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A retrospectively longitudinal study of overreaching in elite female Chinese Wrestlers

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Main Content

- Definition and Prevalence
- Monitoring Indexes and Evaluation
- Case analysis
- Cautions

What is OR and OTS

OT has different terms and definition

- overtraining syndrome
- staleness syndrome
- chronic fatigue syndrome
- unexplained underperformance
- overstrained

- stagnation
- burnout
- overworked
- overstressed
- overused

the different stages of training, OR and OTS

PROCESS	TRAINING (overload)	INTENSIFIED TRAINING →		
OUTCOME	ACUTE FATIGUE	FUNCTIONAL OR (short-term OR)	NON-FUNCTIONAL OVERREACHING (extreme OR)	OVERTRAINING SYNDROME (OTS)
RECOVERY	Day(s)	Days – weeks	Weeks – months	Months - …
PERFORMANCE	INCREASE	Temporary performance decrement (e.g., training camp)	STAGNATION DECREASE	DECREASE

(Romain Meeusen, Belgium, 2013)

Potential triggers of OR and OTS

- Increased training load without adequate recovery
- Monotony of training
- Excessive number of competitions

- Personal and emotional (psychological) problems
- Stressors including personal life and occupational

- Sleep disturbances
- Previous illness
- Injury
- Altitude exposure

Definition of OR and OTS for female wrestlers

Classification of FOR, NFOR and the OTS For Female Wrestlers

	Classification
FOR	the wrestler experienced decreased **training performance**, which was followed by full recovery and enhanced **competition performance** within 2 wk of engaging in an appropriate **recovery** regimen.
NFOR	if episodes of decreased competition performance lasted 2-6 wk.
OTS	if episodes of decreased competition performance lasted more than 6 wk.

Definition

Training Performance

The assessment of a decrease in training performance was completed by experienced coaches based on the wrestler's inability to maintain the scheduled training load and a decrease in the wrestler's combative scoring point

Full recovery

Full recovery of a wrestler was confirmed when the two were reestablished.
If the two criteria were not met simultaneously, the wrestler was not considered to be fully recovered.
even though the monitoring parameters recover to within the normal range.

Definition

competition performance

Point Scale	Competition Performance
0	the athlete is 'off her game' and performance is significantly decreased
1	performance is better than 0, but still lowered
2	performance is slightly below normal
3	no improvement from the original level
4	performance is slightly enhanced
5	performance has improved considerably and the athlete is performing at a high level

After two weeks of recovery, the athlete got "0" or "1" grade, and she was considered to be in NFOR state.

Prevalence of OR and OT in female wrestlers

Prevalence

subjects

Weight class	n	Age (yr)	Height (cm)	Body mass (kg)
48 kg	31	22 (3)	158.9 (3.5)	52.7 (1.7)
55 kg	30	23 (2)	163.5 (2.8)	60.4 (2.2)
63 kg	32	23 (3)	168.1 (2.2)	67.1 (1.8)
72 kg	21	23 (2)	173.6 (2.5)	74.0 (2.3)
Total	114	23 (2)	165.4 (5.9)	62.7 (7.9)

times

2003-2012

Prevalence

a prevalence of 3.6%, 6.4% and 0.6% for FOR, NFOR and the OTS, respectively.

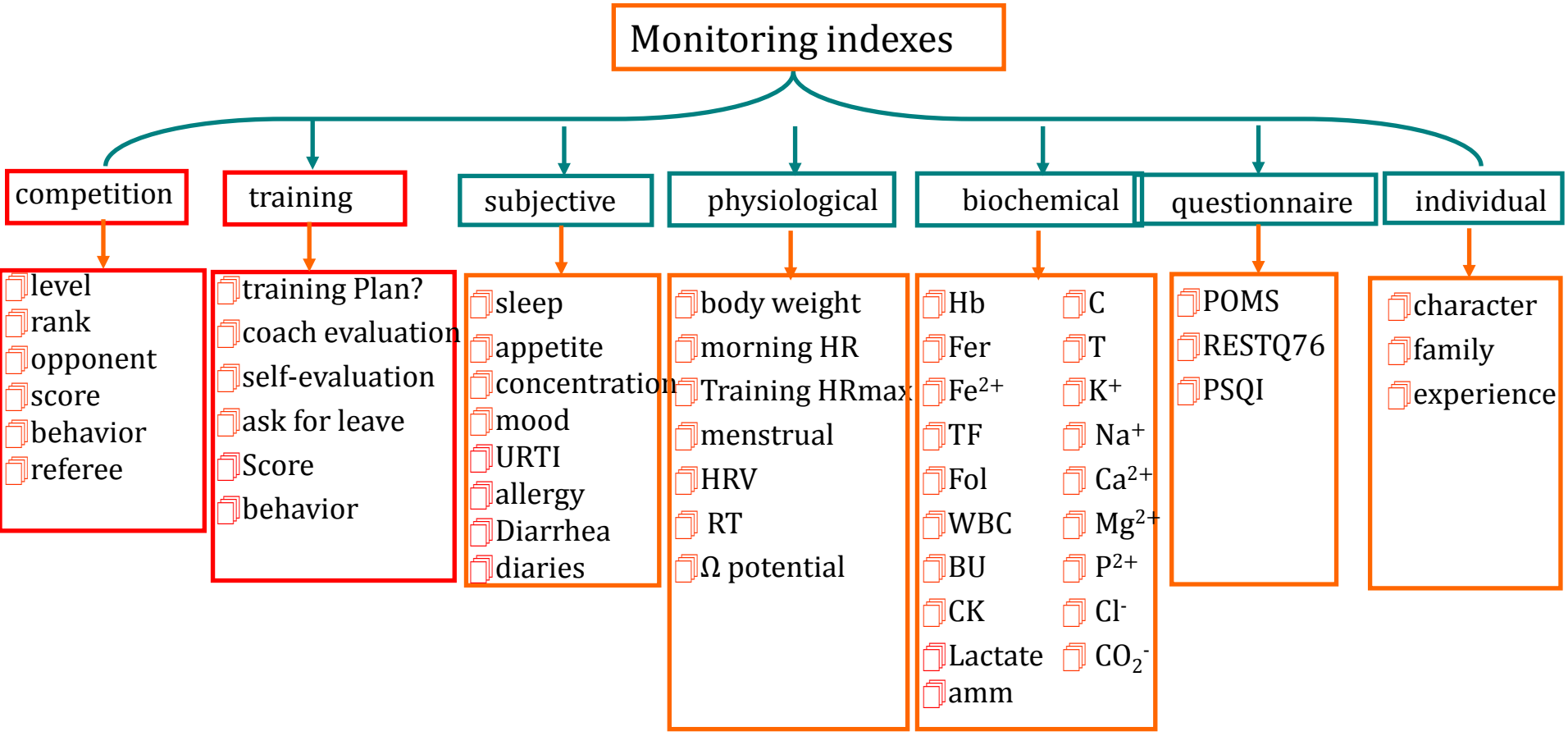
Nine (69%) of the 13 athletes who had ranked top-3 in World Championships experienced NFOR at least once.

