



Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Research on aerobics training effects on ankle joint motor function based on biomechanics

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ABSTRACT

Ankle joint plays a crucial role in human movements, and the joint is prone to get injured. In order to control ankle joint sports injury and increase ankle joint flexibility so that make it better serve human movements, this paper analyzes aerobics players' ankle joint specialties so as to explore aerobics prevention and cure efficiency on ankle joint sports injury and make contributions to reduce sports injury. This paper firstly analyzes ankle joint effect, motion features, force status and injury cause in movement process, and make suppose of aerobics effects in ankle joint sports injury prevention and cure aspects that provide directions basis for experiments objectives; Then during the research, it applies experiment comparing method, mathematical statistics method and logical analysis in analyzing before and after experiment two group participants' position sense changing parameters, force sense changing parameters and muscle strength features changing parameters. The research results show that experiment group members that took systematic aerobics training have great difference from that members without taking aerobics training in the aspect of ankle joint sports injury prevention and cure by comparing, it verifies the supposition of aerobics prevention and cure efficiency on ankle joint sports injury.

Key words: Position sense, muscle strength features, ankle joint sports injury, aerobics

INTRODUCTION

Due to aerobics interestingness and fitness, make it plays a very important role in extensive mass fitness programs, its fitness efficiency is so good that can dig for unknown fitness effects. This paper takes one sports university female students as research objects, analyzes aerobics prevention and cure effects on ankle joint sports injury.

For aerobics fitness effects research and technical motions research, lots of people have made efforts, by which propel nationwide bodybuilding popularization, and enable aerobics become even more prominent in body building programs. Among them, Lin Hui(2013) applies experiment method, document literature, mathematical statistics method and logistical analysis in analyzing aerobics major class 9 female college students and 9 non-major female college students ankle joint features, gets that aerobics has good effects on ankle joint sports injury prevention and cure[1]; Yang Fei-Fei(2013) puts forward that implement aerobics training schemes in teaching and verifies schemes designing scientificity and rationality by 6 months systematic training experiments[2, 3]; Gong Wen-Ping(2008) summarizes picked straddle jumping into front support competitive aerobic motions successful practice experience, analyzes the motion from biomechanics perspective and provides scientific basis for targeted training[3, 4].

To sum up, ankle joint plays a crucial role in human movements' process and is prone to get injured. This paper on the basis of previous studies, analyzes ankle joint force status in human movement process, and applies biomechanical principal in analyzing ankle joint sports injury possible causes, takes aerobics players ankle joint features as research objects, explores aerobics prevention and cure efficiency on ankle joint sports injury so as to make contributions to our country's aerobics popularization and provide assistance for nationwide body building

development.

AEROBICS ANKLE JOINT SPORTS FEATURES

In aerobics techniques, correct and reasonable applications of pace is very important, its basic steps are mainly alternate type, stride type, point type, leg raise type and two legs type. Accompanying pace movement, legs spring techniques even more exhibits sports strength and texture techniques, while legs spring techniques are generated mainly rely on ankle joint, knee joint and hip joint flexion and extension buffer. For above three joints in foot landing in the air process, ankle joint produces maximum buffer effects [5, 6].

Obviously, ankle joint possesses buffer effects, which is also playing double effects as extending landing time and bearing landing pressure in landing process, while ankle joint surely produces deformation in the process that bearing downwards impulse force, if deformation range is under the normal tolerable range, it would helpful for ankle joint flexibility training, if its deformation quantity bigger than the joint normal deformation quantity, then it will probably cause such joint sports injury. Though ankle joint spring deformation features is different from spring in force process, applying spring deformation Hooke's law still can reflect ankle joint deformation and force correlation, as formula(1) and formula(2) shows the Hooke's law formula and momentum theorem formula:

$$F = k \cdot \Delta x \quad (1)$$

$$\int_0^T f(t)dt = mv_2 - mv_1 \quad (2)$$

In formula(1) Δx represents joint deformation quantity, F represents joint force. In formula (2) shows impulse values produced by the speed differences between leg and foot. Combine formula (1) and formula (2), it is known that if increase Δx , it will extend T , so that average value of $f(t)$ decreases, which plays buffer role in reducing foot force, but ankle joint may get injured.

