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The effect of PNF stretching on the flexibility quality of rhythmic gymnastics students and its experimental analysis

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ABSTRACT

PNF stretching, playing an important role in developing the rhythmic gymnastics teaching in colleges, is a vital means to fully improve the flexibility quality of students. From the students' development perspective, PNF stretching significantly impacts on the ability of muscle groups against external force, improving the students' flexibility quality. PNF stretching not only lays a solid foundation for the balance development of students' flexibility quality, but also provides strong protection of restraining the development of non-dominant flexibility quality. The teaching characteristic of PNF stretching is that the external force can assist to get a better effect of stretching. On the whole process, the increasing communication between students makes the flexibility quality training more interesting, which helps the enhancement of muscle flexibility of students.

KEYWORDS

PNF stretching; Rhythmic gymnastics; Flexibility quality; Effect and analysis.



INTRODUCTION

PNF stretching is a way to maximally improve the flexibility quality of human bodies during exercising. When it talks about the essence of stretching, the effect of PNF stretching is the most obvious, which needs the external force assistance to realize the best performance. This paper studies the flexibility quality training of rhythmic gymnastics students in colleges. PNF stretching is researched during the teaching. Regular training method is considered as the control group, which reflects the positive effect of PNF stretching on the flexibility quality training of rhythmic gymnastics students. The data of two groups of teaching experiment will be organized and analyzed. This paper also discusses the positive effect of PNF stretching on the body's flexibility of rhythmic gymnastics students, providing a solid theory fundament and data support for the wide application of PNF stretching in rhythmic gymnastics. The diagram of PNF stretching is shown as Figure 1.

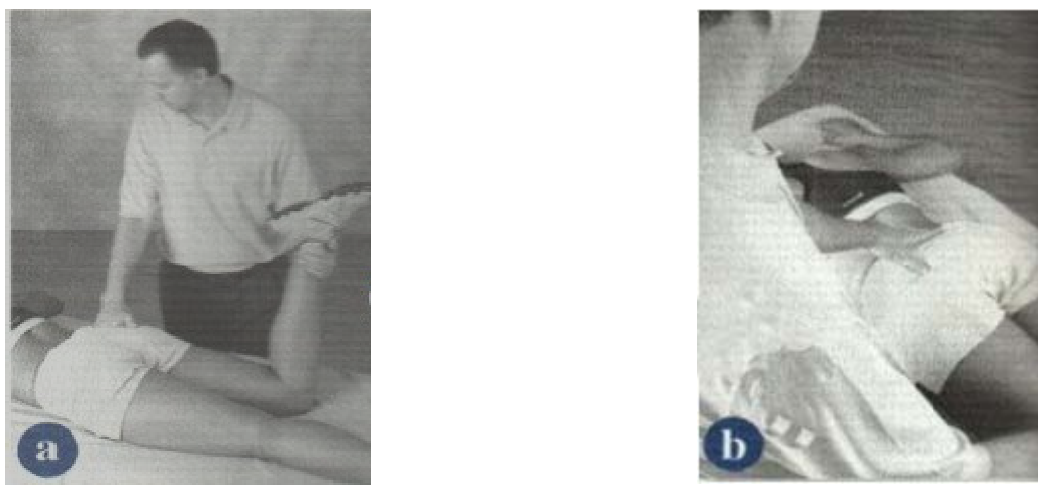


Figure 1 : The diagram of PNF stretching

THE RESULTS OF PNF STRETCHING AGAINST RESISTANCE FOR 5S, 10S AND 15S

On the process of PNF stretching overcoming resistance for rhythmic gymnastics students, the research data in TABLE 1 presents that the students of A group use 70% own strength when they contract actively the muscle groups to get the pain point, and the duration against external force is about 5s. After relaxing muscles, stretch the muscles to the opposite direction. Then keep 30s when the muscles stretch forward at maximum. Every muscle group on the body repeats three times and carries out three experiments every other minute.