Monitoring period	n	Competition (number of wrestlers that competed)	FOR	NFOR	OTS
Nov 2003 – Mar 2004	32	2004 Olympic Qualification Tournament (1)	1	---	---
Apr 2004 – Jul 2004	32	2004 National Qualification Tournament (8)	2	1	---
Oct 2005 – Sep 2006	40	2006 Senior Asian Championship (7)	---	---	---
		2006 World Cup (7)	---	---	---
		2006 Senior World Championships (7)	1	1	---
Oct 2006 – Dec 2006	40	2006 15th Asian Games (4)	1	2	---
Jan 2007 – Jan 2008	40	2007 National Qualification Tournament (12)	1	4	---
		2007 Senior Asian Championships (7)	---	---	---
		2007 National Qualification Tournament (12)	---	1	---
		2007 Senior World Championships (7)	1	2	---
		2008 World Cup (14)	---	---	---
Feb 2008 – Jul 2008	40	2008 Senior Asian Championships (7)	---	---	---
		2008 National Qualification Tournament 1 (7)	---	---	1
		2008 National Qualification Tournament 2 (6)	1	1	---
Oct 2009 – May 2010	34	2010 World Cup (14)	---	1	---
		2010 Senior Asian Championships (7)	---	2	---
Jun 2010 – Nov 2010	36	2010 Junior Asian Championships (8)	---	1	---
		2010 Junior World Championships (8)	---	1	---
		2010 Youth Olympic Games (1)	---	---	---
		2010 Senior Combat Games (3)	---	---	---
		2010 Senior world Championships (7)	1	2	---
		2010 16th Asia games (4)	---	---	---
Dec 2010 – Nov 2011	30	2011 World Cup (7)	1	1	---
		2011 Junior Asian Championship (8)	---	---	---
		2011 Senior Asian Championship (7)	1	---	---
		2011 Senior World Championship (7)	---	---	---
Dec 2011 – May 2012	34	2012 Senior Asian Championship (7)	2	---	---
		2012 National Qualification Tournament (16)	---	2	---
		2012 Olympic Qualification Tournament 1 (1)	---	1	---
		2012 Olympic Qualification Tournament 2 (1)	---	---	1

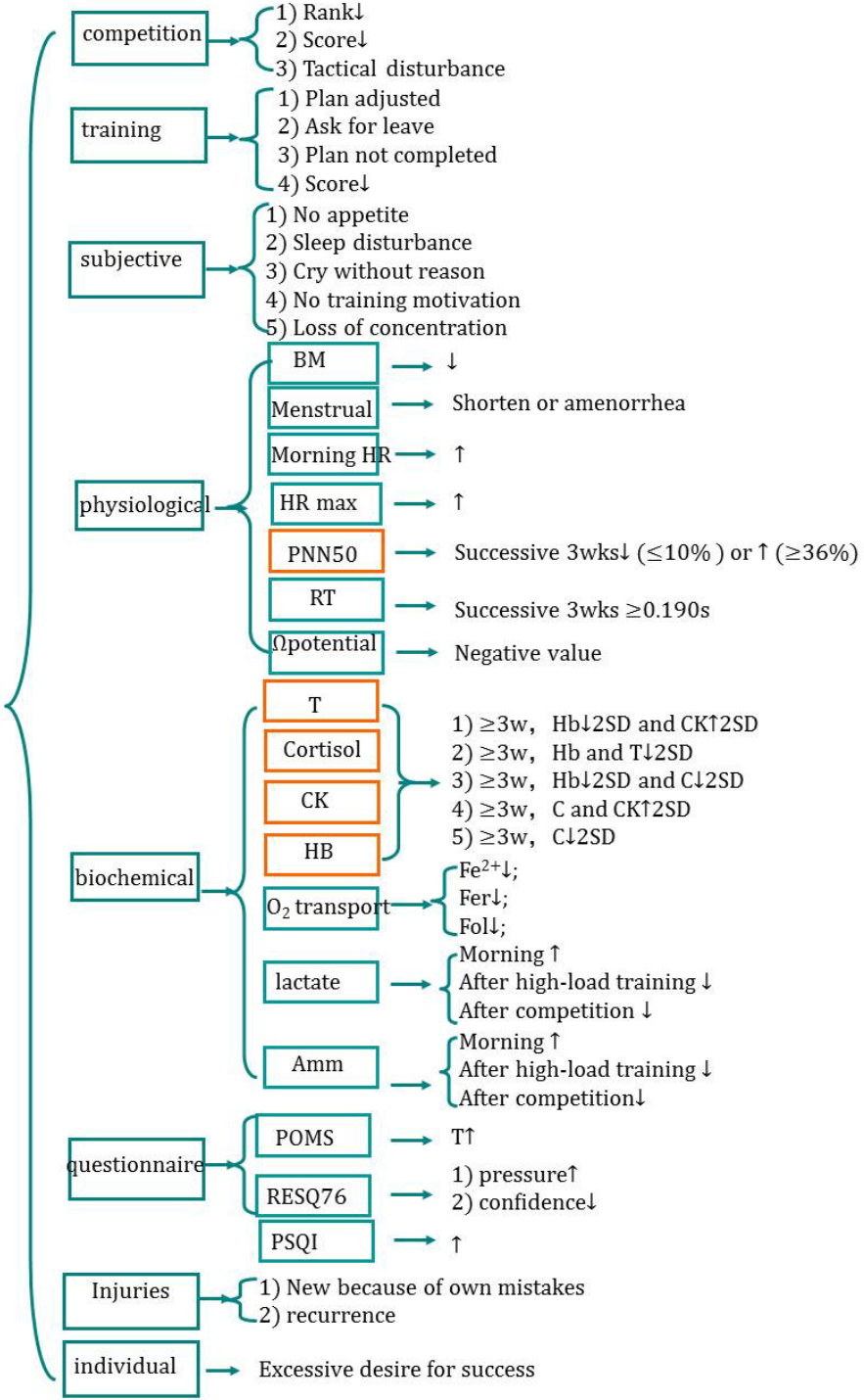
Monitoring indexes and Evaluation

Monitoring indexes

1) Direct observational
2) Physiological screening
3) Biochemical screening
4) Questionnaires
5) Individual character


Monitoring indexes
competition
training
subjective
physiological
biochemical
questionnaire
individual
level
rank
opponent
score
behavior
referee
training Plan?
coach evaluation
self-evaluation
ask for leave
Score
behavior
sleep
appetite
concentration
mood
URTI
allergy
Diarrhea
diaries
body weight
morning HR
Training HRmax
menstrual
HRV
RT
Ω potential
Hb
Fer
Fe2+
TF
Fol
WBC
BU
CK
Lactate
amm
C
T
K+
Na+
Ca2+
Mg2+
P2+
Cl-
CO2-
POMS
RESTQ76
PSQI
character
family
experience

Evaluation Methods



NFOR:

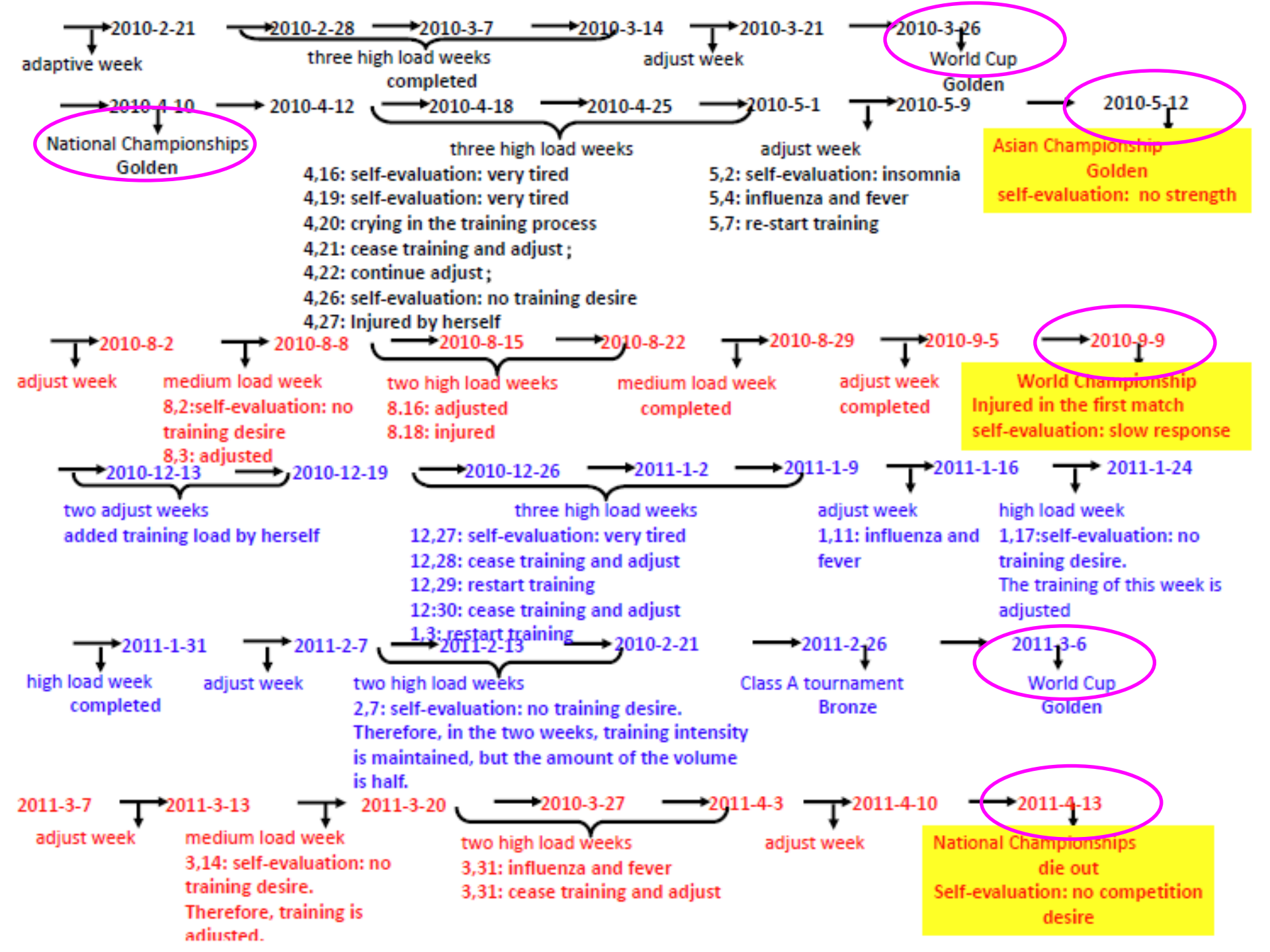
three-consecutive-week change patterns of the following markers may imply a state of NFOR:

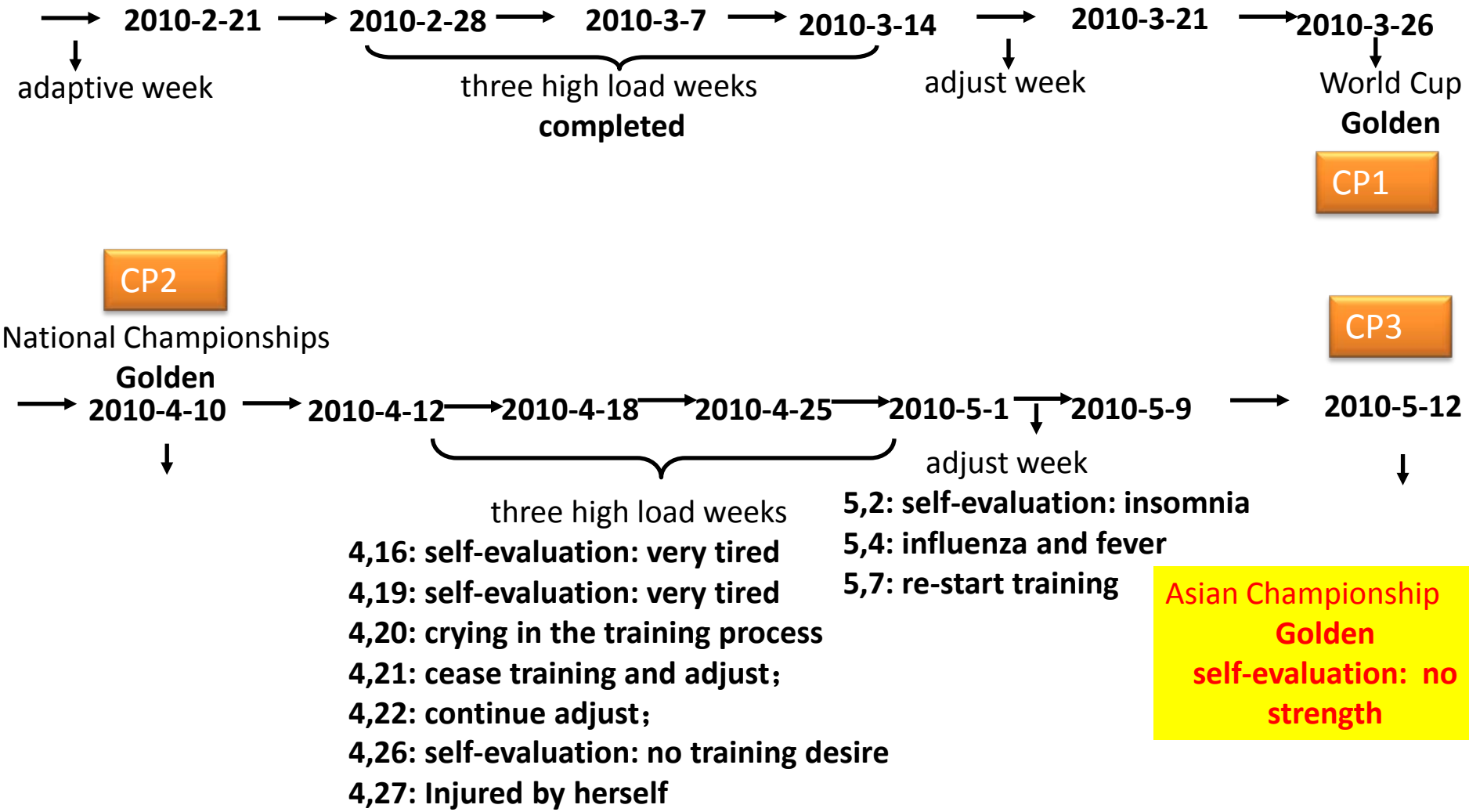
markers	Change Pattern
Biochemical	(I)sustained CK in the range(X+2SD) accompanied with a fall(2SD) in HB
	(II)increase of both CK and C to the range (X+2SD)
	(III)decrease of both HB and T to the range(X-2SD)
	(iv) continued decrease in HB to the range(X-2SD) following enhanced C to the range(X+2SD)
	(v) decrease in C to the range(X-2SD)
Physiological	PNN50 significantly increased(≤10%)
	PNN50 significantly decreased(≥36%)