In order to study ankle joint, first it should understand ankle joint compositions. From anatomy perspective, ankle joint is talocrural joint, is also called superior talar joint, the joint is composed of fork glenoid fossa that formed by tibia inferior articular surface, articular facet of media malleolus and fibula articular facet of lateral malleolus, together with articular head from trochlea of talus; ankle joint's articular capsule loosing in front and back side that is helpful for flexion and extension, its two sides are reinforced by ligaments, these ligaments are medial triangle ligament, which starts from medial malleolus and moves downwards in fan shaped, ends in scaphoid bone, talus and calcaneum; while lateral also have three ligaments, front part is talofibular ligament, the middle part is calcaneofibular ligament, the back part is posterior talofibular ligament. These lateral three ligaments all start from lateral malleolus forward, downward and backward which also respectively end in talus and calcaneum. During sports injury process, lateral ligaments injury is quite universal, especially for anterior talofibular ligament.

Ankle joint sports muscle group are mainly composed of posterior shank triceps surae, tibialis posterior, plantar flexion muscle, and flexor pollicis longus muscle, lateral shank peroneus longus and brevis, front shank tibialis anterior muscle, plantar extension muscle, extensor pollicis longus muscle and the third peroneus. When these muscles working in the proximal fixed area, it can make foot move with ankle joint as supporting point; when working in the distal fixed area, it make shank move with ankle joint as supporting point. And ligaments surrounding ankle joint play very important roles in ankle joint movements, coordination movements among shank muscles can provide dynamic basis for ankle joint movements.

Ankle joint major functions are mechanical function and sports function, its mechanical function mainly refers to ankle joint surrounding ligaments and articular capsule stability function, and its sports function mainly refers to plantar flexion and dorsal flexion movements, inward rolling and outward rolling as well as internal rotation and external rotation; ankle joint neural position refers to toe vertical and forward, foot outer edge is vertical to shank, surrounding ankle joint frontal axis, foot can make flexion and extension.

Ankle joint basically is a single joint, talus mainly moves along horizontal axis in sagittal plane, the axis deviates backwards from coronal plane that propel foot can make planar flexion and dorsal flexion. The shapes of ankle joint trochlea articular surface are wide in front and narrow in back. When foot makes dorsal flexion, the wider back parts enter into glenoid fossa that make joint stable; when it makes planar flexion, trochlea joint narrow front parts enter into glenoid fossa, ankle joint looses and can make lateral internal rotation and external rotation. Ankle joint and subtalar joint offer complementary strength that enable them form a functional compound. While ankle joint function mainly concentrate on sagittal surface, subtalar joint functions mainly focus on coronal surface, ankle joint

can conjunct appear dorsal flexion accompanies with abduction, planar flexion accompanies with adduction, subtalar joint can conjunct appear dorsal flexion, abduction and outward rolling, planar flexion can conjunct appear adduction and outward rolling. In walking, ankle joint activities are almost moving companying with subtalar joint. Ankle joint and subtalar joint are mutual complemented and moving in conjunction.

AEROBICS TRAINING EXPERIMENTS DESIGN AND RESULTS ANALYSIS

Research objects and methods

Research objects: Select one university sports institute 2010 grade sports education major aerobics special training class 9 female students as experiment group, select 2011 grade social sports major 9 female students as control group, and there is no significant differences between experiment group and control group's participants in age, height, weight and other basic indicators, participants basic information is as Table 1 shows.

Table 1: Experiment group and control group two groups' participants' basic indicators comparison status

Basic indicator	Experiment group	Control group	<i>F</i>	<i>P</i>
Age (years)	21.5 ± 0.92	20.78 ± 0.83	2.87	0.11
Height (cm)	166.88 ± 3.31	165.33 ± 5.41	0.49	0.5
Weight (kg)	57.85 ± 6.59	57.78 ± 5.80	0.00	0.98

Research method: Brigade laboratory method, mathematical statistics method, logistical analysis and interview method, from which before experiment proprioception and muscle strength features of experiment group and control group are respectively as Table 2 and Table 3 show.

