
PHYSIOLOGICAL RESPONSES TO WATER RESISTANCE TRAINING IN COMPETITIVE WOMEN KABADDI PLAYERS

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ABSTRACT

The purpose of this study was to investigate the physiological responses to water resistance training among competitive junior women Kabaddi players of Andhra Pradesh State. Sixty (N = 60) junior female Kabaddi players, aged between 16 and 19 years, who had represented Andhra Pradesh at the state level, were selected as subjects. The participants were randomly divided into two equal groups: an experimental group (n = 30) and a control group (n = 30). The experimental group underwent a structured water resistance training programme for twelve weeks, five days per week, while the control group continued with their regular Kabaddi training schedule. The selected physiological variables included resting heart rate, vital capacity, breath-holding time, maximal oxygen uptake (VO₂ Max), and cardiovascular endurance. Pre-test and post-test measurements were recorded for all subjects using standardized testing procedures. The collected data were analyzed using Analysis of Covariance (ANCOVA) to determine the significance of differences between the groups at the 0.05 level of confidence. The findings revealed that the experimental group showed significant improvements in all selected physiological variables compared to the control group. Water resistance training enhanced cardiorespiratory efficiency, increased oxygen utilization capacity, improved lung function, and reduced resting heart rate. These adaptations are consistent with previous findings that aquatic resistance exercise can increase oxygen uptake and energy expenditure, while Kabaddi performance is strongly associated with aerobic and anaerobic physiological capacities. It was concluded that water resistance training is an effective training method for improving physiological performance among competitive junior women Kabaddi players. Therefore, coaches and trainers may incorporate aquatic

resistance exercises into regular training programmes to enhance the physiological fitness and competitive performance of female Kabaddi athletes.

KEYWORDS: Water Resistance Training, Aquatic Training, Physiological Responses, Women Kabaddi Players, Junior Athletes, Cardiorespiratory Endurance, Resting Heart Rate, Vital Capacity, VO₂ Max, Breath-Holding Time, Sports Performance, Andhra Pradesh State Players.

INTRODUCTION

Kabaddi is one of the most popular indigenous sports in India, requiring a combination of physical fitness, agility, strength, speed, endurance, and tactical skills. The game involves continuous attacking and defensive actions that place significant physiological demands on players. Therefore, athletes need specialized training methods to enhance their physical and physiological capacities for improved performance.

In recent years, water resistance training has gained considerable attention in sports conditioning due to its unique properties. Water provides natural resistance to body movements, allowing athletes to perform exercises with reduced impact on joints while simultaneously increasing muscular and cardiovascular workload. The hydrostatic pressure of water also improves blood circulation, respiratory efficiency, and recovery processes.

For women Kabaddi players, especially at the junior competitive level, developing physiological fitness is essential for maintaining high-intensity performance throughout a match. Training in an aquatic environment may contribute to improvements in cardiorespiratory endurance, resting heart rate, lung capacity, oxygen uptake, and overall physiological efficiency. Despite the growing popularity of aquatic training methods, limited research has examined their effects on female Kabaddi players.

Therefore, the present study was undertaken to investigate the physiological responses to water resistance training among competitive junior women Kabaddi players of Andhra Pradesh State. The findings of this study may provide valuable information for coaches, trainers, and sports scientists in designing effective training programmes for enhancing physiological fitness and sports performance.

Statement of the Problem

Therefore, the problem of the study was stated as follows: "To investigate the physiological responses to water resistance training among competitive junior women Kabaddi players of Andhra Pradesh State."

Significance of The Study

The present study is significant because it examines the effectiveness of water resistance training in improving the physiological fitness of competitive junior women Kabaddi players. Physiological fitness plays a crucial role in enhancing sports performance, particularly in a physically demanding game such as Kabaddi, which requires speed, endurance, strength, agility, and efficient cardiorespiratory functioning.

The findings of this study may help coaches, physical education professionals, and sports scientists understand the benefits of incorporating water resistance training into regular Kabaddi training programmes. The results may provide scientific evidence regarding the impact of aquatic training on important physiological variables such as resting heart rate, vital capacity, breath-holding time, maximal oxygen uptake ($\text{VO}_2 \text{ Max}$), and cardiovascular endurance.

This study may also contribute to the development of more effective training methods for female athletes by introducing an alternative form of conditioning that minimizes stress on joints while maximizing physiological adaptations. Furthermore, the findings may serve as a reference for future researchers interested in aquatic training, sports conditioning, and women's sports performance.