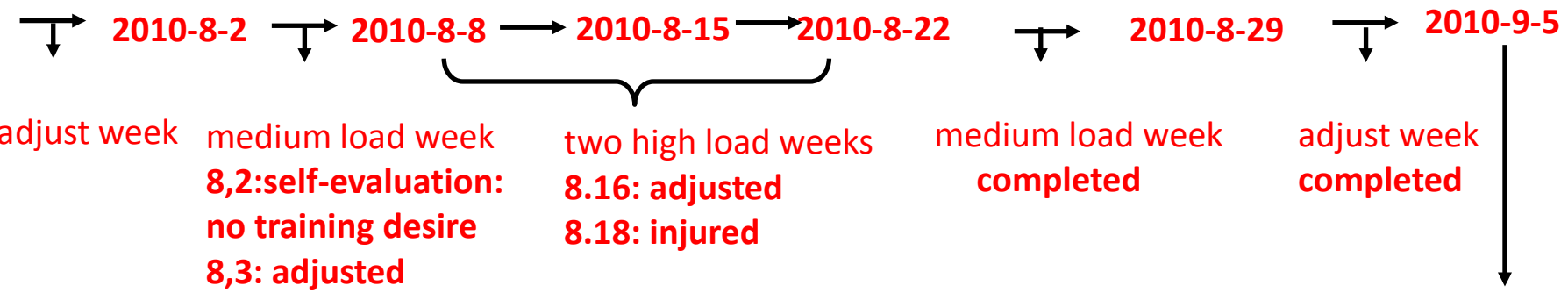
Normal value

indexes	N	X±SD
HB(g/L)	2455	130.1±8.8
CK(U/L)	2555	162±78
T(ng/dL)	2169	46±15
C(μg/dL)	2094	16.4±4.0

Case analysis


2010-2-21
adaptive week
2010-2-28
2010-3-7
2010-3-14
three high load weeks completed
2010-3-21
adjust week
2010-3-26
World Cup
Golden
2010-4-10
National Championships
Golden
2010-4-12
2010-4-18
2010-4-25
three high load weeks
4,16: self-evaluation: very tired
4,19: self-evaluation: very tired
4,20: crying in the training process
4,21: cease training and adjust;
4,22: continue adjust;
4,26: self-evaluation: no training desire
4,27: Injured by herself
2010-5-1
adjust week
5,2: self-evaluation: insomnia
5,4: influenza and fever
5,7: re-start training
2010-5-9
2010-5-12
Asian Championship
Golden
self-evaluation: no strength
2010-8-2
adjust week
2010-8-8
medium load week
8,2:self-evaluation: no training desire
8,3: adjusted
2010-8-15
2010-8-22
two high load weeks
8.16: adjusted
8.18: injured
2010-8-29
medium load week
completed
2010-9-5
adjust week
completed
2010-9-9
World Championship
Injured in the first match
self-evaluation: slow response
2010-12-13
2010-12-19
two adjust weeks
added training load by herself
2010-12-26
2011-1-2
2011-1-9
three high load weeks
12,27: self-evaluation: very tired
12,28: cease training and adjust
12,29: restart training
12:30: cease training and adjust
1,3: restart training
2011-1-16
adjust week
1,11: influenza and fever
2011-1-24
high load week
1,17:self-evaluation: no training desire.
The training of this week is adjusted
2011-1-31
high load week
completed
2011-2-7
adjust week
2011-2-13
2010-2-21
two high load weeks
2,7: self-evaluation: no training desire.
Therefore, in the two weeks, training intensity is maintained, but the amount of the volume is half.
2011-2-26
Class A tournament
Bronze
2011-3-6
World Cup
Golden
2011-3-7
adjust week
2011-3-13
medium load week
3,14: self-evaluation: no training desire.
Therefore, training is adjusted.
2011-3-20
2010-3-27
2011-4-3
two high load weeks
3,31: influenza and fever
3,31: cease training and adjust
2011-4-10
adjust week
2011-4-13
National Championships
die out
Self-evaluation: no competition desire

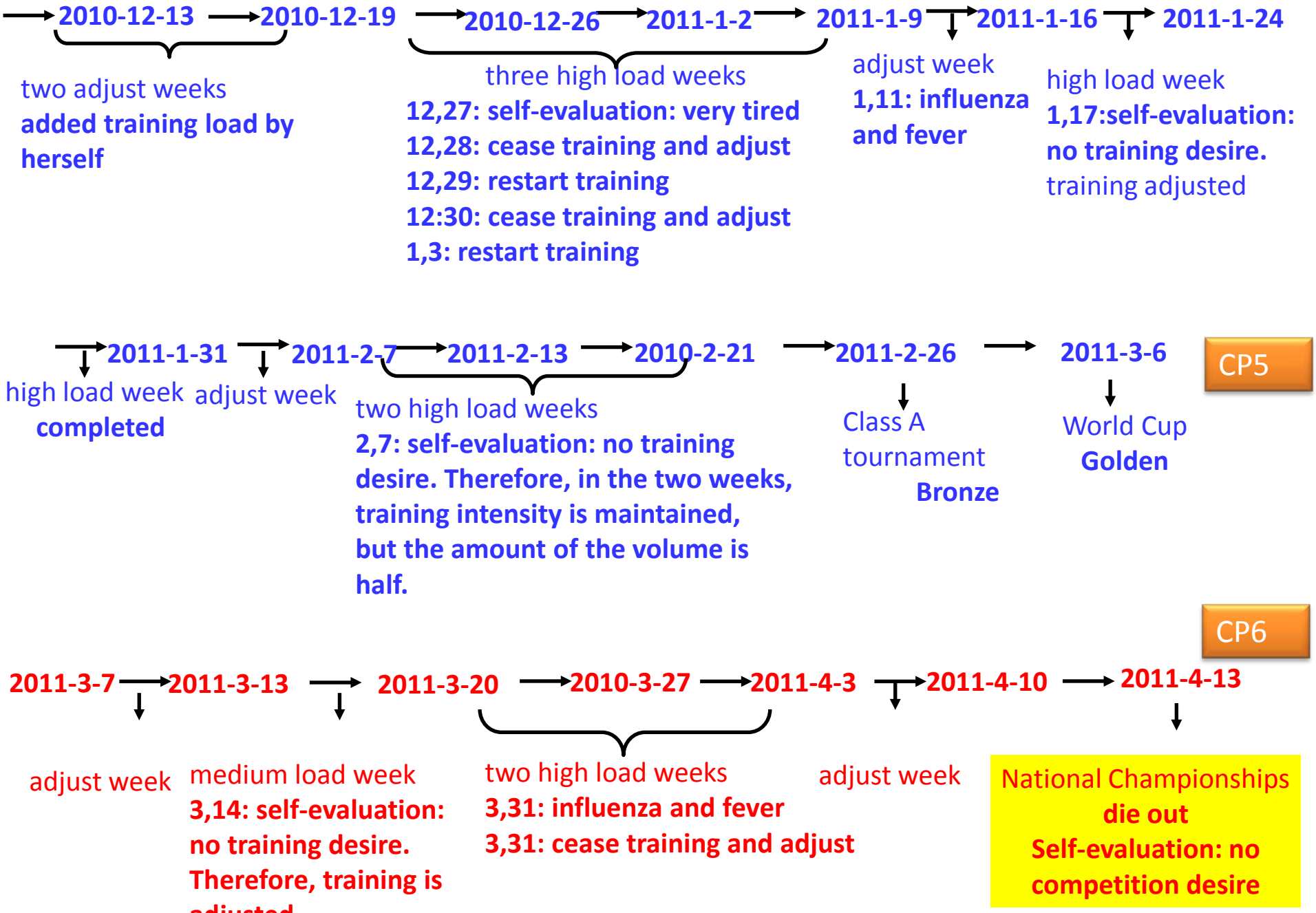

2010-2-21
2010-2-28
2010-3-7
2010-3-14
2010-3-21
2010-3-26
adaptive week
three high load weeks
completed
adjust week
World Cup
Golden
CP1
CP2
National Championships
Golden
CP3
2010-4-10
2010-4-12
2010-4-18
2010-4-25
2010-5-1
2010-5-9
2010-5-12
three high load weeks
adjust week
5,2: self-evaluation: insomnia
5,4: influenza and fever
5,7: re-start training
4,16: self-evaluation: very tired
4,19: self-evaluation: very tired
4,20: crying in the training process
4,21: cease training and adjust;
4,22: continue adjust;
4,26: self-evaluation: no training desire
4,27: Injured by herself
Asian Championship
Golden
self-evaluation: no strength



