

Load Structure of the Pre-Competition Altitude Training on Triathletes for Seventh World Military Games

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Abstract: Load structure of the pre-competition altitude training on triathletes for seventh world military games. Through monitoring the systematic performance indicators of the pre-Seventh World Military Games, and tracking trainers for implementation of training programs in the altitude training, basing on the results of functional monitoring and competition, the composition and application of the load structure of pre-competition altitude training in triathlon were analyzed and evaluated comprehensively to make empirical study on the pre-competition altitude training. The results are as follows: 1. The training load pattern of the pre-race was the second maximum load, the maximum load, the medium load and pre-match adjustment. Aerobic training was accounted for 65% of total training, mixed oxygen training is accounted for 28%, anaerobic training was accounted for 7%. 2. The hematocrit (HCT) of male athletes decreased in the last week before the race, $P > 0.05$, urea nitrogen (BUN) was higher than the normal range from the third to the twice week before the race, $P < 0.05$, creatine kinase (CK) increased in the last week before the race and the competitive state decreased, $P > 0.05$. The hematocrit (HCT) of female athletes increased in the last week before the race, $P < 0.05$. Testosterone (T) increased significantly from the third to the twice week before the race, $P < 0.05$, and competitive status increased. 3. The pre-competition load structure arrangement was basically reasonable, achieving the best competitive state by doing precise training control was the key to acquire the best competitive performance.

Keywords: Seventh World Military Games, Triathlon, Altitude Training, Load Structure, Functional Monitoring

1. Introduction

Since triathlon had rose in the 1970s, it had rapidly swept the world and was currently the sport of Olympic Games, Asian Games and National Games. From the end of the 7th Military World Games, triathlon was no longer a military Games event. China started late in this event. Since winning the women's Asian Championship in 2005, China had made few achievements in recent years. The best result for men in recent years was the third place at the Jakarta Asian Games. The triathlon of the 7th Military World Games ended on October 27, 2019. A total of 28 countries participated in the triathlon, with masters gathered. China sent 6 men and 6 women outstanding athletes to participate in the competition. In the end, China had won the third place in women's team competition and mixed competition between men and women.

The BAYI Triathlon team had been training on the altitude all the year round. Because of the altitude training effect, it had made remarkable achievements in both international and domestic competitions in recent years.

The training practice of excellent athletes had proved that the arrangement of pre-competition training' scientificness will directly affect athletes' best competitive state and the best competitive ability in major competitions [1]. The load amount and intensity of pre-competition training, the emergence of large load peak, the proportion of competition load, and the best time to adjust the pre-competition load are also closely related to competitive level of the athletes [2]. In order to prepare for the 7th Military World Games, the altitude training program was adopted, and Yunnan Chenggong (1980 meters above sea level) was selected as the main training base, with the purpose of scientifically using altitude training to improve exercise load performance and then competitive performance advanced. This

study aims to analyze the rationality and shortcomings of the structure arrangement through the quantitative and qualitative analysis for the pre-competition, then provide experimental basis for scientific and effective altitude training to prepare the future competition.

2. Methods

2.1. Subjects

International level of all BAYI triathletes who were distributed to Chinese national team, on the list of participants in the 2018-2019, there were 6 men and women. The average age of the men was 26.33 ± 5.21 , the average height of men was 177.28 ± 3.45 cm, the average weight of men was 71.18 ± 4.29 kg, the average training years of men was 7.21 ± 3.78 years. The average age of the women was 25.12 ± 4.07 , the average height of women was 171.15 ± 3.87 cm, the average weight of women was 62.43 ± 3.54 kg, the average training years of women was 5.78 ± 3.23 years. Both the Chinese Triathlon Federation and the local institute of Sports Science approved the study.

2.2. Procedures

Interviews and Observations. The coaches and athletes of China's 2018-2019 BAYI Triathlon team were interviewed, with the main purpose being to understand the problems related to the training load before the military games and the main feelings of the athletes after the implementation of the training load. During the altitude training for the Military

Games, we engaged in the team throughout the whole process, and observed the physiological and biochemical indicators and external performance of the athletes before the competition.