TABLE 1: Overcoming resistance for 5s

Subjects	1	2	3	4	5	6	7	8
Forward split before experiment	145	162	135	140	143	138	149	151
Forward split after experiment	165	173	150	150	155	149	157	165
Cross split before experiment	140	152	130	135	140	130	145	145
Cross split after experiment	153	164	145	146	151	143	154	159

On the study of B group, the rhythmic gymnastics students are asked to contract their muscle groups and keep 70% strength at pain point, then to keep about 10s overcoming external force. Next, relax muscle groups and stretch them to the opposite direction as A group for about 30s. Repeat three times experiments for different muscle groups every other minute (as shown in TABLE 2).

TABLE 2 : Overcoming resistance for 10s

Subjects	1	2	3	4	5	6	7	8
Forward split before experiment	138	142	136	145	146	152	145	175
Forward split after experiment	158	160	157	164	163	172	164	185
Cross split before experiment	137	138	135	140	141	146	139	165
Cross split after experiment	152	155	152	159	156	166	158	175

When conducting the research of C group, repeat the same procedures in A and B group, keeping the duration of overcoming external force about 15s. Then stretch the muscle groups to the opposite direction, keeping 30s at the maximum of relaxing muscle groups. Repeat three times of experiments with the same procedure every other minute and every muscle group repeat three times, the data as shown in TABLE 3.

TABLE 3 : Overcoming resistance for 15s

Subjects	1	2	3	4	5	6	7	8
Forward split before experiment	135	145	147	149	141	139	138	142
Forward split after experiment	150	160	158	160	155	149	142	160
Cross split before experiment	130	140	140	142	135	132	135	140
Cross split after experiment	151	155	153	155	152	143	140	154

THE ANALYSIS OF PNF STRETCHING AGAINST RESISTANCE FOR 5S, 10S AND 15S WHEN DOING FORWARD AND CROSS SPLITS

The students of A group use 70% own strength when they actively contract muscle groups to get the pain point, and keep about five seconds to overcome external force. After relaxing the muscles, stretch the muscles to the opposite direction. Then, keep 30s when muscles stretch forward at the maximum. Every muscle group on the body repeats the action three times. During the process, conduct three experiments every other minute (as shown in TABLE 4). The data will be analyzed by related data analysis program, which is called T-test.

TABLE 4 : Overcoming resistance for 5s

Subjects	1	2	3	4	5	6	7	8	sd ± mean
Forward split before experiment	145	162	135	140	143	137	149	151	145.25 ± 8.73
Forward split after experiment	165	173	150	150	155	149	157	165	158.00 ± 8.79 2.32
Cross split before experiment	140	152	130	135	140	130	145	145	139.63 ± 7.73
Cross split after experiment	153	164	145	146	151	143	154	159	151.88 ± 7.22 1.67

The data analysis shown in TABLE 4 fully presents that there is a significant difference on the process of forward split after five seconds of overcoming resistance by PNF stretching for rhythmic gymnastics students in colleges. The result fully explains that there is an obvious improvement of students' flexibility after the experiment.

On the experimental process of B group, the students are asked to keep 70% own strength when they contract muscle groups to get the pain point, and keep the motion about ten seconds to overcome external force. After relaxing the muscle groups, stretch the muscles to the opposite direction as A group and keep 30s. Every muscle group on the body repeats the action three times. During the process, conduct three experiments every other minute (as shown in TABLE 5). The data will be analyzed by related data analysis program for T-testing.

TABLE 5 : Overcoming resistance for 10s

Subjects	1	2	3	4	5	6	7	8	sd ± mean
Forward split before experiment	138	142	136	145	146	152	145	175	147.37 ± 12.21
Forward split after experiment	158	160	157	164	163	172	164	185	165.38 ± 9.19 2.44
Cross split before experiment	137	138	135	140	141	146	139	165	142.63 ± 9.61
Cross split after experiment	152	155	152	159	156	166	158	175	159.13 ± 7.82 4.44

The data analysis shown in TABLE 5 fully presents that there is a very significant difference on the process of forward split after ten seconds of overcoming resistance by PNF stretching for rhythmic gymnastics students in colleges. The result fully explains that there is an obvious improvement of students' flexibility after the experiment.