2010-9-9

World Championship
Injured in the first match
self-evaluation: slow response

CP4


2010-12-13
2010-12-19
two adjust weeks
added training load by herself
2010-12-26
2011-1-2
three high load weeks
12,27: self-evaluation: very tired
12,28: cease training and adjust
12,29: restart training
12:30: cease training and adjust
1,3: restart training
2011-1-9
adjust week
1,11: influenza and fever
2011-1-16
high load week
1,17:self-evaluation: no training desire.
training adjusted
2011-1-24
2011-1-31
high load week completed
2011-2-7
adjust week
2011-2-13
2010-2-21
two high load weeks
2,7: self-evaluation: no training desire. Therefore, in the two weeks, training intensity is maintained, but the amount of the volume is half.
2011-2-26
Class A tournament
Bronze
2011-3-6
World Cup
Golden
CP5
CP6
2011-3-7
adjust week
2011-3-13
medium load week
3,14: self-evaluation: no training desire. Therefore, training is adjusted.
2011-3-20
2010-3-27
2011-4-3
two high load weeks
3,31: influenza and fever
3,31: cease training and adjust
adjust week
2011-4-10
2011-4-13
National Championships
die out
Self-evaluation: no competition desire

Physiological Screening

data	training	Ω	RT	menstrual cycles
2006-2-22		-22.1	0.162	2010-1-27
2006-3-1	H	-12.4	0.187	2010-2-25
2006-3-8	H	-38.4	0.167	2010-3-28
2006-3-15	H	-2.9	0.188	2010-4-28
2006-3-22	A	**-52.4**	0.193	
2006-4-19	H/A	**-61.8**	**0.202**	
2006-4-26	H/A	-18.7	**0.203**	
2006-5-2	H/A	-34.3	**0.193**	**2010-5-16**
2006-5-10	A	3.2	0.185	**2010-6-5**
2010-5-17	A	9.5	0.190	
2010-8-2	A	-7.9	0.186	**2010-6-26**
2010-8-9	half/A	-26.3	0.176	**2010-7-16**
2010-8-16	H	-14.6	**0.193**	**2010-8-16**
2010-8-23	H/A	6	**0.187**	
2010-8-30	half	8.8	**0.193**	**2010-9-5**
2010-9-6	A		**0.188**	**2010-9-25**
				2010-10-15
2010-12-13	A	-48.5	0.184	**2010-11-4**
2010-12-20	A	-20.5	0.179	**2010-11-24**
2010-12-27	H/A			**2010-12-17**
2010-1-3	H			
2011-1-10	H			**2011-1-7**
2011-1-17	A			
2011-1-24	H/A			**2011-1-27**
2011-1-31	H			
2011-2-7	A			
2011-2-13	H/A			
2011-2-21	H/A			**2011-2-18**

Biochemical Screening

data	training	Hb	CK	T	C	Fer	Fe^{2+}
2006-2-22		134	234	49.8	13.12	13.73	12.80
2006-3-1	H	129	131	50.68	12.66	39.79	12.5
2006-3-8	H	130	181	38.83	15.01	24.59	10.8
2006-3-15	H	125	235	47.76	15.15	32.77	9.50
2006-3-22	A	130	314	59.95	13.55	46.59	10.55
2006-4-19	H/A	130	179	66.02	12.74	13.26	15.9
2006-4-26	H/A	138	177	51.89	14.6	15.60	13.9
2006-5-2	H/A	138	117	43.84	13.11	22.13	15.80
2006-5-10	A	121	225	45.85	13.35	25.33	20.10
2010-5-17	A	131	193	36.58	11.55	16.13	8.40
2010-8-2	A	130	213	32	9.69	13.55	10.10
2010-8-9	half/A	127	225	49.58	10.8	133.33	10.70
2010-8-16	H	122	390	34.03	14.53	10.11	9.60
2010-8-23	H/A	119	297	31.28	11.8	6.9	8.30
2010-8-30	half	113	280	41.95	11.06	5.21	7
2010-9-6	A	117	305	43.66	13.15	5.04	9.50
2010-12-13	A	125	272	35.01	20.79	6.25	10.10
2010-12-20	A	122	204	29.37	10.97	4.87	10.50
2010-12-27	H/A	121	499	46.03	17.93	4.84	8.30
2010-1-3	H						
2011-1-10	H	126	224	31.64	16.2	7.71	9.20
2011-1-17	A	129	467	9.12	0.97	11.71	11.80
2011-1-24	H/A	124	155	40.11	13.7	6.99	12.50
2011-1-31	H	119	237	26.8	11.47	8.18	9.50
2011-2-7	A						
2011-2-13	H/A	116	299	44.43	14.17	7.35	9.20
2011-2-21	H/A	115	202	37.43	13.87	5.45	8.60

questionnaire Screening

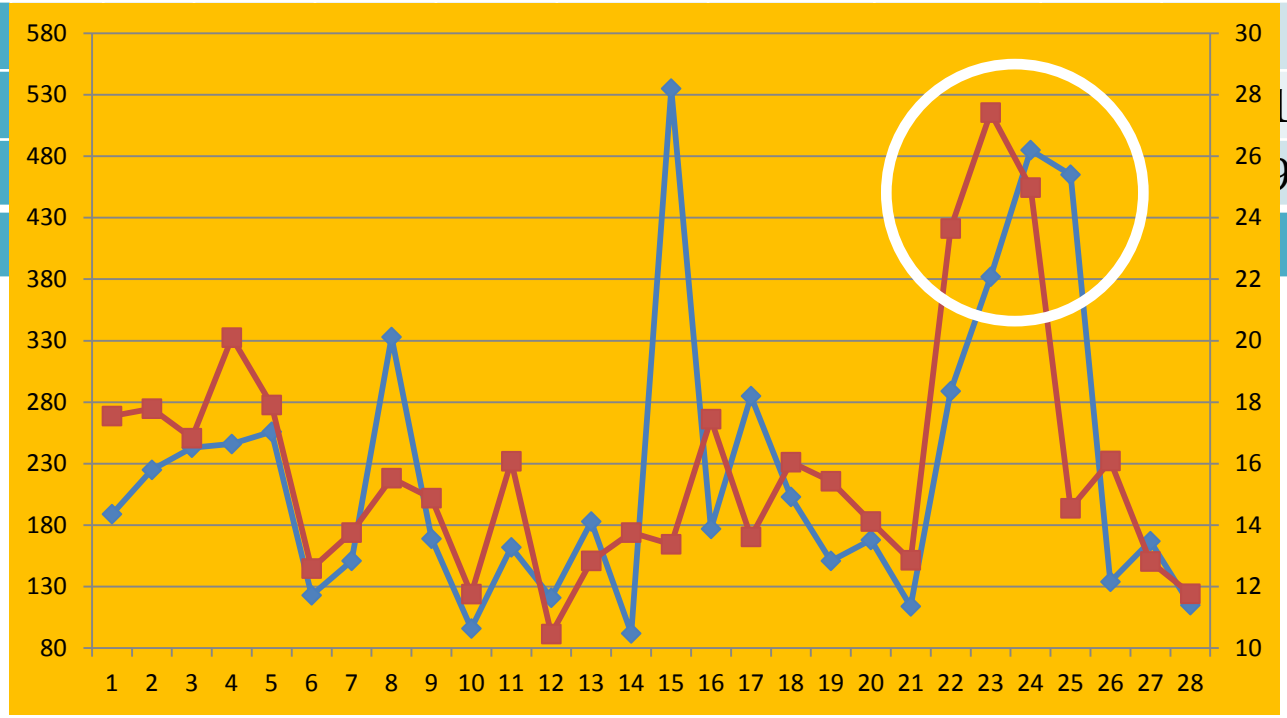
1) PSQI increased;

2) T (POMS) increased.