2.2.1. Training Load and Training Protocol

Training load is to reflect the load stimulation of the athlete in the training process to improve the overall competitive ability [3]. It is mainly composed of two circumference indicators of load quantity and load strength, and various combination methods are formed through the respective regional changes of these two indicators. In practical application, the coaches made corresponding arrangements according to the actual needs. The training protocol was mainly aim to the sprint stage before the competition. The training place was in Kunming, Yunnan province (1891 meters above sea level). There were four weeks before the competition, the first week was the strengthening and improvement stage, the second week was the improvement of the breakthrough stage, the third week was the pre-race intensity reduction stage, mainly for aerobic training, the fourth week was the pre-competition adjustment stage, highlighting the intensity stimulation and simulating the competition intensity. The four-week training load structure were made up of the sub-maximum, maximum, medium, pre-competition adjustment parts, and weekly training and rest were matched by "6+1" mode (6 training days, 1 rest day). The main purpose was to improve the pre-competition special ability, and was able to prepare for the World Military Games after the altitude training.

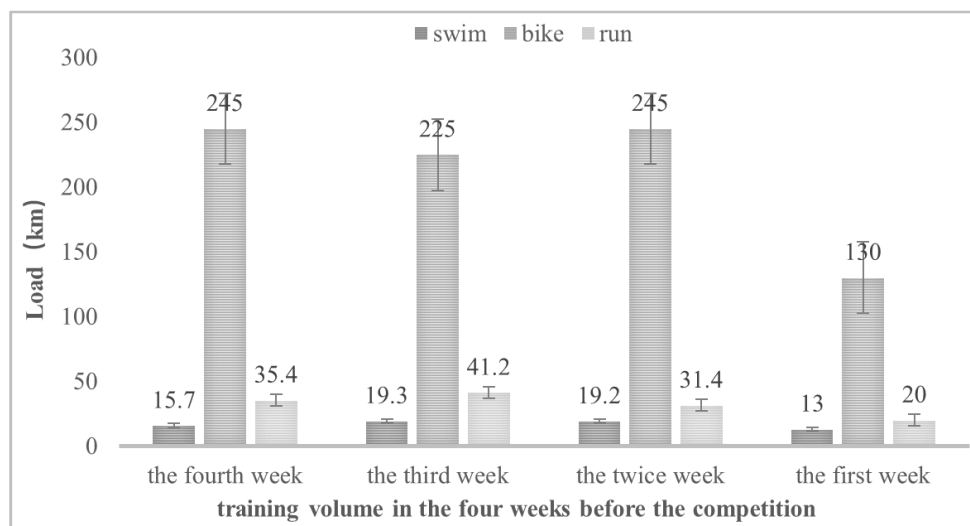


Figure 1. Comparison of bicycle, running and swimming week's training load in preparation for military games (unit: km).

2.2.2. Total Load Volume and Load Strength for the Four Weeks Before the Competition

The standard distance of triathlon Olympic Games is 1.5km swimming, 40 km cycling and 10 km running, a total of 51.5 km, belongs to the physical leading endurance sports, endurance plays a decisive role in many physical factors. Therefore, it is very necessary for the body to have the ability

to withstand the load for a long time, among which the load quantity is one of the pre-conditions that the body must has [4]. The overall load quantity in the four weeks before the competition was not large, with an average of 43.3km per day, the total week's load of swimming was 67.2km, the cycling was 845km, and running was 128km. The performance of triathlon mainly depends on the maximum energy release by the body within the given distance and the corresponding

special ability in the most economical and reasonable form. Therefore, the load intensity must be increased on the basis of the load quantity to make it to be an "effective quantity"[5]. The intensity allocation for the four weeks before the competition was mainly aerobic training, the average heart rate was from 160 to 170 bpm and the average blood lactate was around about 4 mmol/L. The proportion of mixed oxygen training was 28%, the heart rate was mainly controlled between 170~180 bpm, and the blood lactate was between 5~9mmol/L. The proportion of high intensity was about 7%, the heart rate was greater than 180bpm, and the blood lactate was between 10~12 mmol/L. Early findings suggested that [6], running made the greatest contribution to overall performance, the second was cycling, the last was swimming. Although they were distinguished by gender and competition level, running contributed more to the overall performance in major events such as the Olympic Games and the World Championships.