On the experimental process of C group, the procedures on the above groups are conducted accordingly, extending to fifteen seconds of overcoming external force while contracting muscle groups. Then, stretch the muscle groups to the opposite direction and keep 30s at the maximum of relaxation. Every muscle group repeats the same actions three

times. During the process, conduct three experiments every other minute (as shown in TABLE 6). The data will be analyzed by related data analysis program for T-testing.

TABLE 6 : Overcoming resistance for 15s

Subjects	1	2	3	4	5	6	7	8	sd ± mean	
Forward split before experiment	135	145	147	149	141	139	138	142	142.00 ± 4.75	
Forward split after experiment	150	160	158	160	155	149	142	160	154.25 ± 6.64	1.93
Cross split before experiment	130	140	140	142	135	132	135	140	136.75 ± 4.37	
Cross split after experiment	151	155	153	155	152	143	140	154	150.38 ± 5.70	4.61

It can be obviously seen from the data analysis in TABLE 6 that the result of forward split improves greatly after fifteen seconds of PNF stretching to overcome resistance. It clearly shows that the flexibility of students has advanced significantly after the experiment.

THE INDEX ANALYSIS BETWEEN GROUPS AFTER AND BEFORE THE EXPERIMENTS

The comparison of forward split after the experiment between A, B and C groups adopts One-Way ANOVA method. As shown in TABLE 7 (unit: degree)

TABLE 7 : The comparison of forward split between A, B and C group

Subjects	1	2	3	4	5	6	7	8	sd ± mean	
Forward split after experiment	165	173	150	150	155	149	157	165	158.00 ± 8.79	
Forward split after experiment	158	160	157	164	163	172	164	185	165.38 ± 9.19	3.19
Forward split after experiment	150	160	158	160	155	149	142	160	154.25 ± 6.64	-0.59

TABLE 7 obviously shows that the students of A group can use 70% own strength while actively contracting muscle groups to the pain point and keep 5s, 10s and 15s to overcome resistance on the experimental process of PNF stretching to overcome resistance for the rhythmic gymnastics students in colleges. After relaxing the muscles, stretch them to the opposite direction. Then, keep 30s as the muscles stretching forward at the maximum. In this study, every muscle group on the body repeats three times the same actions and conduct three experiments every other minute. The data analysis shows that the second experimental result of forward split flexibility is much better than the third group. It also shows that overcoming resistance for 10s adopting the method of “PNF stretching to contract muscles- overcoming resistance- stretching to the opposite direction” is better than other methods.

THE ANALYSIS OF CROSS SPLIT BETWEEN GROUPS AFTER AND BEFORE THE EXPERIMENTS

The comparison of cross split after the experiment between A, B and C groups adopts One-Way ANOVA method. As shown in TABLE 8 (unit: degree)

TABLE 8 : The comparison of cross split between A, B and C group

Subjects	1	2	3	4	5	6	7	8	sd ± mean	
Cross split after experiment	153	164	145	146	151	143	154	159	158.88 ± 7.22	
Cross split after experiment	152	155	152	159	156	166	158	175	159.13 ± 7.82	1.89
Cross split after experiment	151	155	153	155	152	143	140	154	150.38 ± 5.7	0.02

The students of A group can use 70% own strength while actively contracting muscle groups to the pain point and keep 5s, 10s and 15s to overcome resistance on the experimental process of PNF stretching to overcome resistance for the rhythmic gymnastics students in colleges. After relaxing the muscles, stretch them to the opposite direction. Then, keep 30s as the muscles stretching forward at the maximum. In this study, every muscle group on the body repeats three times the same actions and conduct three experiments every other minute. It can be seen that the second experimental result of cross split flexibility is much better than the third group. It also shows that overcoming resistance for 10s adopting the method of "PNF stretching to contract muscles- overcoming resistance- stretching to the opposite direction" is better than the other two methods for 5s and 15s.

THE IMPROVEMENT OF FLEXIBILITY OF RHYTHMIC GYMNASTICS STUDENTS BY PNF STRETCHING

The improvement of forward split of rhythmic gymnastics students by PNF stretching

The data in TABLE 9 can be seen that the rhythmic gymnastics students both in experimental group and control group before the experiment have the similar average records of forward split, which are 17.48cm and 17.85cm ($P>0.05$). After both groups accepting different training for the same duration meanwhile, the record of rhythmic gymnastics students of experimental group improves much more than the control group. The result presents that PNF stretching has the more important impact on the flexibility of the rhythmic gymnastics students in the teaching process. But the regular flexible training also plays a positive role in the improvement of the flexibility quality of the rhythmic gymnastics students.