Case1: the conoccurrence of NFOR and significant increase of CK and C

Athlete D

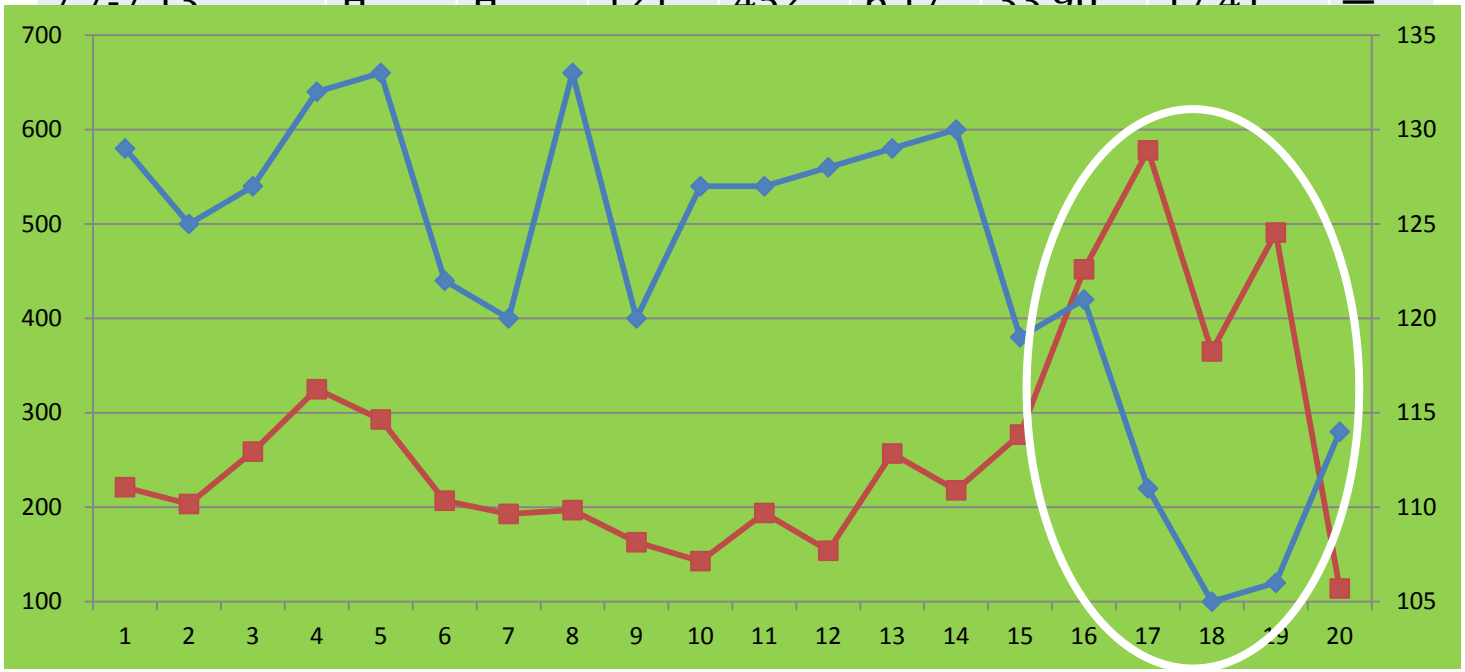
weeks	PL	FL	HB	CK	BU	T	C	Amm	Fol	Fer	Fe^{2+}	S
1,9-1,16	A	A	141	114	7.57	51.79	12.86	60.46	2.9	53.6	30.8	
2,27-3,4	M	M	135	289	5.35	51.09	23.65	77.74	2.2	70.76	11.8	—
3,5-3,11											14.2	—
3,12-3,18											9.7	↓
3,19-3,25										98	5.8	
4,5												



Case2: the conoccurrence of NFOR and significant changes of Hb and CK

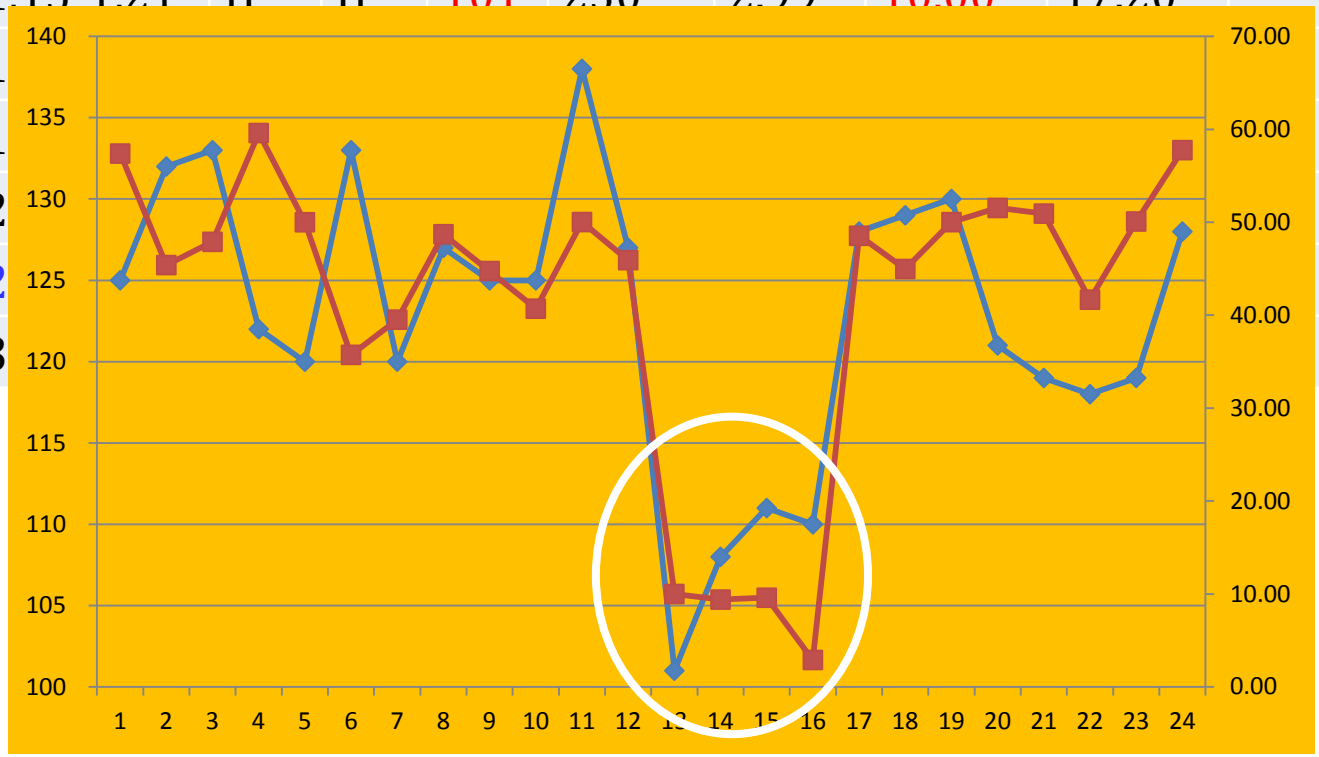
Athlete B

weeks	PL	FL	HB	CK	BU	T	C	S
6,23-6,29	A	A						
6,30-7,6	H	M	119	277	5.74	61.42	20.00	
7.7-7.13	H	H	121	452	6.17	33.90	17.41	—

