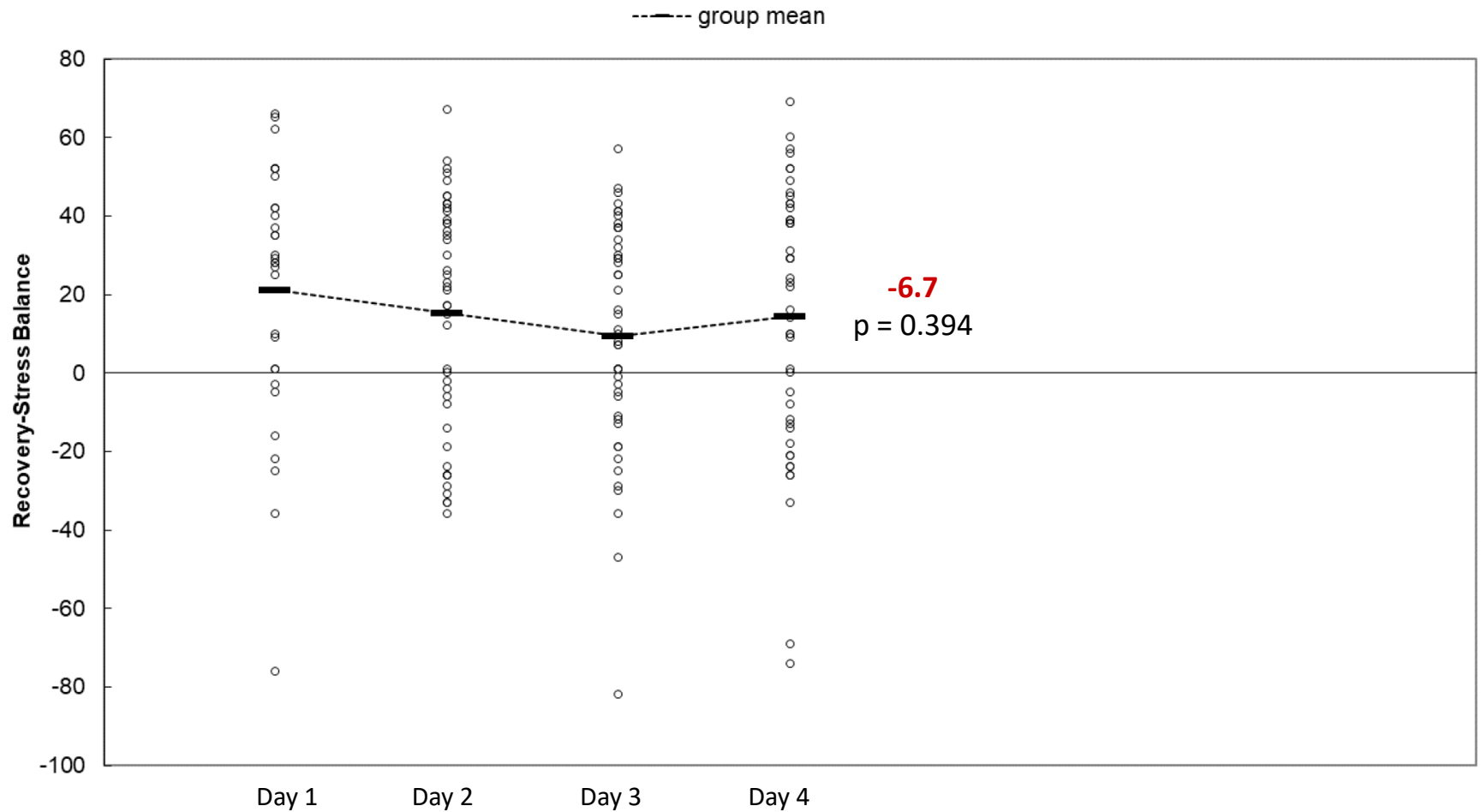


Results – Recovery-Stress balance



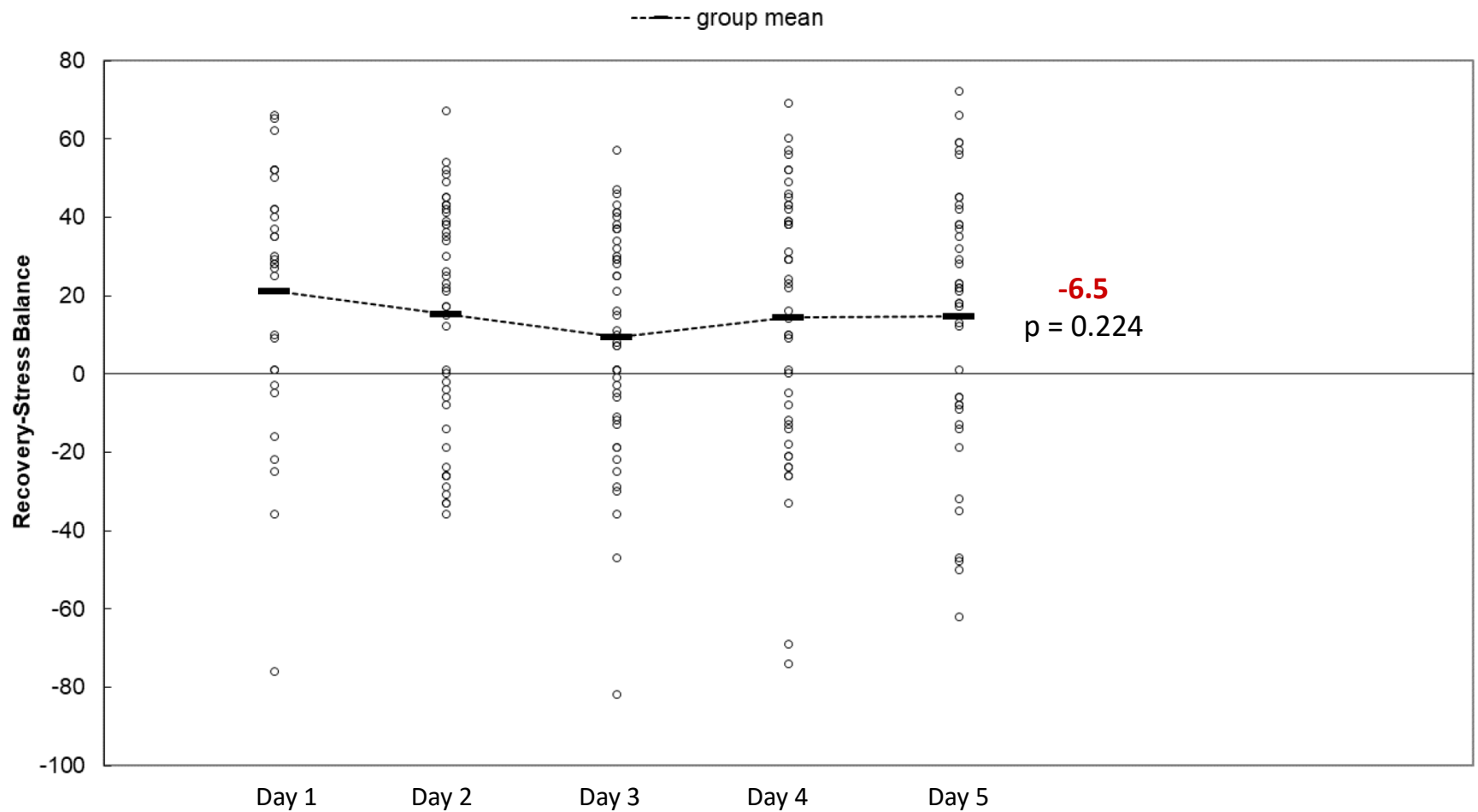


Results – Recovery-Stress balance



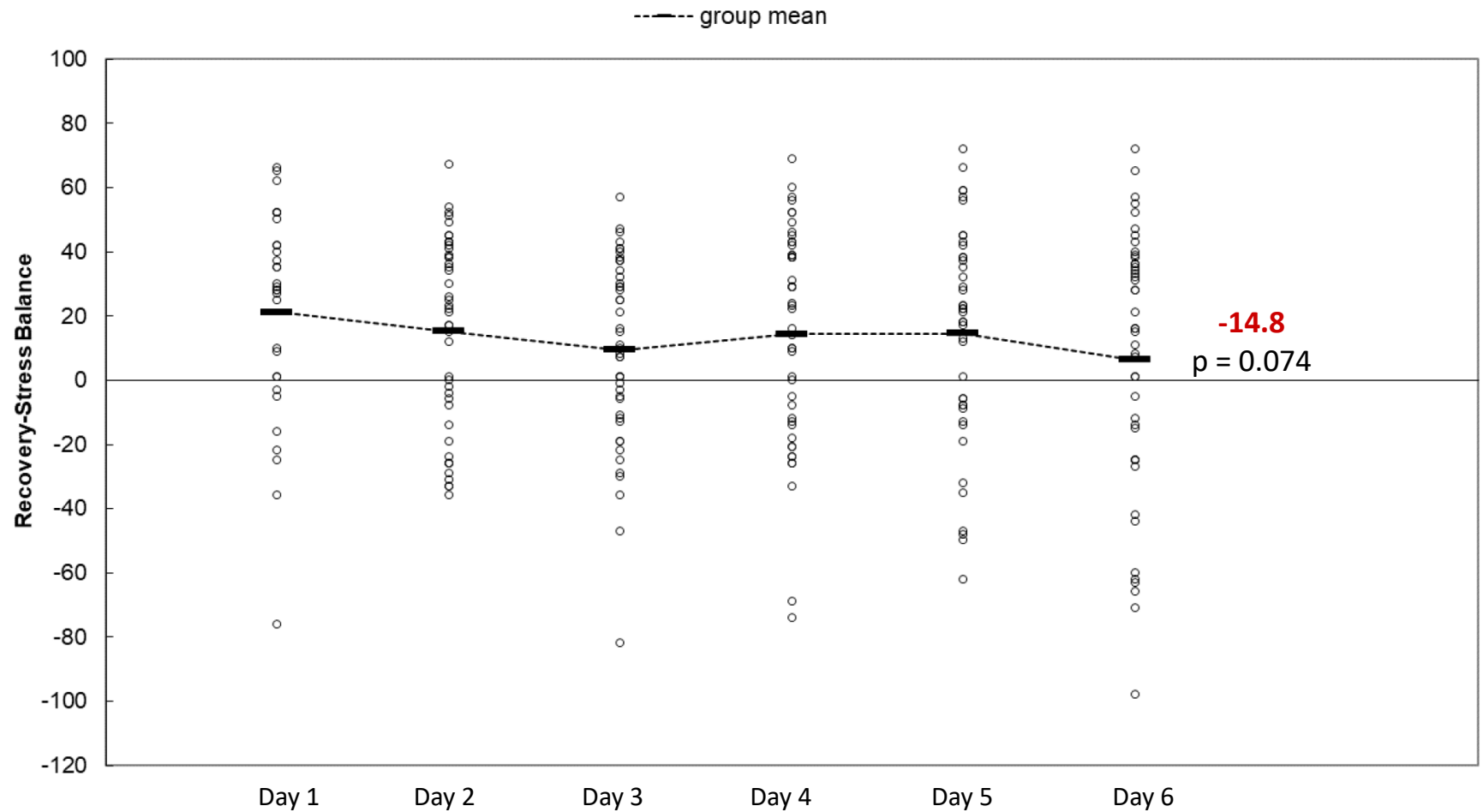


Results – Recovery-Stress balance



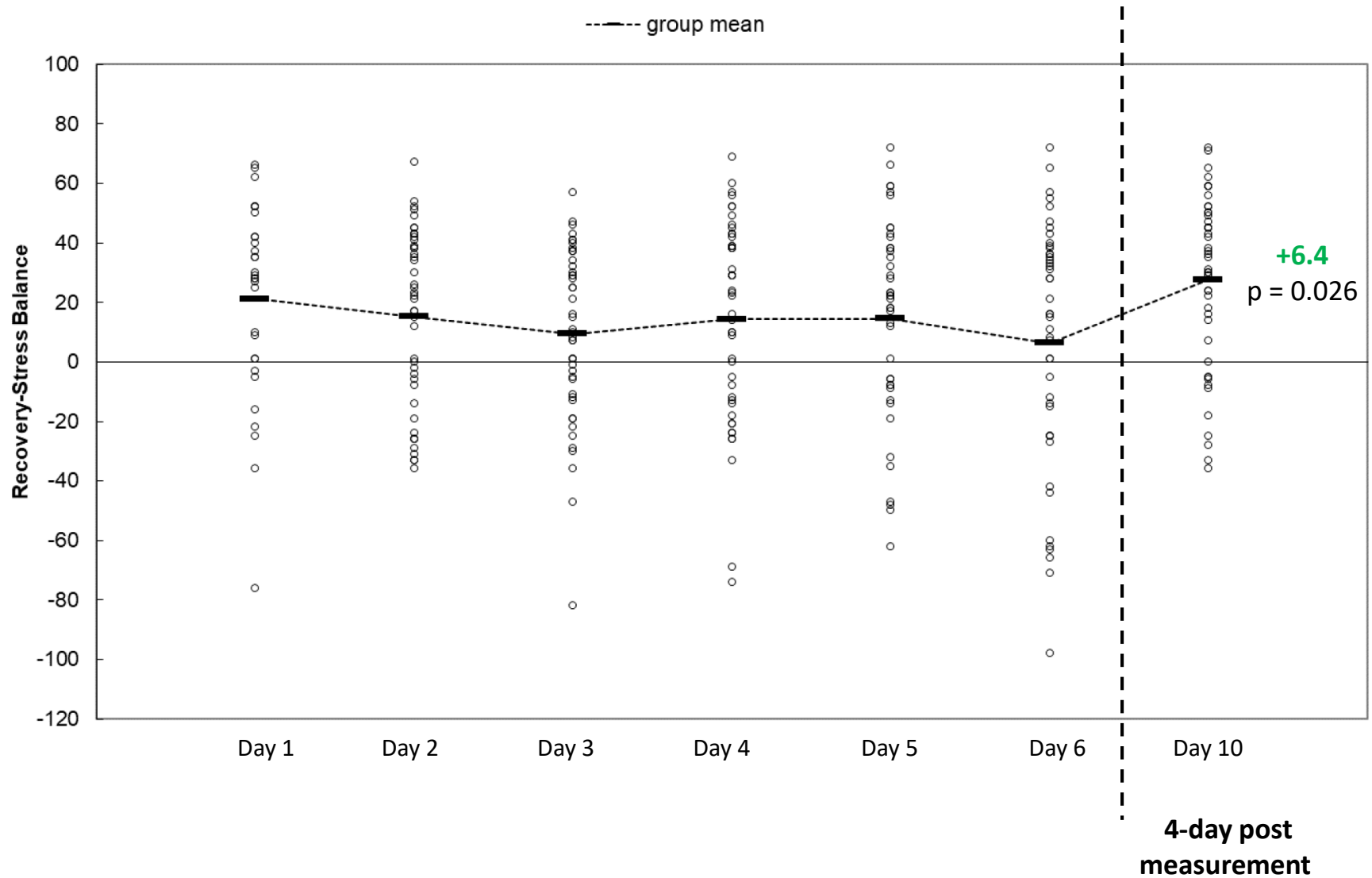


Results – Recovery-Stress balance



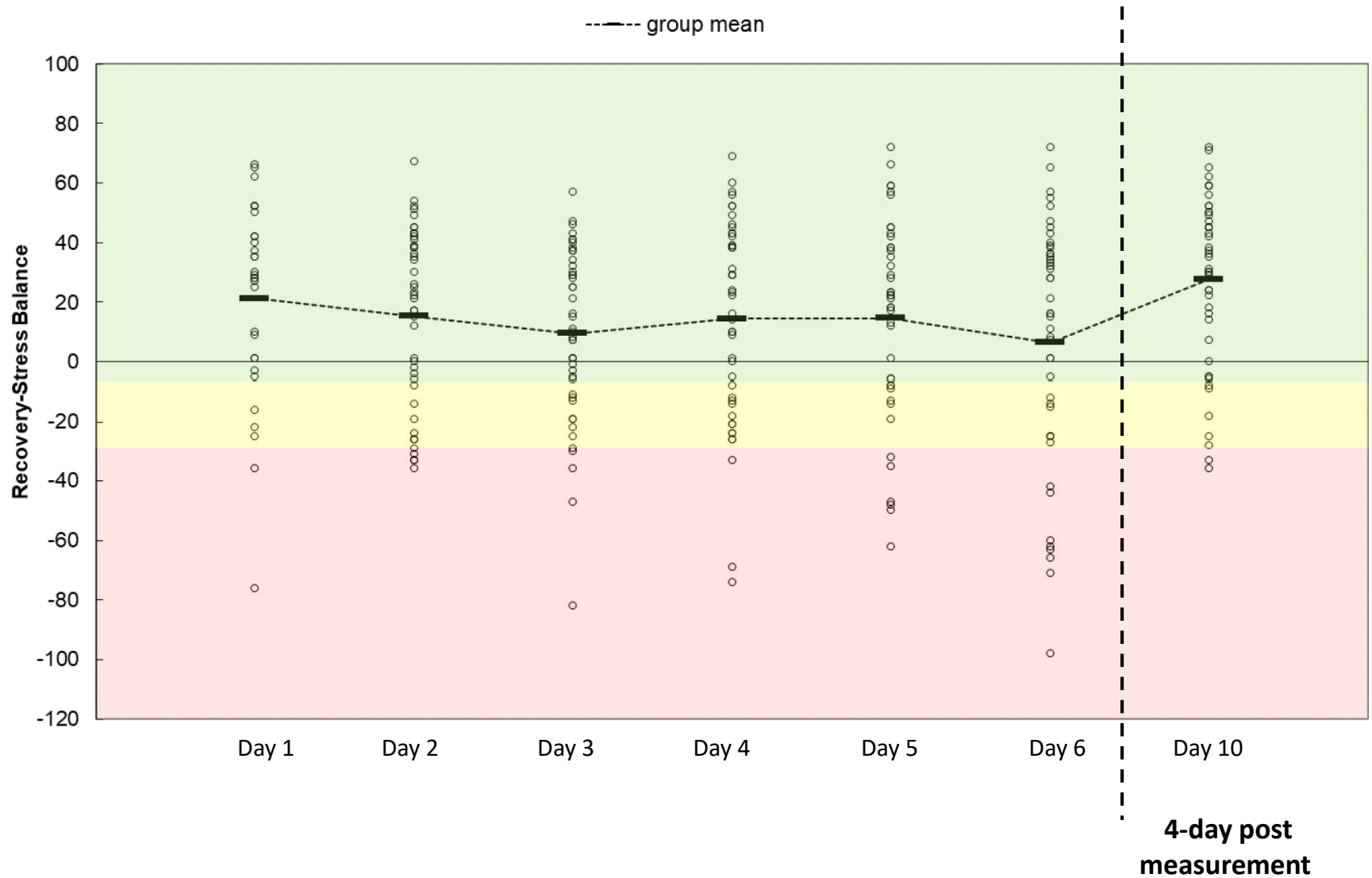


Results – Recovery-Stress balance





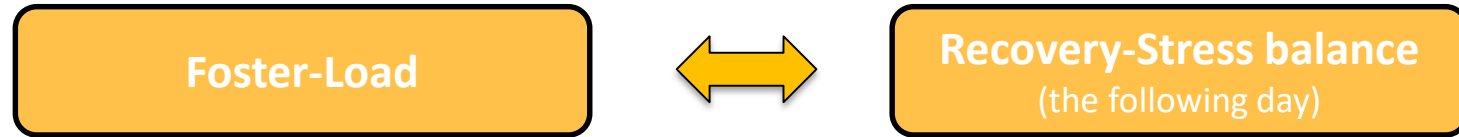
Results – Recovery-Stress balance





Results

Relationship between Foster-Load & Recovery-stress balance