TABLE 9 : The contrast of two groups of rhythmic gymnastics students doing forward split with the advantage leg before and after the experiment

		mean value	standard deviation	N	T	P
Experimental (before)	group	17.48	6.89	10	0.21	>0.05 no significant difference
Control group		17.85	6.64	10		
Experimental (after)	group	9.68	6.42	10	0.34	>0.05 no significant difference
Control group		10.14	6.70	10		

PS: $P>0.05$ means no significant difference.

By contrasting the records of two groups of rhythmic gymnastics students, it can be found that the difference of average records is not significant ($P>0.05$). Moreover, during the record's measurement with the advantage leg, the increase of both groups of students is about 7.7cm, which means that there is no significant difference for the flexible training of the advantage leg between PNF stretching and regular training method. The reason of the situation is as the following. The flexibility quality of rhythmic gymnastics students is not very good. During the process of the static flexible stretching, the respiratory rate of the students is relatively stable, so the height of the body center of gravity moves down. Because of the measurement with the advantage leg, the students' improvement is obvious, which positively impacts the confidence of the rhythmic gymnastics students. The contrast of two groups of rhythmic gymnastics students doing forward split with the disadvantage leg before and after the experiment is shown as TABLE 10.

TABLE 10 : The contrast of two groups of rhythmic gymnastics students doing forward split with the disadvantage leg before and after the experiment

		mean value	standard deviation	N	T	P
Experimental (before)	group	19.84	6.89	10	1.4	>0.05 no significant difference
Control group		22.42	7.1	10		
Experimental group (after)		15.06	7.06	10	1.47	>0.05 no significant difference
Control group		17.84	7.39	10		

PS: $P>0.05$ means no significant difference.

It can be obviously found from TABLE 10 that the average flexibility records of two groups of rhythmic gymnastics students float from 19.84cm to 22.42cm, which shows that there is no significant difference between two groups ($P>0.05$). After experimental group and control group accepting different training for the same duration meanwhile, the average records of two groups of rhythmic gymnastics students are 15.06cm and 17.84cm. The result presents that there is a significant difference between the records of two groups of the students ($P<0.05$). It proves that the flexibility of the rhythmic gymnastics students improves greatly after PNF stretching training. But the students in control group also increase their

records after the regular training. The difference between the average records is not significant. However, when it talks about measuring the record with the disadvantage leg, the increase of flexibility of the students in the experimental group is much better than the control group. It is usual for the rhythmic gymnastics students to do regular training, which results that the students have the painfulness during the training of forward split and produce psychological problems. Therefore, many rhythmic gymnastics students tend to stretch the advantage leg rather than the disadvantage leg, which results that the flexible development of both legs of these students is not balance enough and the muscle tissue damage even sometimes occurs while stretching the disadvantage leg.

The promoting effect on the rhythmic gymnastics students doing sit-and-reach by PNF stretching

The data of TABLE 11 obviously shows that the difference between the records of the rhythmic gymnastics students before the experiment is not significant, which are 7.72cm and 7.85cm. Then after eight weeks of stretching experimental teaching, there is significant difference between the experimental results of two groups of students. The sit-and-reach record of the experimental group has increased 7cm than before the experiment.

TABLE 11 : The contrast of two groups of rhythmic gymnastics students doing sit-and-reach before and after the experiment

	mean value	standard deviation	N	T	P
Experimental group (before)	7.51	4.89	10	0.16	>0.05 no significant difference
Control group	7.72	5.02	10		
Experimental group (after)	14.5	4.02	10	2.18	<0.05 significant difference
Control group	12.16	4.08	10		

PS: sit-and-reach means to measure the distance of hands over toes. P>0.05 means no significant difference. P<0.05 means significant difference.

