

Electronic Supplementary Material

Training During the COVID-19 Lockdown: Knowledge, Beliefs, and Practices of 12,526 Athletes from 142 Countries and Six Continents

Authors: Washif JA¹* (first author) Chamari K² (last author)

Affiliations: ¹Sports Performance Division, Institut Sukan Negara Malaysia (National Sports Institute of Malaysia), Kuala Lumpur, Malaysia; ²Aspetar, Orthopaedic and Sports Medicine Hospital, FIFA Medical Centre of Excellence, Doha, Qatar

***Contact:** jad@isn.gov.my

S1: Calculation of sample size.

The sample size was calculated according to the following predictive equation (Whitley & Ball, 2003):

$$N = \frac{(Z_{\alpha/2})^2 p q}{\Delta^2}$$

where N = number of needed athletes; $Z_{\alpha/2}$ = two-tailed normal deviate for type 1 error ($Z_{\alpha/2}$ =3.29 for 99.9% level of significance); q = 1-p; Δ = accuracy (=1.44%), and p = percentage of athletes who continued to train on a daily basis. According to Pillay et al. (2020), among the included 692 athletes, 422 (p = 0.61) continued to train on a daily basis. The sample size was therefore 12418 consecutive athletes. The assumption of 10% for missing or duplicate data gave a revised sample of 13798 athletes [$13798 = 12418 / (1.00-0.10)$].

References

1. Whitley E, Ball J. Statistics review 4: sample size calculations. Crit Care 2002;6:335-341.
2. Pillay L, Janse van Rensburg DC, Jansen van Rensburg A, et al. Nowhere to hide: the significant impact of coronavirus disease 2019 (COVID-19) measures on elite and semi-elite South African athletes. J Sci Med Sport 2020;23:670-679. <https://doi.org/10.1016/j.jsams.2020.05.016>

S2: Participants' responses to training interruption and its consequences during COVID-19 lockdown (n = 12,495).

	WC	INT	NAT	ST	REC	Overall	P ‡
	Correct or 'positive' answer, %						
K1: Lockdown resulting in limited training can/has the potential to reduce my fitness level ^(C)	68	68	68	69	62 ^b	68	0.005
K2: To maintain my fitness: I must keep my training volume (duration) high ^(F)	12 ^b	12	14	13	18 ^a	13	<0.001
K3: To maintain my fitness: I must keep my training intensity high ^(C)	72	74 ^a	71	71	62 ^b	71	<0.001
K4: If I decrease my training frequency (number of training sessions per week) by 30% or more, my fitness will decrease in a few weeks ^(C)	87	89	87	88	85	88	0.079
K5: Lockdown can/has reduced my technical skills ^(C)	58	59	56	57	51 ^b	57	0.002
K6: Lockdown is a challenge for my mental health ^(C)	56	56 ^b	59	61	56	58	<0.001
During the lockdown, I can perform normal training as usual ^(NS)							
K7: I think it is OKAY to not train at all during the lockdown ^(F)	83 ^a	82 ^a	77	78	71 ^b	79	<0.001
K8: During the lockdown, my aerobic fitness (endurance capacity) can be maintained by doing bodyweight-based High-Intensity Interval Training ^(C)	48	49	47	47	44	47	0.089
K9: During the lockdown, my pre-lockdown muscular strength can be trained / maintained by lifting light weights ^(F)	32 ^a	30	30	27 ^b	28	30	0.004

‡ Using Chi-square test for independence; %, within athlete's levels, represent 'yes' answer, relative to 'no' answer; ^a, significantly higher; ^b, significantly lower;

WC = world class, INT = international, NAT = national, ST = state, REC = recreational; (C) = correct statement, (F) = false, (NS) = non-scored, K = knowledge.

S3: Participants' beliefs/attitudes related to training interruption during COVID-19 lockdown (n = 12,495).