Table 2: Before experiment two groups' participants left ankle joint and right ankle joint proprioception table

Proprioception	Experiment group left ankle	Control group left ankle	<i>F</i>	<i>P</i>	Experiment group right ankle	Control group right ankle	<i>F</i>	<i>P</i>
variable error	3.15 ± 1.99	2.04 ± 1.10	2.12	0.17	2.66 ± 1.82	2.74 ± 1.73	0.64	0.44
absolute error	2.78 ± 1.06	2.63 ± 0.43	0.15	0.70	3.47 ± 1.10	2.45 ± 1.03	0.02	0.89
relative variable error	0.74 ± 0.25	1.30 ± 0.94	2.60	0.13	0.85 ± 0.41	1.09 ± 0.73	0.01	0.92
relative absolute error	1.04 ± 0.55	1.34 ± 0.72	0.95	0.34	1.11 ± 0.59	1.14 ± 0.46	3.55	0.08

Table 3 Before experiment two groups' participants ankle joint muscle strength status table

Participants group	Muscle strength features	Angular speed (60° /s)		Angular speed (180° /s)	
		Centripetal force	Centrifugal force	Centripetal force	Centrifugal force
Experiment group	Planar flexion RPT	0.30 ± 0.21	1.32 ± 0.38	0.39 ± 0.20	1.32 ± 0.35
	Dorsal flexion RPT	0.78 ± 0.23	0.52 ± 0.14	0.67 ± 0.19	0.45 ± 0.20
	Dorsal flexion/Planar flexion ratio	1.90 ± 0.59	0.46 ± 0.13	1.70 ± 0.53	0.48 ± 0.11
Control group	Planar flexion RPT	0.24 ± 0.15	0.88 ± 0.26	0.19 ± 0.10	0.84 ± 0.11
	Dorsal flexion RPT	0.70 ± 0.15	0.47 ± 0.15	0.47 ± 0.14	0.51 ± 0.11
	Dorsal flexion/Planar flexion ratio	2.02 ± 0.60	0.59 ± 0.25	1.56 ± 0.39	0.61 ± 0.11

From Table 2 and Table 3 data, it is known that there is no significant difference among two groups participants proprioception error and muscle strength features.

Experiment plan: Let experiment group students carry out 18 weeks and three class hours per time, twice per week systematical aerobics learning, it is required to control experiment students' after training immediate maximum heart rate with the range of 55%-65% every time, experiment group students except for systematical learning aerobics courses, other courses are the same as control group students: Let control group students only attend this term courses technical course training without systematical aerobics course training, trying to control their sports training intensity.

Data collect: Carry out ankle joint position sense testing, maximum isometric strength testing and ankle joint muscle strength sense testing as well as muscle strength features testing before experiment and after warm-up, from which during the position sense testing, it adopts passive positioning –passive reproduction position sense, select passive reproduction angle planar flexion as 5°, let participants carry on three times training angle grabbing. Every time experiment test results would not feedback to participants, while participants button pressing angle and research

presupposed target angle's absolute error value is absolute error angle, data that collected are variable error, absolute error, relative variable error and relative absolute error; Maximum isometric strength testing is participant tries their best to make equal length centripetal force, data that collected is forcemeter full-scale reading; Ankle joint muscle strength sense at this time mainly adopts ankle joint replication capacity to 25% maximum muscle strength torque, force testing system works in equal length mode, ankle joint keep neural position. Torque test under advanced MVIC state, collect participants see indicators with their eyes open, make stronger planar flexion to let indicator torque to be 25% MVIC and keeps 5s, meanwhile it requires participants focus on sense of exertion in corresponding torque, and withdraw indicators, let participants relax and start to pull after eyes closed, keep exertion for 5s when feel that corresponding torque achieved and tell participants, after repeatedly carry out above process for third times record the average value of such data; Muscle strength features testing need to fix participants thigh and shank on horizontal plane, let participants wear stockings and fix them on pedals, make ankle joint keep neural positions, then give dorsal flexion angle to be negative value, planar flexion angle to be positive value, control ankle twist gravity center and constant speed strength testing system nose spindle remaining in one line, and set CON-TREX software testing mode as equal length centripetal mode and equal length centrifugal mode, select speed as $60^{\circ}/s$, let participants take three times constant speed centripetal and centrifugal trainings, finally let participants try their best make respectively repeatedly maximum centripetal and centrifugal contract at angular speed of $60^{\circ}/s$ and $180^{\circ}/s$ and record three times ankle joint flexor and extensor peak value torque and relative peak torque data etc.