As can be seen from Figure 1, the order of the three training items was respectively the cycling, the running and the swimming, which was consistent with the training arrangement of the Spanish triathlon team [7]. Cycling occupies an important position in the triathlon. It is not only the largest single event, but also plays a role in connecting the preceding and the next item. The cycling ability directly affects the contribution rate of running to performance. This agrees with the results of Millet GP *et al* [8], which showed a significant relationship between running performance and total performance, but also a significant relationship between cycling training load and running performance, and no significant relationship between load of running and cycling and swimming performance. Studies had shown that if swimming had an advantage of about 30s, the chance of entering the top 10 was 85%, otherwise only 15% chance of entering the top 10 [9], so it was necessary to effectively increase the amount of swimming training.

2.3. Measures

All the intravenous blood samples were collected from the tester every Monday morning during the training period. The main test indicators were blood routine, urea nitrogen, creatine kinase, testosterone, and cortisol. The blood routine test instrument was Beckman LH750 automatic Analyzer, the urea nitrogen and creatine kinase indicators were tested from Beckman Coulter automatic biochemical analyzer AU480, and testosterone and cortisol indicators were tested from Beckman access2 automatic microparticle chemiluminescence Immunoassay Analyzer.

2.4. Statistical Analyses

Acquired data were processed and analyzed using Statistical Package for the Social Sciences, version 18.0 (SPSS, High Wycombe, United Kingdom), the indexes were expressed as mean \pm standard deviation, compared between groups by paired T-test. The 95% confidence level was set as the level of significance, the 99% confidence level was considered as very significant levels.

3. Results

3.1. Function Indicator Test Results for the Four Weeks Before the Competition

The functional monitoring indicators for the four weeks were hemoglobin, hematocrit, erythrocytes (HB/HCT/RBC), blood urea (BUN), serum creatine kinase (CK), blood testosterone (T), and serum cortisol (C). The main purpose was to give the diagnosis and analysis of functional status and sports load of the athletes, to predict the competitive state and sports performance, then provided the reference of altitude training on biochemical monitoring research mode, and the reasonable advice for the future scientific training plans and reasonable arrangements of training content.

The HB, HCT and RBC are important indicators reflecting the human oxygen transport system and the exercise anemia, or to evaluate the exercise fatigue. Studies had shown that the low oxygen environment and the altitude exercise training are the main reasons affecting the three indicators [11, 12]. During exercise, muscle metabolism function is strengthened, protein and amino acid catabolism will increase, blood concentration increases and kidney function will decrease, and the ability to eliminate blood urea nitrogen decreases, the normal reference value of morning blood urea nitrogen in Chinese excellent athletes is 4~7 mmol/L [13]. The CK is one of the key enzymes in skeletal muscle energy metabolism, both exercise load and high-altitude hypoxia environment can promote a significant increase in CK activity, its activity can be used as a sensitive indicator to assess muscle to withstand stimulation and understand skeletal muscle microscale damage and its adaptation and recovery, the range of total morning start activity in normal female athletes is 10 to 200 U/L and 10 to 300 U/L for male athletes [14]. The main role of blood testosterone (T) is to promote protein synthesis, while the role of cortisol (C) is to promote the decomposition of protein. Therefore, the ratio of testosterone and cortisol can be used as one of the monitoring indicators for the early judgment of overtraining and excessive fatigue in athletes [15]. Numerous studies had shown that the changes in blood testosterone induced by exercise were mainly affected by factors such as the density, load intensity, load volume, and duration of exercise. Blood testosterone concentration increases after a short and high intensity exercise, medium intensity duration of short exercise can significantly increase blood testosterone concentration, long time exercise can reduce blood testosterone concentration [16, 17]. Davies *et al* showed that the loading intensity of 60% Vo_2 max was the intensity threshold that caused increasing in plasma cortisol concentrations. It was generally believed that there was a non-specific mechanism of cortisol elevation during movement, mainly in the case of exercise and stress, through the corticohalamic, pituitary and adrenal cortex axis to affect the plasma cortisol concentration changes [18]. Lower serum testosterone levels in athletes can reflect overtraining to some extent, but individual differences also existed [19], in the monitoring process of exercise training, the ratio of blood testosterone and cortisol was often used to evaluate the