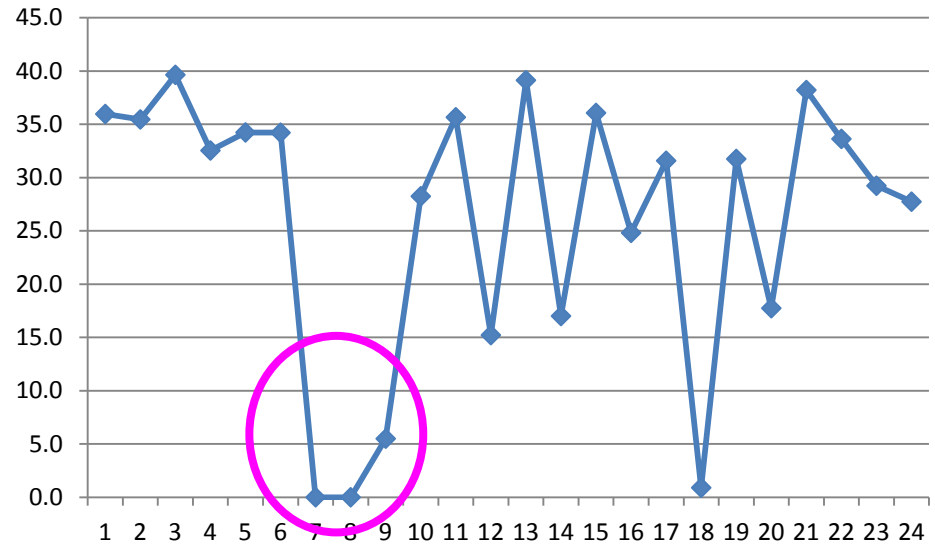


Case3: the conoccurrence of NFOR and significant decrease of Hb and T

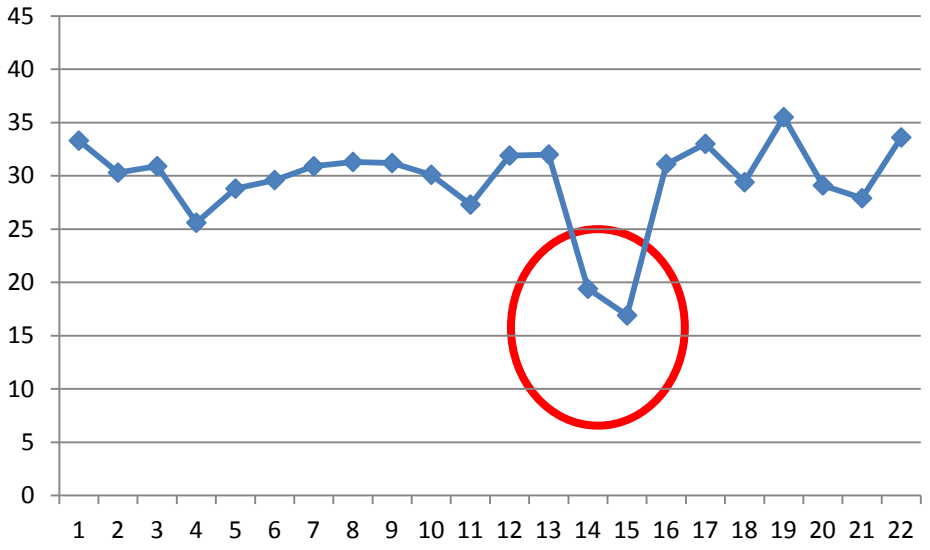
weeks	PL	FL	HB	CK	BU	T	C	S
1,1-1,14	A	A	127	194	4.91	45.92	22.94	
1,15-1,21	H	H	101	230	2.99	10.00	17.20	—
1								
1								
2								
2								
3								



Case4: the conoccurrence of NFOR and significant decrease of PNN50



NFOR: three weeks



FOR: two weeks

Case5: the conoccurrence of NFOR and significant increase of PNN50

weeks	PL	FL	SDNN	RMSSD	SDSD	PNN50	TP	HF	HF nu	LF	LF nu	VLF	S
4,12-4,18	H	H	74	100	127	31.4	1919	1540	84	304	16	74	—
4,19-4,25	H	M	111	146	173	27.9	1299	888	72	341	28	70	↓
4,26-5,2	H	M	159	204	265	35.8	6748	5733	87	882	13	133	↓
5,3-5,9	A	A	118	169	218	43.2	6213	4235	70	1826	30	151	
5,10-5,16	A	A											
5.13	CP1	2											
5,17-5,23	A	A	130	189	238	36.9	6891	3946	59	2698	41	247	
5,24-5,30	M	M	183	294	389	47.5	15496	14376	94	914	6	206	↓
5,31-6,6	M	M	151	228	301	44.3	7667	6194	86	977	14	496	↓
6,14	CP2	1											

Synthesized Evaluation using the blood and nervous indexes

monitor	PL	FL	Hb	CK	T	C	PNN50	S
7,30	A	A	131	188	63.76	13.12		
8,6	A	A	130	124	43.05	14.04	3.0	
8,13	H	H	125	245	49.40	18.28		—
8,20	H	H	130	1097	50.70	18.63	9.1	—
8,27	H	M	130	374	55.34	17.53	6.7	↓
9,3	H	H	129	375	56.09	18.82	12.3	↓
9,11	A	A						
9,17	A	L	125	367	56.35	14.69		
9,21	CP	1						↓

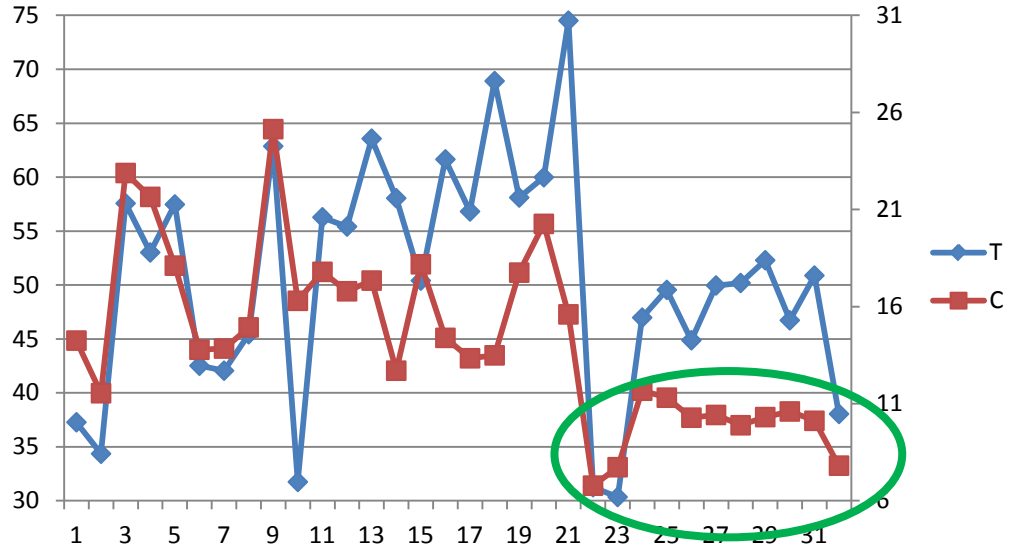
Blood indexes are normal, but PNN50 decline continually.