	WC	INT	NAT	ST	REC	Overall	P ‡
	‘Positive’ answer, %						
B1: Less than 4 weeks of lockdown will have little or no effect on my fitness levels ^(C)	33 ^a	30	28	29	32	30	0.002
B2: Lockdown can make me mentally vulnerable ^(C)	40 ^b	42 ^b	46	50 ^a	45	45	<0.001
B3: I want to maintain my fitness during the lockdown period ^(C)	87	87	83	86	78 ^b	85	<0.001
My coach wants me to maintain my fitness during the lockdown period ^(NS)							
B4: I think it is sufficient and effective to interact with my coach by correspondence during the lockdown period (e.g., video conferencing, messages, phone calls, others...) ^(C)	65 ^a	63	60	58	47 ^b	60	<0.001
B5: I want(ed) to train during lockdown, but I don't (did not) know how ^(F)	61 ^a	55	52	51	50 ^b	54	<0.001
I have found video conferencing/tutorials online/TV for training with very little equipment needed (bodyweight) ^(NS)							
I could train as I wished during lockdown ^(NS)							
B6: Training during lockdown is often boring and less motivating ^(C)	52	53	55	55	49	54	0.009
During lockdown I feel/felt anxious ^(NS)							
During the lockdown I am/was constantly scared to get infected by the COVID-19 virus ^(NS)							
When in lockdown I think (I was thinking) that lockdown period may last longer than expected ^(NS)							
B7: The absence of competition impacts(ed) on my training motivation ^(C)	55	59	58	58	40 ^b	57	<0.001
During lockdown, I feel/felt that I can/could do more training if racing against others ^(NS)							

‡ Using Chi-square test for independence; %, within athlete's levels, represent 'yes' answer, relative to 'no' answer; ^a significantly higher; ^b significantly lower;

WC = world class, INT = international, NAT = national, ST = state, REC = recreational; (C) = correct statement, (F) = false, (NS) = non-scored, B = beliefs/attitudes.

S4: Participants' knowledge as classified by athlete classification (n = 12,495).

	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Don't Know (%)	<i>P</i> ‡
Q1. Lockdown resulting in limited training can/has the potential to reduce my fitness level							
World class	29	40	13	12 ^a	5	2 ^a	<0.001
International	28	41	15	9	6	2	
National	31 ^a	38	13	9	6	3 ^a	
State	29	40	14	8	6	3	
Recreational	26	37	15	10	9 ^a	3	
Overall	29	39	14	9	6	3	
Q2. To maintain my fitness: I must keep my training volume (duration) high							
World class	30 ^a	43	14	8	3 ^b	2	<0.001
International	28	46	13	8	5	2	
National	26	44	14	8	7 ^a	2	
State	25	46	14	8	4 ^b	2	
Recreational	19 ^b	44	16	9	10 ^a	3	
Overall	26	45	14	8	5	2	
Q3. To maintain my fitness: I must keep my training intensity high							
World class	28	44	15	8 ^a	3 ^b	1	<0.001
International	28	45	14	7	4	1	
National	27	44	15	6	6 ^a	2	
State	26	46	17	7	3	2	
Recreational	19 ^b	44	19 ^a	8	8 ^a	2	
Overall	27	45	16	7	4	2	
Q4. If I decrease my training frequency (number of training sessions per week) by 30% or more, my fitness will decrease in a few weeks.							
World class	23	46	16	9	4	2	0.073
International	23	48	16	8	4	2	
National	22	48	16	8	5	2	
State	22	48	16	8	4	3	
Recreational	21	47	15	9	6	2	
Overall	22	48	16	8	5	2	
Q5. Lockdown can/has reduced my technical skills							
World class	24 ^a	34	16 ^b	18 ^a	6	2	<0.001
International	22	36	18	15	6	3	
National	21	35	19	15	7	3	
State	21	36	19	16	6	2 ^b	
Recreational	18 ^b	34	18	17	10 ^a	3	
Overall	21	36	18	16	7	3	
Q6. Lockdown is a challenge for my mental health							
World class	22 ^b	34	17	16 ^a	9	2 ^b	<0.001
International	25	32	18	16 ^a	7	3	
National	26	34	17	12 ^b	8	3	
State	27	34	18	13 ^b	7	2 ^b	
Recreational	25	32	19	11 ^b	9	4 ^a	
Overall	25	33	18	14	8	2	
Q7. During the lockdown period, I can perform normal training as usual							
World class	4	16	14 ^b	36	30 ^a	0 ^b	<0.001
International	3 ^b	16	17	39	25	1	
National	5	16	17	37	25	1	
State	5	17	17	36	23	1	
Recreational	5	20 ^a	17	32 ^b	23	3 ^a	
Overall	5	16	17	37	25	1	
Q8. I think it is OKAY to not train at all during the lockdown period							
World class	2	6 ^b	8 ^b	27	56 ^a	1	<0.001
International	2	8	8 ^b	30	53	0 ^b	
National	2	10 ^a	10	28	50	1	
State	3	9	10	29	49	1	