physical function and exercise load of athletes. When the ratio was kept within a certain range, it indicated that the load was appropriate, the motor function state and the body

recovery ability were good; when the ratio dropped, the load was too large or the physical function of the athletes decreased [20].

Table 1. Physiological and biochemical of function indicators of for the four weeks before the Military Games. *(Male n=6, Female n=6).

Sex	Indexes	4 th W PC	3 rd W PC	2 nd W PC	1 st W PC
Male	HB (g/L)	168.57±3.76	169.12±7.16	170.37±2.08	167.78±9.61
Female		140.25±6.37	142.18±6.21	139.95±5.47	152.38±12.41*
Male	RBC (10~12/L)	5.39±0.11	5.42±0.16	5.40±0.08	5.30±0.21
Female		4.68±0.22	4.72±0.18	4.60±0.19	4.90±0.29*
Male	HCT (%)	48.67±1.21	48.5±1.96	49.0±1.10	47.33±2.81
Female		41.83±1.72	41.33±1.51	40.50±1.64	43.50±3.56*
Male	BUN (mol/L)	6.39±1.15	7.58±1.31*	7.32±1.57	6.17±1.52*
Female		6.08±0.66	6.32±0.87	5.66±1.17*	6.06±1.32
Male	CK (U/L)	417.83±155.06	291.33±46.61	277.83±69.31	401.33±273.41
Female		225.67±127.99	151±71.85*	133.67±50.80	179.50±79.62
Male	T (ng/dL)	616.5±156.24	585.17±233.24	610.67±140.62	626.67±94.48
Female		61.67±22.19	53.33±20.05*	66.33±18.01*	65.33±20.77
Male	C (ug/dL)	17.31±0.80	18.68±2.00	19.31±3.43	18.19±2.75
Female		16.73±1.87	18.47±1.31	18.35±4.58	18.60±2.89
Male	T/C	35.47±8.24	31.30±11.24	32.59±9.95	35.65±10.37
Female		3.67±1.26	2.92±1.24**	3.85±1.59	3.57±1.19

*Data are presented as mean +SD. *Significantly ($p<0.05$) lower than males for respective interval duration. ** Significantly ($p<0.01$) lower than males for respective interval duration. (4th W PC means the fourth week in pre-competition, 3rd W PC means the third week in pre- competition, 2nd W PC means the second week in pre- competition, 1st W PC means the first week in pre- competition).

Table 1 showed that, the indicators of HB, HCT, HCT in male athletes did not change significantly over time, but there was a tendency from gradually increasing to decreasing. However, the female athletes' indicators changed significantly before the competition ($p<0.05$). The trend of female athletes was different from that of male athletes, which firstly ascended and secondly decreased and then ascended. It showed that the training plan of the reduction and outstanding intensity in the third week was more reasonable for the physical endurance of male athletes, and did not cause fatigue due to the increasing of the intensity. In the fourth week of effective adjustment after the rapid improvement, the excess recovery had been acquired. According to the adjusted indicators before the competition, female athletes' performance in the first week was significantly higher than the fourth week before the competition, while male athletes' performance was slightly lower than the fourth week. It might be one of the factors that women's performance was better than men's performance at the Military Games.