Foster-Load	1-day post RSQ balance		
	correlation coefficient	p-value	Inference
Day 1	.050	.745	trivial
Day 2	-.067	.663	trivial
Day 3	.158	.295	small
Day 4	-.271	.082	small
Day 5	-.354	.017	moderate

3-pass long tour

→ The magnitude of the daily training load appears to have a larger impact on perceived recovery-stress balance towards the end of training camp



Limitations

Some evidence for unreliable self-assessment of load perception in young athletes (Bourdon et al., 2017; Williams et al., 1994)

Limited data on thresholds for recovery-stress questionnaire in youth skiers



Conclusions

Subjective and easy-to-use tools can be helpful in monitoring overall load and identifying individuals at risk in youth cross-country skiers during high-load training blocks

External, psychosocial stressors likely contribute to the overall load experienced by young athletes and should be considered in load monitoring & prescription

The management of training load in young athletes is fundamental to guarantee a long sporting career and/or engagement in sporting activities

→ Endurance athlete development is a long term project



References

- Bergeron, M. F., Mountjoy M, Armstrong N, et al. International Olympic Committee consensus statement on youth athletic development. *Br J Sports Med.* 2015;49(13):843–851.
- Bourdon, P. C., Cardinale, M., Murray, A., Gastin, P., Kellmann, M., Varley, M. C., . . . Cable, N. T. (2017). Monitoring Athlete Training Loads: Consensus
- Drew, M. K., Finch CF. The relationship between training load and injury, illness and soreness: a systematic and literature review. *Sports Med.* 2016;46(6):861–883.
- Gleeson, M., & Pyne, D. B. (2016). Respiratory inflammation and infections in high-performance athletes. *Immunol. Cell Biol.* 94, 124–131.
- Huxley, D. J., O'Connor, D., Healey. P. A. An examination of the training profiles and injuries in elite youth track and field athletes. *Eur J Sport Sci.* 2014;14(2):185–192.
- Kellmann, M., Kallus, K. W. *The Recovery-Stress Questionnaire for Athletes.* Champaign, IL: Human Kinetics; 2001.
- Kellmann, M., Bertollo, M., Bosquet, L., Brink, M., Coutts, A. J., Duffield, R., et al. (2018). Recovery and performance in sport: consensus statement. *Int. J. Sports Physiol. Perform.* 13, 240–245.
- Pensgaard, A. M., Ivarsson, A., Nilstad, A., Solstad, B. E., and Steffen, K. (2018). Psychosocial stress factors, including the relationship with the coach, and their influence on acute and overuse injury risk in elite female football players. *BMJ Open Sport Exerc. Med.* 4:e000317.
- Williams, J. G., Eston, R., Furlong, B. CERT: a perceived exertion scale for young children. *Percept Mot Skills.* 1994;79(3 Pt 2):1451–1458.



Thanks for your attention!



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