Recreational	2	13 ^a	12 ^a	27	45 ^b	2	
Overall	2	9	9	28	51	1	
Q9. During the lockdown period, my aerobic fitness (endurance capacity) can be maintained by doing bodyweight-based High-Intensity Interval Training							
World class	10	39	23	18	7	4	
International	10	39	24	18	6 ^b	3 ^b	
National	9	37	25	18	7	4	<0.001
State	10	37	24	18	6	5	
Recreational	8	37	21	17	9 ^a	8 ^a	
Overall	10	38	24	18	7	4	
Q10. During the lockdown period, my pre-lockdown muscular strength can be trained / maintained by lifting light weights							
World class	7	37	21	22	10	3	
International	6	38	23	22	8	3	
National	7	38	23	21	9	3	<0.001
State	7	40	22	20	8 ^b	3	
Recreational	6	40	21	19	10	5 ^a	
Overall	7	38	22	21	9	3	

‡ Using Chi-square test for independence; %, within athlete's levels, represent 'yes' answer, relative to 'no' answer; ^a significantly higher; ^b significantly lower;

N.B. – 36% agreed and 21% strongly agreed that movement restrictions could reduce technical skill (Q5); world class and recreational athletes had higher (24%) and lower (18%) scores for strongly agree, respectively ($p < 0.05$). 33% agreed and 25% strongly agreed that movement restrictions were mentally challenging (Q6); less (strongly agreed) among world-class athletes ($p < 0.05$). Moreover, 51% strongly disagreed for “OKAY to not train at all” statement (Q8) during movement restrictions; here, world-class had highest score while recreational athletes had lowest score ($p < 0.05$). *Other details are described in the main text.*

S5: Participants' belief/attitude/fact/feeling as classified by athlete classification (n = 12,495).

	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Don't Know (%)	<i>P</i> ‡
Q1. Less than 4 weeks of lockdown will have little or no effect on my fitness levels							
World class	6 ^a	27	20	35	11	2	
International	4	26	22	35	11	2	
National	5	24	21	36	13	2	<0.001
State	5	24	21	38	10	2	
Recreational	6	27	21	30 ^b	14	3	
Overall	5	25	21	36	12	2	
Q2. Lockdown can make me mentally vulnerable							
World class	10 ^b	30 ^b	22	25 ^a	11	1	
International	11	31	23	25 ^a	9	1	
National	12	34	21	23	8	2	<0.001
State	13	37 ^a	21	20 ^b	8	2	
Recreational	14	32	22	21	8	4 ^a	
Overall	12	34	22	23	8	2	
Q3. I want to maintain my fitness during the lockdown period							
World class	51 ^a	36	5	2	3 ^b	3 ^b	
International	51 ^a	37	4 ^b	1	3 ^b	4	
National	45 ^b	39	5	2	5 ^a	5 ^a	<0.001
State	47	39	6	2	4	3 ^b	
Recreational	39 ^b	41	6	1	6 ^a	8 ^a	
Overall	47	38	5	1	4	4	
Q4. My coach wants me to maintain my fitness during the lockdown period							
World class	42 ^a	40	9	3	4 ^b	4 ^b	
International	44 ^a	37	8 ^b	3	4 ^b	5 ^b	
National	37	38	10	3	5	7 ^b	<0.001
State	33 ^b	38	14 ^a	3	4 ^a	9 ^a	
Recreational	21 ^b	38	16 ^a	4	7 ^a	14 ^a	
Overall	37	38	11	3	5	7	
Q5. I think it is sufficient and effective to interact with my coach by correspondence during the lockdown period (e.g., video-conferencing, messages, phone calls, others...)							
World class	25 ^a	40	15 ^b	12	5	3 ^b	
International	23	39	18	11	5	3 ^b	
National	22	39	17	12	6 ^a	4 ^b	<0.001
State	20 ^b	38	19	12	4 ^b	6 ^a	
Recreational	15 ^b	33 ^b	21 ^a	12	7	12 ^a	
Overall	22	39	18	12	5	5	
Q6. I want(ed) to train during lockdown, but I don't (did not) know how							
World class	4 ^b	13 ^b	19	37	25 ^a	2	
International	5 ^b	17	22	36	19	1 ^b	
National	6	18	21	36	17 ^b	2	<0.001
State	7 ^a	19	22	34	17 ^b	2	
Recreational	6	20	20	31 ^b	20	2	
Overall	6	18	21	35	19	2	
Q7. I have found video-conferencing/tutorials online/TV for training with very little equipment needed (bodyweight). I think they can be helpful in maintaining athletes' fitness.							
World class	15	46	20 ^a	8	7	4	
International	15	49 ^a	18	8	7	3	
National	17	46	18	8	7	4	<0.001
State	19 ^a	46	18	8	6	3	
Recreational	17	43	14 ^b	9	9 ^a	7 ^a	
Overall	17	47	18	8	7	4	
Q8. I could train as I wished during lockdown							
World class	9	25	16 ^b	31	19 ^a	1	
International	8	25	20	31	16	1	0.021