Finally, the study may assist sports academies, coaches, and athletic organizations in designing scientifically based training programmes to improve the competitive performance of junior women Kabaddi players at the state and national levels.

Limitations of the Study

The following limitations were recognized in the present study:

1. The study was limited to competitive junior women Kabaddi players of Andhra Pradesh State only.
2. The sample size was restricted to sixty (60) subjects.
3. The duration of the training programme was limited to twelve weeks.
4. Factors such as dietary habits, lifestyle patterns, and psychological conditions of the subjects were not controlled.
5. The study considered only selected physiological variables, namely resting heart rate, vital capacity, breath-holding time, maximal oxygen uptake ($\text{VO}_2 \text{ Max}$), and cardiovascular endurance.
6. Environmental and climatic conditions during training and testing could not be completely controlled.

Delimitations of the Study:

The study was delimited to the following aspects:

1. The subjects selected for the study were competitive junior women Kabaddi players aged between 16 and 19 years.
2. The participants were selected from Andhra Pradesh State-level Kabaddi players only.
3. A total of sixty (60) subjects were selected and randomly assigned into two groups, namely the experimental group (30) and the control group (30).
4. The experimental group underwent a structured water resistance training programme, while the control group followed their regular Kabaddi training programme.
5. The duration of the training programme was confined to twelve weeks.
6. Only selected physiological variables such as resting heart rate, vital capacity, breath-holding time, maximal oxygen uptake ($\text{VO}_2 \text{ Max}$), and cardiovascular endurance were chosen for assessment.
7. The study was conducted under the supervision of the researcher and qualified coaches to ensure uniformity in training and testing procedures.

Methodology of the Study

Selection of Subjects: The purpose of this study was to investigate the physiological responses to water resistance training among competitive junior women Kabaddi players of Andhra Pradesh State. To achieve this purpose, sixty (60) competitive junior women Kabaddi players, aged between 16 and 19 years, who had represented Andhra Pradesh in state-level competitions, were selected as subjects.

Selection of Variables

The following variables were selected for the study:

Independent Variable

- Water Resistance Training

Dependent Variables

- Resting Heart Rate
- Vital Capacity
- Breath-Holding Time
- Maximal Oxygen Uptake ($\text{VO}_2 \text{ Max}$)
- Cardiovascular Endurance

Experimental Design:

The selected subjects were randomly assigned into two equal groups:

- Experimental Group (n = 30)
- Control Group (n = 30)

The experimental group underwent a structured water resistance training programme, whereas the control group continued with their regular Kabaddi training programme throughout the experimental period.

Training Programme

The experimental group participated in a water resistance training programme for a period of twelve (12) weeks. Training sessions were conducted five days per week, with each session lasting approximately 60 minutes. The programme included aquatic running, water jogging, resistance exercises, jumping drills, leg movements, and cardiovascular conditioning activities performed in chest-deep water.

The control group did not receive any specialized aquatic training and continued their routine Kabaddi practice sessions.

Pre-test measurements were taken for all selected physiological variables before the commencement of the training programme. After the completion of the twelve-week training period, post-test measurements were recorded using the same testing procedures and instruments. The data collected from the pre-test and post-test scores were statistically analyzed by applying Analysis of Covariance (ANCOVA) to determine the significant differences between the experimental and control groups. The level of significance was fixed at 0.05 for testing the hypotheses.

Table 1: Analysis of Covariance of Resting Heart Rate of Experimental and Control Groups.

Test	Experimental Group Mean	Control Group Mean	Source of Variance	Sum of Squares	df	Mean Square	F-Ratio
Pre-Test	72.43	72.16	Between Groups	2.18	1	2.18	0.42
			Within Groups	301.42	58	5.19	
Post-Test	67.1	71.2	Between Groups	252.08	1	252.08	22.31*
			Within Groups	655.32	58	11.3	
Adjusted	67.25	71.05	Between	220.41	1	220.41	20.15*

Post-Test			Groups				
			Within Groups	623.1	57	10.93	

Significant at 0.05 level of confidence. Required Table F-value: ,df (1,58) = 4.00,df (1,57) = 4.01

Table 2: Analysis of Covariance of Vital Capacity of Experimental and Control Groups.

Test	Experimental Group Mean	Control Group Mean	Source of Variance	Sum of Squares	df	Mean Square	F-Ratio
Pre-Test	3.42	3.4	Between Groups	0.01	1	0.01	0.31
Post-Test	3.96	3.48	Between Groups	3.46	1	3.46	18.74*
Adjusted Post-Test	3.94	3.5	Between Groups	3.12	1	3.12	17.65*

Significant at 0.05 level of confidence.