From the perspective of urea nitrogen index, the overall level of male athletes was higher than that of female athletes, and they were higher than the normal range before the competition ($>7\text{mmol/L}$), indicating that male athletes had withstander more load than female athletes. Male athletes' indexes appeared higher than the normal range in the third week before the competition and differed significantly from the fourth weeks ($p<0.05$). There was only a significant drop in the first week before the competition ($p<0.05$), and returned to the normal range. From the results of the competition, the individual performance of male athletes was particularly outstanding, but the overall average level was not ideal, which might be related to the functional status and decreased recovery level of the athletes before the competition. Female athletes' urea nitrogen levels were within the normal

range for the four weeks before the competition, showing a trend of going up and down and then up. There were significant differences in the second week compared with the third week before the competition ($p<0.05$). It showed that after the three weeks' heavy load training before the competition, the bodies were effectively adjusted, the function recovery speed was fast, and the bodies were more adapted to the load structure arrangement. Therefore, the overall performance of female athletes was more outstanding, and the competitive performance was more outstanding. From the CK index, male athletes were overall higher than female athletes, which was in line with the gender differences of general physical fitness events. The value of the fourth week before the competition was higher, and the third and the second weeks before the race decreased, the difference was not significant. However, the first week before the competition rose to the same level as the fourth week before the competition, indicating that the intensity stimulation of the first week before the competition was too high for male athletes, and the strong muscle stimulation needed a long time to recover, which was relatively unfavorable for the following competition. However, female athletes were only slightly higher in the fourth week before the race, with a significant decline ($p<0.05$), and only a small increase in the first week before the competition, indicating that the intensity and stimulation before the race was reasonable, making the muscles in the appropriate excitement. From the perspective of the competition process, some male athletes showed obvious muscle stiffness in the final running stage, which might be related to the high CK value before the competition.

Men's testosterone value first declined and then rose, and the differences were not significant, women's testosterone values were in a trend of downward, comparing with the second and the third week before the competition, the

difference was significant ($p < 0.05$). Although the women athletes' level declined slightly in the first week comparing with the twice and third week before the competition, but the average was at a high level. We can also saw that the overall competitive state of women athletes was good through the competition. From the perspective of T / C, men athletes were in a trend of downward and upward, while women athletes were in the trend of downward, only the third week's value was very significant with the fourth week before the competition ($p < 0.01$), then followed by rising changes. From the perspective of T / C, both male and female athletes were in a relatively stable range, and no excessive fatigue phenomenon occurred.

3.2. Analysis of the Results of the 7th World Military Games

A total of 28 countries participated in the triathlon of the Military Games, including 85 athletes in the men's elite group, 41 athletes in the women's elite group, 18 teams in the men's elite team event, 9 teams in the women's elite team event and 14 teams in the mixed team event. China had sent six men and six women to participate in the men's elite individual, men's elite group, women's elite individual, women's elite team and mixed team events respectively. Finally, we won the bronze medal in women's team event, the bronze medal in mixed team event, the 10th place of men's elite individual event, and the 6th place of women's elite individual event.

Table 2. Summary of Men's Group Competition Results of the 7th World Military Games.

POS	COUNTRY (NAME)	SWIM	T1	BIKE	T2	RUN	TIME	TD
1	RUS	52:39	5:43	2:38:35	1:41	1:34:52	5:13:30	+0:00
	POLYANSKIY Igor	17:21	1:58	52:31	0:28	31:15	1:43:33	
	POLYANSKIY Dmitry	17:26	1:51	52:35	0:41	31:59	1:44:32	
	BRIUKHANKOV Aleksandr	17:52	1:54	53:29	0:32	31:38	1:45:25	
2	FR	53:36	5:41	2:41:39	1:25	1:33:18	5:15:39	+2:09
	le CORRE Pierre	17:23	1:50	52:38	0:26	30:04	1:42:21	
	CONINX Dorian	17:27	1:51	52:34	0:31	30:04	1:42:27	
	PIETRERA Thomas	18:46	2:00	56:27	0:28	33:10	1:50:51	
3	BR	53:20	5:52	2:40:31	1:55	1:34:53	5:16:31	+3:01
	WILLY Kaue	17:46	1:59	53:28	0:36	31:18	1:45:07	
	SCLEBIN Diogo	17:46	1:57	53:32	0:39	31:17	1:45:11	
	DINIZ Matheus	17:48	1:56	53:31	0:40	32:18	1:46:13	
4	CHN	52:41	5:56	2:39:51	1:49	1:36:17	5:16:34	+3:04
	LI Ming xu	17:38	2:03	53:36	0:33	31:07	1:44:57	
	BAI Fa quan	17:41	1:53	53:44	0:45	31:44	1:45:47	
	XU Zheng	17:22	2:00	52:31	0:31	33:26	1:45:50	

Table 3. Summary of Women's Group Competition Results of the 7th World Military Games.