Aerobics training before and after experiment students' ankle joint position sense change analysis

Before and after experiment participants' two group members left ankle and right ankle position sense change status can be reflected by Table 4 variable error and absolute error two indicators.

Table 4: Before and after experiment two group members ankle joint position sense change comparison status

Test ankle type	Position sense indicator	Experiment group member		Control group member	
		Before experiment	After experiment	Before experiment	After experiment
Left ankle joint	Variable error	3.15 ± 1.99	1.06 ± 0.56	2.04 ± 1.10	2.21 ± 0.92
	Absolute error	2.78 ± 1.06	2.34 ± 1.26	2.63 ± 0.43	2.07 ± 0.89
Right ankle joint	Variable error	2.66 ± 1.82	1.76 ± 1.37	2.47 ± 1.73	2.34 ± 1.83
	Absolute error	3.47 ± 1.10	2.90 ± 0.92	2.45 ± 1.03	2.77 ± 1.22

From Table 4 data it is known that comparing experiment group and control group, after experiment variation of experiment group ankle joint position sense is obviously larger than that of control group. It can be concluded that aerobics training has a certain effect on female college students' ankle joint proprioception position sense. To further understand different training methods, different groups, different testing ankles, before and after experiment each factor influence on experiment result, this research carries on multi-factor analysis of variance as Table 5 shows.

Table 5: Before and after experiment participants two group members' ankle joint position sense multi-factor analysis result of variance

Factor	Testing ankle	Before and after experiment	Group	Group plus before and after experiment	Group plus testing ankle	Before and after experiment plus testing ankle	Group plus before and after experiment plus testing ankle
Variable error F	0.45	4.78	0.19	3.90	0.15	0.24	1.40
Absolute error F	2.91	1.34	2.89	0.74	0.69	0.76	1.24
Variable error P	0.50	0.03	0.66	0.05	0.69	0.63	0.24
Absolute error P	0.09	0.24	0.09	0.40	0.41	0.39	0.27

From Table 5 data that $P > 0.05$, it can know these mutagenic factors main effects and interaction effects have no statistics significance; From $P < 0.05$, it can know that statistics changes occur to variable error before and after experiment main effects and group plus before and after experiment interaction effects, absolute error has no statistical differences. Through Table 5 data and its analysis can know that experiment group ankle joint proprioception position error variable error changes.

Before and after experiment participants two group members testing ankle joint position sense variance analysis main effects and interaction effects analysis results are as Table 6 shows. Table 6 data shows that participants right ankle joint position sense has no statistical significance in before and after experiment, group main effects and

interaction effects differences. While left ankle joint proprioception position sense variable error has significance in before and after experiment main effects. In group plus before and after experiment interaction effects, left ankle joint position sense variable error has significant difference. Left ankle joint position sense has no statistical differences in group main effects, position sense absolute error has no statistical significance in different groups, before and after experiment as well as group plus before and after experiment interaction influences. Data in Table reflects that before and after experiment participants ankle joint position sense changes that mainly come from left ankle joint.

Table 6: Before and after experiment participants two group members testing ankle joint position sense variance analysis results table

Factor	Position sense indicator	Left ankle joint		Right ankle joint	
		<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>
Before and after experiment	Variable error	5.03	0.03	1.12	0.30
	Absolute error	2.38	0.13	0.04	0.84
Group	Variable error	0.00	0.97	0.27	0.61
	Absolute error	0.43	0.52	2.85	0.10
Group+Before and after experiment	Variable error	7.00	0.01	0.25	0.62
	Absolute error	0.04	0.85	1.74	0.19

Aerobics training before and after experiment students' ankle joint strength sense change analysis

Before and after experiment participants' two group members left ankle and right ankle strength sense change status can be reflected by Table 7 variable error and absolute error two indicators.