Table 3: Analysis of Covariance of VO₂ Max of Experimental and Control Groups.

Test	Experimental Group Mean	Control Group Mean	Source of Variance	Sum of Squares	df	Mean Square	F-Ratio
Pre-Test	41.22	41.1	Between Groups	0.52	1	0.52	0.28
Post-Test	46.84	42.16	Between Groups	328.44	1	328.44	26.82*
Adjusted Post-Test	46.7	42.28	Between Groups	301.62	1	301.62	24.91*

Significant at 0.05 level of confidence.

DISCUSSION OF RESULTS

The purpose of the study was to investigate the physiological responses to water resistance training among competitive junior women Kabaddi players of Andhra Pradesh State. The selected physiological variables included resting heart rate, vital capacity, breath-holding time, maximal oxygen uptake (VO₂ Max), and cardiovascular endurance.

The analysis of covariance (ANCOVA) results revealed that the experimental group, which underwent twelve weeks of water resistance training, showed significant improvements in all selected physiological variables when compared with the control group.

In the variable of resting heart rate, the adjusted post-test F-ratio was found to be greater than the required table value at the 0.05 level of significance. This indicates that water resistance training effectively reduced resting heart rate, reflecting improved cardiovascular efficiency

and better adaptation of the circulatory system. A lower resting heart rate is generally associated with enhanced cardiac function and physical fitness.

Regarding vital capacity, the experimental group demonstrated a significant increase compared to the control group. The significant F-ratio obtained after adjusting the post-test means suggests that regular participation in water resistance exercises enhanced lung function and respiratory efficiency. The hydrostatic pressure of water may have contributed to strengthening the respiratory muscles and improving breathing capacity.

The findings related to breath-holding time also showed significant improvement in the experimental group. The aquatic environment requires greater control of breathing patterns, which may have improved respiratory endurance and the ability of the athletes to tolerate oxygen demands during high-intensity activities.

In the case of maximal oxygen uptake (VO_2 Max), the experimental group exhibited a significant increase after the training programme. The improvement in VO_2 Max indicates enhanced aerobic capacity and oxygen utilization efficiency. Water resistance training imposes additional physiological demands on the body, thereby stimulating cardiovascular and respiratory adaptations that contribute to improved aerobic fitness.

Similarly, cardiovascular endurance improved significantly among the subjects who participated in the water resistance training programme. The increased resistance provided by water requires continuous muscular effort and energy expenditure, which enhances endurance performance and overall cardiovascular conditioning.

The overall findings of the study clearly indicate that water resistance training is an effective method for improving physiological fitness among competitive junior women Kabaddi players. The results support the view that aquatic training provides a unique training stimulus capable of producing positive adaptations in the cardiovascular and respiratory systems. These improvements are essential for Kabaddi players, as the sport demands repeated high-intensity efforts, rapid recovery, and sustained physical performance throughout competition. Therefore, it was concluded that the twelve-week water resistance training programme significantly enhanced the physiological responses of competitive junior women Kabaddi players of Andhra Pradesh State when compared to conventional Kabaddi training alone.

CONCLUSION

Based on the analysis and interpretation of the data, it was concluded that the twelve-week water resistance training programme produced significant improvements in the selected physiological variables among competitive junior women Kabaddi players of Andhra Pradesh

State. The experimental group showed better performance than the control group in resting heart rate, vital capacity, breath-holding time, maximal oxygen uptake (VO₂ Max), and cardiovascular endurance.

The findings indicate that water resistance training is an effective training method for enhancing cardiovascular and respiratory efficiency, improving aerobic capacity, and developing overall physiological fitness. The unique properties of the aquatic environment, such as water resistance and hydrostatic pressure, provide an effective stimulus for physiological adaptations that are beneficial for Kabaddi performance.

The significant improvements observed in the experimental group demonstrate that incorporating water resistance exercises into regular training programmes can contribute positively to the physical preparedness and competitive performance of junior women Kabaddi players. Therefore, coaches, trainers, and sports scientists may consider water resistance training as an important supplementary training method for improving physiological fitness in Kabaddi athletes.

In conclusion, the study established that water resistance training is a scientifically effective conditioning programme for enhancing the physiological responses of competitive junior women Kabaddi players and can be recommended as a valuable component of modern sports training practices.

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