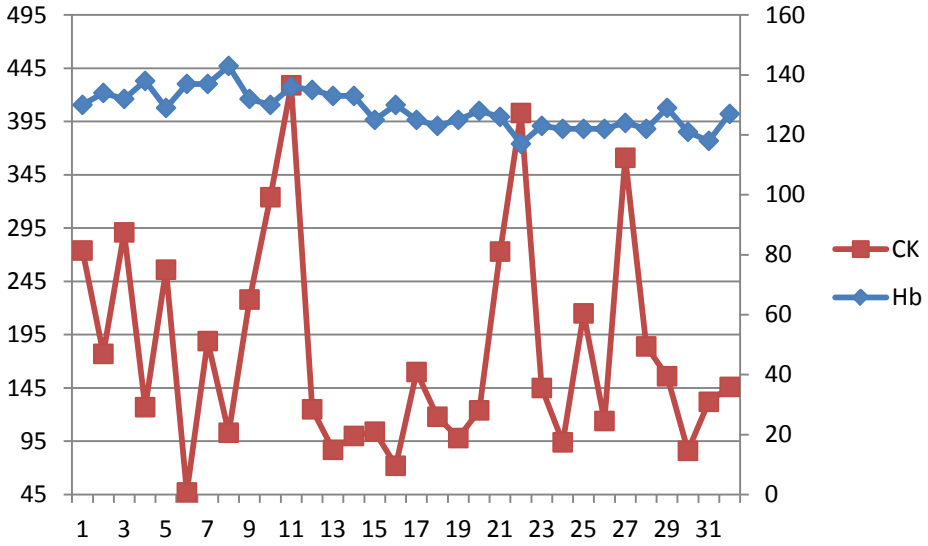
An overtraining state athlete M

In Sep, Cortisol decline to a very low range, after two weeks recovery , the athletes performed badly in the competition. In the next year, the same symptom occurred, and the recovery exceed 6 weeks.

monitor	PL	FL	HB	CK	T	C	S
8,6	M	M	127	88	50.35	14.86	—
8,13	M	M	128	98	36.08	16.95	—
8,20	H	H	140	92	59.84	17.53	—
8,27	M	M	124	102	8.92	0.35	↓
9,3	H	A	116	133	17.36	1.81	↓
9,11	H	A					↓
9,17	A	A	125	104	18.60	6.82	
9,21	CP	0					↓
2,17	A	H	135	6045	57.78	13.65	
2,24	M	M	138	117	46.05	13.01	—
3,2	M	M	126	88	67.94	13.20	—
3,9	H	M	127	170	53.12	15.09	—
3,16	H	H	136	914	41.1	13.23	—
3,23	H	M	123	64	6.55	0.58	↓
3,30	H	M	126	98	68.85	8.16	—
4,6	H	M	120	111	53.87	10.92	↓
5,11	A	A	118	128	41.72	1.70	
5,18	M	M	130	218	54.30	11.66	↓
5,20	CP	0					↓

An overtraining state athlete N





After Cortisol decline several weeks, overstraining state happened, even if the Hb, T, and CK under normal range.

cautions

1) Individual character
2) Some indexes' advancement and lag
3) Sample analysis time
4) Undertraining

cautions

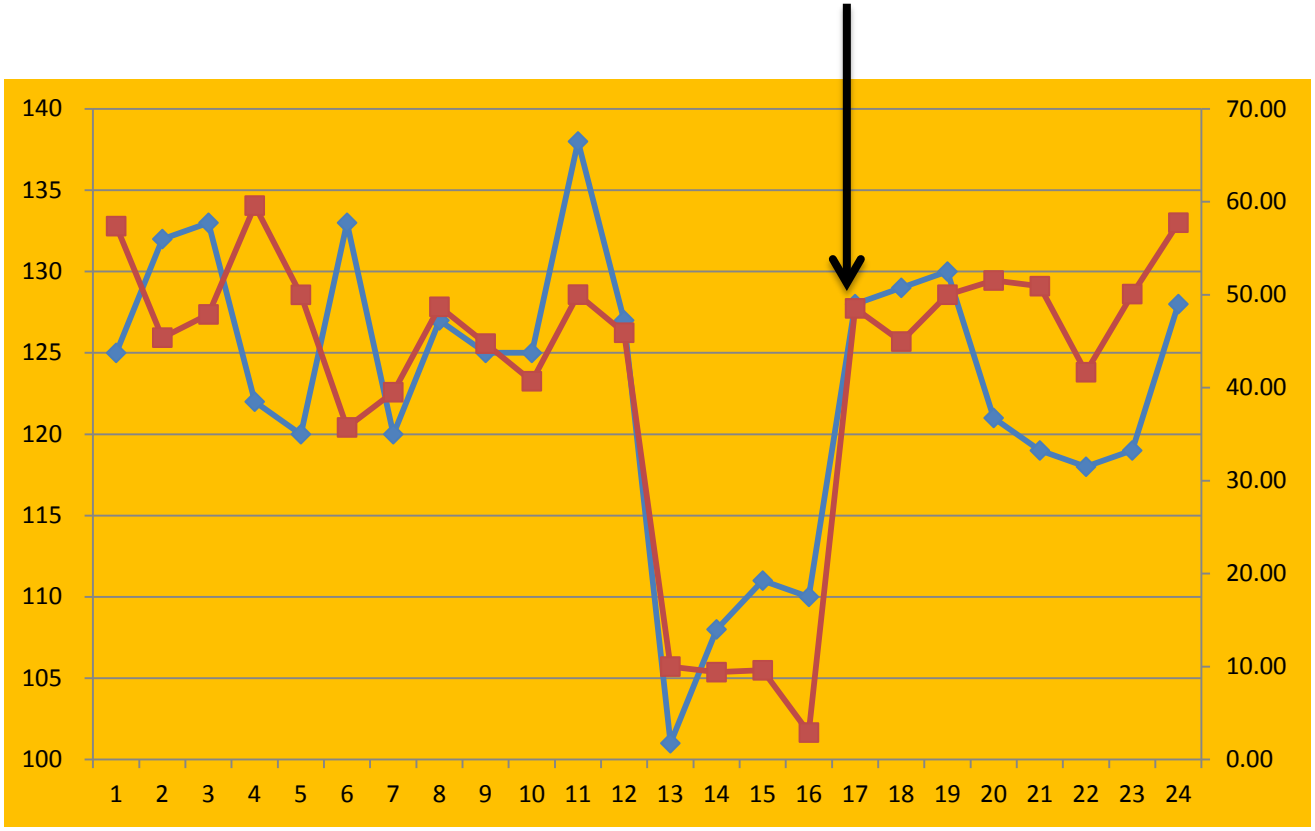
1) Individual character

T normal value for different athletes

Athlete	N	X	SD	mix	max
36	34	53.8550	9.44479	22.37	78.98
50	46	29.9307	10.03227	.00	48.80
74	46	35.0708	8.44221	21.68	48.95
87	36	76.6561	13.22391	46.09	97.31
88	31	35.8768	7.47686	23.65	50.63

cautions

2) Some indexes' advancement and lag



cautions

3) Sample analysis time

- time of sampling, food intake, time after the end of exercise, gender, age, etc. may influence the hormonal profile.
- measuring methods and/or detection limits of the analytical equipment used may differ between studies

cautions

4) No completely regularity

- All monitoring markers should be combined together to give a judgment. Don’t depend on a single parameter.
- All change character of monitoring parameters must be analyzed at the basis of training plan, Especially for biochemical indexes measured under training planned.

cautions

5) undertraining

- All monitoring markers are normal, which may be undertraining. As a result, the competition may be failure.

Recovery Procedure

1) Adjusting the training program is the most fundamental means, which include reduce the training time on the wrestling mad, the training volume, and transfer training site, add the recovery time.

2) Strengthen psychological counseling: It is a essential work before important competitions. According to the pressure and situations of the athletes, coaches and researcher make the individual analysis and processing.

4) Strengthen stretch, massage and physiotherapy measures.

5) Enhanced nutritional supplements and dietary balance.

6) Strengthen the treatment of injuries.


Thanks for your attention