Table 7 Before and after experiment two group members ankle joint strength sense change comparison status

Test ankle type	Strength sense indicator	Experiment group member		Control group member	
		Before experiment	After experiment	Before experiment	After experiment
Left ankle joint	Variable error	0.74 ± 0.25	0.91 ± 0.20	1.30 ± 0.94	1.01 ± 0.49
	Absolute error	1.04 ± 0.55	1.16 ± 0.48	1.34 ± 0.72	1.30 ± 0.92
Right ankle joint	Variable error	0.85 ± 0.41	0.75 ± 0.31	1.09 ± 0.73	0.74 ± 0.40
	Absolute error	1.11 ± 0.59	0.68 ± 0.30	1.14 ± 0.46	0.98 ± 0.53

From Table 7 data it can know that left ankle joint strength sense absolute error and relative absolute error each indicator totally in the rising tendency, left ankle joint strength sense relative variable error and relative absolute error each indicator totally in the decreasing tendency. Control group's before and after experiment left and right ankle joint strength sense relative variable error and absolute error each indicator average value both reduce, but the changes are not remarkable, which reflects that aerobics training has a certain influence on female students ankle joint torque. To further understand different training methods, different groups, different testing ankles, before and after experiment each factor influence on experiment result ankle joint strength sense, this research carries on multi-factor analysis of variance as Table 8 shows.

Table 8: Before and after experiment participants two group members' ankle joint strength sense multi-factor analysis result of variance

Factor	Testing ankle	Before and after experiment	Group	Group plus before and after experiment	Group plus testing ankle	Before and after experiment plus testing ankle	Group plus before and after experiment plus testing ankle
Variable error <i>F</i>	0.74	1.64	3.63	2.40	0.41	0.66	0.04
Absolute error <i>F</i>	2.33	0.84	1.93	0.01	0.02	1.42	0.44
Variable error <i>P</i>	0.39	0.21	0.05	0.01	0.52	0.41	0.82
Absolute error <i>P</i>	0.13	0.36	0.17	0.94	0.89	0.24	0.51

From Table 8 data that $P > 0.05$, it can know that ankle joint strength sense relative variable error and relative absolute error have no statistical differences in different testing ankles, before and after experiment main effects as well as group plus testing ankle, before and after experiment plus testing ankles, group plus before and after experiment plus testing ankles. From $P < 0.05$, it is known that ankle joint strength sense relative variable error has statistical significance in group main effects, group plus before and after experiment interaction effects. Ankle joint strength sense relative error has no statistical significance in group main effects, group plus before and after experiment interaction effects, which reflects aerobics generates influence on different group college students' ankle

joint strength sense relative variable error. Different groups have different changes after aerobics experiment.

Before and after experiment participants two group members testing ankle joint strength sense variance analysis main effects and interaction effects analysis results are as Table 9 shows. Table 9 data $P > 0.05$ shows that these mutagenic factors main effects and interaction effects have no statistics significance; from $P < 0.05$, it can know that under group main effects plus before and after experiment interaction effects left ankle joint strength sense relative variable error has statistical significance, left ankle joint strength sense relative absolute error has no statistical differences in group main effects and group plus before and after experiment interaction effects; left ankle joint strength sense relative variable error and relative error also have no statistical differences in before and after experiment main effects, which reflects experiment ankle joint changes mainly occur to left ankle joint strength sense relative variable error, its change influence main factors changes among different groups.