National	8	24	19	31	17	1	
State	9	23	20	31	15	1	
Recreational	8	25	18	30	17	2 ^a	
Overall	8	24	19	31	17	1	
Q9. Training during lockdown is often boring and less motivating							
World class	15 ^b	37	19	20 ^a	7	2 ^b	
International	19	34 ^b	19	18	8	3	
National	19 ^a	36	17	15 ^b	9	3	<0.001
State	17	39 ^a	18	16	8	3	
Recreational	15	35	18	17	11 ^a	4 ^a	
Overall	18	36	18	17	9	3	
Q10. During lockdown I feel/felt anxious							
World class	10 ^b	31	21	24 ^a	13 ^a	2	
International	11 ^b	32	23	22	11	3	
National	13	33	21	20	11	3	<0.001
State	15 ^a	34	21	19	10 ^b	2	
Recreational	13	29	22	18	14 ^a	4 ^a	
Overall	13	33	21	20	11	3	
Q11. During the lockdown I am/was constantly scared to get infected by the COVID-19 virus							
World class	9 ^b	21 ^b	20	30 ^a	19 ^a	1 ^b	
International	12	25	22	26	14	2	
National	11	26	22	25	15	2	<0.001
State	11	27 ^a	22	2 ^b	15	2	
Recreational	12	26	23	23	14	3	
Overall	11	26	22	25	15	2	
Q12. When in lockdown I think (I was thinking) that lockdown period may last longer than expected							
World class	18 ^b	44	16 ^a	13 ^a	5	3	
International	22	44	15	10	5	3	
National	22	45	14	10	6	3	<0.001
State	24 ^a	44	13 ^b	11	5	3	
Recreational	22	40	14	12	8 ^a	4	
Overall	22	44	14	11	6	3	
Q13. The absence of competition impacts(ed) on my training motivation							
World class	22	34	16	19 ^a	9	1 ^b	
International	22	37	16	16	7	2	
National	23	36	15	15	8	3	<0.001
State	22	37	15	16	8	2	
Recreational	13 ^b	28 ^b	24 ^a	18	12 ^a	5 ^a	
Overall	22	36	16	16	8	2	
Q14. During lockdown, I feel/felt that I can/could do more training if racing against others. Training by myself without partners/opponents reduced my training load (volume/intensity)							
World class	12 ^b	38	20	20 ^a	7	3	
International	16	38	20	15	8	3	
National	17	37	19	15	9	4	<0.001
State	17	38	19	15	8	3	
Recreational	15	32 ^b	21	18	10	4	
Overall	16	37	19	16	8	3	

‡ Using Chi-square test for independence; %, within athlete's levels, represent 'yes' answer, relative to 'no' answer; ^a significantly higher; ^b significantly lower;

N.B. – A minority (36%) of athletes disagreed that 4 weeks of movement restrictions have little impact on fitness levels (Q1), less among recreational athletes ($p < 0.05$). Similarly, 34% athletes agreed that movement restrictions can make an athlete mentally vulnerable (Q2); less among world-class and higher among state athletes ($p < 0.05$). 37% of athletes strongly agreed that their coaches wanted them to maintain fitness during movement restrictions (Q4); (more world-class- and international-athletes indicated: strongly agree ($p < 0.05$)). 35% athletes disagreed to the statement of “I want to train during movement restrictions but I don't know how” (less recreational athletes indicated: disagree (Q6), $p < 0.05$). Moreover, 36% of athletes agreed that training during movement restrictions is often boring and less motivating (Q9) (less among international- ($p < 0.05$) but more among state-athletes ($p < 0.05$)). Most athletes agreed (44%) and strongly agreed (22%) that the upcoming period of movement restrictions may

last longer than expected (Q12). 36% athletes agreed and 22% strongly disagreed that the absence of competition impacted their training motivation (Q13) ($p < 0.05$). *Other details are described in the main text.*