POS	COUNTRY (NAME)	SWIM	T1	BIKE	T2	RUN	TIME	TD
1	BR	58:22	6:21	2:58:32	1:39	1:46:15	5:51:09	+0:00
	LOPES Vittoria	18:30	2:08	59:41	0:32	35:53	1:56:44	
	DUARTE Luisa	19:53	2:06	59:30	0:32	34:58	1:56:59	
	NERES Beatriz	19:59	2:07	59:21	0:35	35:24	1:57:26	
2	RUS	57:09	6:15	2:58:44	1:42	1:47:29	5:51:19	+0:10
	DANILOVA Elena	20:02	2:02	59:22	0:33	34:34	1:56:33	
	ABROSIMOVA Anastasiia	18:35	2:06	59:40	0:35	36:20	1:57:16	
	GORBUNOVA Anastasiia	18:32	2:07	59:42	0:34	36:35	1:57:30	
3	CHN	58:08	6:16	2:58:53	1:33	1:47:11	5:52:01	+0:52
	ZHANG Yi	19:39	2:07	59:42	0:32	35:06	1:57:06	
	WEI Wen	18:32	2:12	59:36	0:30	36:24	1:57:14	
	WU Qing	19:57	1:57	59:35	0:31	35:41	1:57:41	

Comparing with the world's top competition level, the competitive level of the Military Games was quite high, all the masters gathered in Wuhan. French athletes, Russian athletes and other world's top athletes had participated in the competition. China's triathlon started relatively late, and there was still a certain gap comparing with the international level, this competition level still had certain highlights and breakthroughs. Li Ming xu's personal ranking was the best result in history in China, his running stage had acquired the best result in history, and Bai Fa Quan had gained his personal best result in the last three years, but the men's level was not average, leaving only two seconds behind Brazil. This was consistent with the functional indexes analysis and load

structure analysis. Some male athletes had suffered from excessive fatigue in the three weeks before the competition, lasting for a relatively long time, which might be the unbearable load structure, and they were not adjusted as soon as possible, resulting in the decline of functional state and recovery ability.

Women also showed the world's top level, Switzerland's Anna's running time was 34 '21, and China's Zhang Yi had run her best result in recent four years with 35'07, Wei Wen also had the best running performance of all time. The women's team results were relatively average, and the top three women athletes also played well and won the bronze medal in the women's team. According to the performance statistics, it

could be seen that there was still a certain gap between both men and women athletes. The international excellent athletes' individual cycling results were much higher than the Chinese' athletes. According to the results of women's individual competitions, when the individual cycling ability was close to the level of the first group, the final ranking mostly depended on the running ability. Therefore, we can see that there was still a lot of rising space for improvement of the cycling' and running' abilities, especially the improvement of cycling ability was also the main problem in the future.