The data of the control group is not as obvious as the experimental group. After the regular teaching, the record of the experimental group only increases 4.5cm. The result shows that the effect of regular flexible training is not obvious for the rhythmic gymnastics students, while the effect of PNF stretching plays an important role in teaching method. By contrasting the data of two groups, there is a significant difference ($P<0.05$). In PNF stretching method, the training of sit-and-reach has little difficulty, so it is fast for the rhythmic gymnastics students to accept and master it. If the subjects have assistance of related external force during the exercise, there will be more obvious training effects.

PNF stretching can arouse the enthusiasm of the rhythmic gymnastics students

The teaching experiment can prove the important role played by PNF stretching in the flexible training of the rhythmic gymnastics students. The application of PNF stretching needs the cooperation between students to help each other by the external force to realize the result of the experiment. Therefore, the communication between students becomes to increase, turning the boring flexible training to be interesting. The enthusiasm of the students is aroused. Moreover, the communication between the students can distract the attention, decreasing the possibility of suffering muscle strain. PNF stretching can be better applied in the rhythmic gymnastics in colleges.

Both PNF stretching and regular flexible training method can effectively improve the flexibility of the rhythmic gymnastics students.

It can be clearly seen from the contrast and analysis of the flexible training in the rhythmic gymnastics in colleges that both PNF stretching and regular flexible training have different advantages. The process of data contrast and analysis can conclude that PNF stretching have more apparent advantages, comprehensively improving the flexibility of the rhythmic gymnastics students. According to the different situations of the students, the positive impact of regular flexible quality training is limited, but having positive impact on the students' psychology. PNF stretching mainly trains the students' flexibility quality to be balanced, enlarging their advantages and restraining the development of disadvantages on the training process of flexibility quality, so the process of flexible training is balanced. It will positively promote the skill development of the rhythmic gymnastics students. Meanwhile, it will increase the enthusiasm of the students to take part in the training. The experimental teaching fully reflects that the traditional training method and PNF stretching play important roles in the flexible training of rhythmic gymnastics students.

CONCLUSION

The conclusion can be made from the experimental teaching in the rhythmic gymnastics students that there are several advantages of PNF stretching in the rhythmic gymnastics teaching. First of all, it impacts the function of muscle groups against external force, further strengthening the flexibility of the rhythmic gymnastics students. Second, it ensures the

balance of flexibility quality training, not only constantly strengthening the students' advantages on the flexibility quality, but also improving the students' disadvantages. Decreasing the distance between advantages and disadvantages can highlight the integrity of the flexibility quality training. Last but not least, it ensures the quality and efficiency of the training. The traditional training process is broken, turning the training method from one-person training to cooperated training. Therefore, PNF stretching has the actual value on the training process of the flexibility quality in the rhythmic gymnastics teaching. Meanwhile, it can satisfy the internal needs while developing the flexibility quality of the rhythmic gymnastics students.

AUTHORS RESUME

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REFERENCES:

- [1] Zhang Fan, Wang Changsheng, Ye Zhiqiang; The contrast experiment research on the effect of different stretching methods on the flexibility quality of hamstrings, *Journal of Tianjin University of Sport*, **29(1)**, 61-65 (2014).
- [2] Li Fang; The contrast research on the flexibility quality training methods of aerobics, *Journal of Wuhan Institute of Physical Education*, **45(9)**, 84-88 (2011).
- [3] Lv Yin; The current survey of the flexibility quality training methods of rhythmic gymnastics in China, *Journal of Chengdu Sport University*, **36(9)**, 62-64 (2010).
- [4] Huang Yan; The study on PNF stretching impacting on the biggest myoelectricity voltage of male TKD athletes' lower limb muscle, *Journal of Beijing Sport University*, **34(10)**, 56-58 (2011).
- [5] Wang Xiaodi; The impacts of PNF stretching on the muscle strength, flexibility and Bioelectricity characteristics, *Chinese Journal of Sports Medicine*, **30(4)**, 387-391 (2011).
- [6] Le Yuzhong; The application research on the stretching in the training of frontal spiking in volleyball, *Journal of Henan Normal University (Natural Science)*, **40(3)**, 177-179 (2012).
- [7] Zeng Rong; The training of PNF stretching and dancing flexibility ability, *Grand Stage*, **4**, 74-75 (2013).