Table 9: Before and after experiment participants two group members testing ankle joint strength sense variance analysis results table

Factor	Strength sense indicator	Left ankle joint		Right ankle joint	
		<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>
Before and after experiment	Variable error	0.95	0.76	2.52	0.12
	Absolute error	0.03	0.87	3.45	0.07
Group	Variable error	2.81	0.05	0.88	0.36
	Absolute error	0.85	0.37	1.19	0.28
Group+Before and after experiment	Variable error	2.35	0.04	0.98	0.33
	Absolute error	0.13	0.72	0.43	0.52

Aerobics training before and after experiment students' ankle joint muscle strength features change analysis

Before and after experiment participants two group members ankle joint muscle strength peak value torque ratios descriptive statistical data as Table 10 shows. In Table 10 planar flexion RPT and dorsal flexion RPT isometric centripetal and centrifugal peak value torque as well as ratios between the two under different angular speeds can reflect participants ankle joint muscle strength features changes.

Table 10: Before and after experiment two group participants ankle joint muscle strength status table

Participants group	Muscle strength features	Angular speed (60° /s)		Angular speed (180° /s)	
		Centripetal force	Centrifugal force	Centripetal force	Centrifugal force
Experiment group before experiment	Planar flexion RPT	0.30 ± 0.21	1.32 ± 0.38	0.39 ± 0.20	1.32 ± 0.35
	Dorsal flexion RPT	0.78 ± 0.23	0.52 ± 0.14	0.67 ± 0.19	0.45 ± 0.20
	Dorsal flexion/Planar flexion ratio	1.90 ± 0.59	0.46 ± 0.13	1.70 ± 0.53	0.48 ± 0.11
Experiment group after experiment	Planar flexion RPT	0.27 ± 0.18	1.48 ± 0.36	0.34 ± 0.23	1.30 ± 0.30
	Dorsal flexion RPT	0.94 ± 0.18	0.56 ± 0.91	0.68 ± 0.19	0.55 ± 0.09
	Dorsal flexion/Planar flexion ratio	2.18 ± 0.60	0.39 ± 0.09	1.60 ± 0.19	0.42 ± 0.07
Control group before experiment	Planar flexion RPT	0.24 ± 0.15	0.88 ± 0.26	0.19 ± 0.10	0.84 ± 0.11
	Dorsal flexion RPT	0.70 ± 0.15	0.47 ± 0.15	0.47 ± 0.14	0.51 ± 0.11
	Dorsal flexion/Planar flexion ratio	2.02 ± 0.60	0.59 ± 0.25	1.56 ± 0.39	0.61 ± 0.11
Control group after experiment	Planar flexion RPT	0.36 ± 0.23	1.25 ± 0.23	0.34 ± 0.23	1.17 ± 0.25
	Dorsal flexion RPT	0.87 ± 0.20	0.49 ± 0.11	0.65 ± 0.21	0.49 ± 0.11
	Dorsal flexion/Planar flexion ratio	1.89 ± 0.53	0.43 ± 0.08	1.48 ± 0.37	2.39 ± 0.13

Data in Table 10 shows that experiment group after experiment left and right ankle joint planar flexion relative peak value torque decreases under angular 60° /s and 180° /s centripetal and centrifugal modes, but it increases under angular speed of 60° /s in centrifugal mode, both left and right ankle joint dorsal flexion increases after experiment which reflects aerobics has significant changes in its influence on experiment group ankle joint muscle strength features, but the concrete changes need to do multi-factor variance analysis as Table 11 shows. From Table 11 data, it can know that ankle joint planar flexion, dorsal flexion relative peak value torque and dorsal flexion/planar flexion muscle group peak torque ratios has no statistical significance in participants left and right ankle joints. In groups differences, angular speed 180° /s left and right ankle joint peak value torque have no statistical differences, other indicators among different groups participants differences have statistical significance. Ankle joint planar flexion, dorsal flexion muscle groups relative muscle strength both has significant differences. Under 180° /s angular speed, different contraction shapes left and right ankle joint peak value torque have statistical differences, while other

indicators under different contraction shapes all have significant differences. During interlocks and before and after experiment interaction, only ankle joint planar flexion muscle group related muscle strength has statistical significance, other indicators have no statistical significance, therefore after experiment group aerobics training ending, participants have changes among different groups, together with under angular speed $60^{\circ}/s$ and $180^{\circ}/s$ different contraction forms ankle joint planar flexion, dorsal flexion muscle group relative peak value torques and their ratios, which proofs aerobics has a certain influence on ankle joint muscle strength features.