4. Discussion

4.1. Rationality Analysis of the Altitude Training Load Structure Before Preparing for the Military Games

Pre-race training is a specialized preparation training process for athletes to create excellent results before participating in important competitions [21]. The load amount and intensity of the pre-competition training, the emergence point of the peak load, the proportion of the competition load, and the best time to adjust the load before the competition are also different according to the characteristics of the sport and the level of the athletes [22]. The arrangement of the sports load structure before the competition should be carefully planned according to the characteristics of the athletes and the situation of the competition load. Whether the arrangement of pre-competition training is scientific and reasonable is directly related to whether the athletes can perform the best competitive state and competitive ability in major competitions and create excellent results [23]. The training load and time of excellent swimmers in China were decreasing with the approaching of the competition. In terms of load intensity, the amount of limit training intensity and large load intensity was less, the more aerobic training with moderate load intensity and small load intensity had become the focus of pre-competition training of excellent swimmers in China [24]. Road cycling and running were the leading physical events, and the pre-race training arrangement should be based on professional quality, aiming to highlight the training speed and speed endurance. Speed training mainly improved the lactate accumulation capacity in a short time period to improve the anaerobic glycolysis capacity, and speed endurance training mainly improved the function of cardiovascular system and special endurance, mainly with medium and high intensity interval training [25, 26]. Aerobic endurance is the foundation of all events, and it plays a leading role in the development of athletes' special competitive ability. Continuous training method is mainly used to improve the aerobic ability. This paper mainly started from the formulation and monitoring of the training plan before the race, and analyzed the rationality and shortcomings of the altitude training load structure before the competition. The purpose of the four weeks' training before the competition was to strengthen the special ability, and to adjust the competitive state before the Military Games and mobilizing the excitement of the athletes to match the competition time. From the point of pre-race training plan, the

overall training quantity was not large, the outstanding point was the training intensity, the quantity and intensity of the four weeks were moderate, sub maximum intensity was stimulated in the third week before the competition, the intensity of running training requirement was higher, and the intensity of the bicycle was not close to the Military Games' intensity, it was because that the domestic bicycle individual performance was weak at this period. From the perspective of biochemical indicators, male athletes had a lack of abilities to withstand load and rapid recovery to a certain extent, which may be related to the unstable functional state before the competition, leading to the fatigue of individual athlete in the four weeks before the competition. For athletes with differences in competitive ability and body conditions, targeted plans should be made, so that the body can recover in a short time, so as to compete in a better competitive state. In the training situation, we can see from the biochemical index monitoring and the results of the Military Games, female athletes' load structure before the race was relatively reasonable, the load quantity in the third week before the game was relatively large, but there were no large fluctuations, the overall adaptability was much better, in the last week before the competitive the function was close to the ideal state, achieving super level performance. From the intensity training arrangement of completion and adjustment, the biochemical indexes monitoring and evaluation, and the final performance, we can see that the previous training composition structure was reasonable. There was no phenomenon of overtraining and difficult recover, the running appearance was praiseworthy, indicating that the preparation stage and the adjustment was reasonable, we had successfully controlled for the intensity and the load volume before the competition. However, the cycling competitive level was relatively low, and there was a certain gap with the world level. The training volume and intensity of the four weeks before the competition was not large, and the main intensity was focused on swimming and running, which was consistent with the situation of domestic competition. However, with the rapid development of triathlon, the ability of cycling should be getting higher than the ability at the moment, which needs to pay attention to the future training. We should rapidly develop the level of cycling in China and shorten the gap with the world's advanced level by increase the training load of cycling.

4.2. Analysis of Athletes' Function Change Trend and Influence of Training Regulation on Competition

The coach of Austrian athlete Kate Allen, the 2004 Athens Olympic champion, pointed out that the functional detection indicators were always used to control and adjust the sports load during the preparations for the Olympic Games. Pre-race training were preparing for four months, mainly including preparation training, heavy load training, simulation competition training and adjust training stages, mainly with red cell count (RBC), hemoglobin (HB), hematocrit (HCT), serum creatine kinase (CK), blood urea (BUN), serum testosterone (T), these six indexes were able to assess the intensity and volume of the load [27]. By observing the