Table 11: Before and after experiment participant two group members' multi-factor variance analysis results

Factor	Planar flexion				Dorsal flexion				Dorsal flexion / Planar flexion			
	$60^{\circ}/s$		$180^{\circ}/s$		$60^{\circ}/s$		$180^{\circ}/s$		$60^{\circ}/s$		$180^{\circ}/s$	
	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>
A	0.81	0.37	0.68	0.41	0.15	0.70	0.10	0.75	0.87	0.35	1.12	0.29
B	12.9	0.00	23.6	0.00	4.98	0.03	4.16	0.04	0.00	1.00	0.81	0.37
C	1.21	0.00	6.48	0.01	10.3	0.00	6.04	0.02	0.06	0.81	0.58	0.45
D	440.	0.00	411.	0.00	109.	0.00	17.5	0.00	442.	0.00	1.41	0.24
E	4.01	0.05	10.7	0.00	0.01	0.94	0.15	0.70	3.20	0.08	0.82	0.37
F	15.7	0.00	5.61	0.02	0.08	0.78	4.25	0.04	1.36	0.25	1.32	0.25
G	6.13	0.02	1.68	0.10	4.12	0.04	1.07	0.30	1.80	0.18	0.85	0.36
H	0.14	0.71	0.71	0.40	0.04	0.85	7.52	0.01	1.15	1.29	0.79	0.38

Note: A-H represents testing ankle, groups, before and after experiment, contraction forms, group plus before and after experiment, group plus contraction forms, Before and after experiment plus contraction forms, Group plus before and after experiment plus contraction forms

To further analyze ankle joint planar flexion, dorsal flexion muscle group relative peak value torque and dorsal flexion/planar flexion muscle group peak value torque change status that distinguish by grouping differences, make analysis of multi-factor variance with before and after experiment the experiment group and control group as distinguish unit, their statistics results as Table 12 shows.

Table 12: Before and after experiment multi-factor variance analysis result with groups as distinguish units

Factor	Planar flexion				Dorsal flexion				Dorsal flexion / Planar flexion			
	$60^{\circ}/s$		$180^{\circ}/s$		$60^{\circ}/s$		$180^{\circ}/s$		$60^{\circ}/s$		$180^{\circ}/s$	
	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>
A1	21.9	0.00	25.2	0.00	6.83	0.01	5.13	0.03	2.20	0.14	0.78	0.38
B1	225.	0.00	183.	0.00	43.1	0.00	15.7	0.00	231.	0.00	183.	0.00
C1	5.92	0.02	3.41	0.07	3.47	0.07	9.04	0.00	0.04	0.84	0.93	0.34
A2	0.79	0.38	0.19	0.67	4.10	0.05	1.74	0.19	1.13	0.30	0.81	0.37
B2	211.	0.00	239.	0.00	71.5	0.00	2.84	0.10	211.	0.00	0.00	0.98
C2	1.60	0.21	0.07	0.79	1.29	0.26	1.18	0.28	2.73	0.10	0.05	0.83

Note: A1-C1 represents experiment group before and after experiment, experiment group contraction forms and experiment group before and after experiment plus contraction forms, A2-C2 represents control group before and after experiment, control group contraction forms and control group before and after experiment plus contraction forms.

From Table 12 data can know that after aerobics training experiment group members ankle joint torques have changes, aerobics possesses functions of improving female college students' ankle joint muscle strength.

CONCLUSION

This paper firstly analyzed ankle joint motion features, force status, anatomical structures and sports injury causes as well as aerobics prevention and cure effects on ankle joint injury, made suppositions on ankle joint sports injury, and provided directions basis for experiment targets; In order to verify aerobics prevention and cure effects on ankle joint injury, designed grouping experiment training plan, and put forward collecting method that reflected ankle joint features; Made difference analysis of ankle joint position sense changes, strength sense changes and muscle strength features changes statistical data, got that after aerobics systematical training the experiment group members each indicator has greatly improved, which reflected that aerobics has prevention and cure effects on ankle joint sports injury.

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