pre-competition training plans of the outstanding athletes in Japan and Hong Kong in the 2004 and 2008 Olympic Games, it can be concluded that the schedule was not clearly defined, mainly for two modes, large cycle and small cycle [28]. The large cycle mode took 3 or 4 months before the competition in the pre-competition training stage. The aerobic training was involved to gradually increase the training intensity, then transited to the stage of improving the competition ability, and finally the pre-competition training was finished by adjusting and getting familiar with the competition condition. This training mode was mostly adopted by Asian countries, and it was suitable for major competition years, such as the Olympic Games, World Games, Asian Games and Asian Championships. The small cycle mode for athletes adopted the method of competition as a part of training, participating in a competition once a month (Europe), one competition was a training cycle, athletes could use several cycles of training to improve their certain aspect of athletic ability [29]. We adopted a large cycle mode in the Military Games, which lasted nearly five months, though we had entered the preparation stage since November 2018 and lasted roughly one year. We participated in domestic competitions since early April 2019, once a month in average. From the results of the competition, the performance of the first half competition was not ideal, until June we gradually resumed the previous best competitive state. This paper mainly focuses on the intensity sprint and the adjustment period before the competition, and it was also the key of the preparing stage of the competition, and the competitive state before the competition directly affected the final performance. Training intensity came from the actual combat competition, improving the comprehensive ability and reasonable arrangement of intensity training interval were the important points, the training load might increase as the intensity of training gradually increased, depending on the maximum oxygen intaking intensity and the lactic acid resistance training intensity. The total load was slightly lower than the preparation period, to ensure that the athletes were able to complete the training task with high quality. In this stage, we mainly pay attention to two points, (1) highlight the key points, recover training must be arranged after intensity training, thus no fatigue accumulation occurred. Different combination methods were used for segmented training, by changing the training methods and mean to reduce the psychological pressure of athletes and relieved mental fatigue. 2) Combined with biochemical indexes monitoring and daily observation, to make a correct judgment on the actual load bearing capacity by the athletes, not only to avoid insufficient stimulation to achieve the training effect but also to avoid fatigue accumulation caused by excessive stimulation. According to the functional indexes, the hematocrit (HCT) of male athletes showed a downward trend ($<50\%$) in the first week before the competition, indicating that the bodies' abilities to carry and use oxygen were insufficient. On the contrary, female athletes showed an upward trend to be a better competitive state. As can be seen from the urea nitrogen (BUN) index, male athletes were above the normal range for two weeks from the third week before the competition, which

was not conducive to recovery for a very short time before the race. Although it was adjusted in the normal range in the week before the competition, the recovery in a short time was bound to affect the competitive state. The creatine kinase (CK) value can reflect the weaker ability of the male athletes to bear the load, and did not return to the ideal status before the competition. Female testosterone (T) values rose significantly from the third to the twice week before the competition, and the competitive status steadily increased, with two athletes achieving their best results in recent years. The ideal function change trend is down-up-up, but the comprehensive function change trend of male athletes was down- down-up, and the final rising degree was not very obvious. This was related to the density of intensity and the recovery time after training. Only when the coaches need to carry out detailed regulation and training arrangement according to individual differences, all the athletes could achieve the changing and improvement of the competitive state. In the future for the training and preparation competition, we should pay attention to solve such problems, in order to rapidly improve the level of China triathlon.

5. Conclusion

The training load pattern of the pre-race was the second maximum load, the maximum load, the medium load and pre-match adjustment. Aerobic training was accounted for 65% of total training, mixed oxygen training is accounted for 28%, anaerobic training was accounted for 7%. Before the competition, the women's load structure was more reasonable, the men's load structure was too large, and the recovery time was insufficient, resulting in a slight decline of the men's competitive ability performance in the competition. The pre-competition load structure arrangement was basically reasonable, achieving the best competitive state by doing precise training control was the key to acquire the best competitive performance.

6. Practical Applications

The pre-race training of triathlon in China was generally a large cycle mode, and the annual training was generally divided into winter training and summer training stages. Winter training was mainly based on aerobic training and basic physical fitness, which lasted for a long time, while summer training mainly focused on special ability training, and the main purpose was to prepare for the competition. Chinese triathlon team generally chose altitude training for pre-race training these years. The load structure of pre-race altitude training was very important to improve the competitive state. In particular, the accurate control of the training rhythm and intensity of the last month before the competition would directly affect the performance of the competition. We stress to find the pre-race training load structure suitable for China's national conditions by using empirical tracking of the pre-competition training plan and conducting personalized analysis of the functional indicators.

By analyzing the load structure and functional status before the 7th Military World Games, we can find out the problem of the training rhythm, and provide the application reference for the pre-competition training arrangement in the future preparation period.

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