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The Impact of High Intensity Interval Training (HIIT) on the Performance of Elite Rowing Athletes

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Abstract

Background: *The rowing being the fitness sports mainly depends upon the endurance component of fitness as valued by the trainers and coaches. But examination of latest training methods to attain optimal performance from elite rowing athletes compelled the trainers to develop combination of cross-fitness and high intensity training versions to achieve competitive performances.*

Objectives: *To evaluate the effects of high intensity interval training (HIIT) on the performance of male (2Kms) elite rowing athletes.*

Methodology: *This quasi-experimental study was conducted with non-probability convenience sampling over a period of 8 weeks. Total n=20 national and international rowing male athletes, aged from 17-32 years, participated during camping for the preparation of national rowing championship at Pakistan Sports Board, Jinnah Complex Islamabad, Pakistan. The athletes with any disease, or trauma and coaches were excluded. The athletes underwent 8 Wks (HIIT) fitness training to improve their overall performance in a controlled training environment. The results of the study were analyzed in frequencies, percentages. One sample t-Test was also incorporated to compare / compute the per-post intervention of 8 weeks.*

Results: *Study revealed significant difference in the scores of the beep (VO2Max) tests. The per-post experiment performance of VO2Max showed, (Mean ± SD), 48.61 ± 4.69 and 52.89 ± 4.85 (mL/Kg/min) respectively, whereas the actual performance of 2km rowing (Mean ± SD) were found 6.84 ± 0.346 and 6.40 ± 0.242 (Mins) respectively. The association between fitness capacity and actual event performance were also analysed. The null hypothesis was rejected and association of high intensity training showed two tailed significant difference < 0.001by analysing through One Sample Test.*

Conclusion: *The eight weeks, high intensity interval training (HIIT) showed substantial improvement in overall fitness and performances of (2KMs) elite rowing athletes.*

Recommendations: *The advance coaches and trainers of today's professional rowing athletes must incorporate this important training technique of (HIIT) during periodization, to improve the standards and overall performances.*

Keywords: High Intensity Interval Training, VO2Max, Aerobic, Cardiovascular Training, Fitness and Peak Performance.

Introduction

The history of rowing shows, that it was considered the pure endurance sports, but gradually the fitness components of this unique sport changed towards speed and strength endurance. The timings of

this event reduced at international levels, due to scientific training techniques being used and implemented. The coaches and trainers followed latest techniques to improve the fitness standards of elite rowing athletes.The main objective of this study was to evaluate the effects of high intensity interval training on the performance of male national rowing players through quasi-experimental study. Sometimes, endurance athletes consider aerobic training methods are useful, yielding large fitness gains due to competition pressure (Rønnestad et al., 2014). Indeed, its fact, high intensity training (HIIT) can also increase the fitness levels of endurance athletes if, tempered with other training techniques in order to achieve the best peak-performance during competition phase (Ali et al., 2020). Most importantly the aerobic and high intensity training is valued more during transition or "Off Season" to build more stamina leading towards competition season (Anjum et al., 2022a). However, during pre-competition and competition phases, theses pure aerobic training version is replaced with high intensity interval training (HIIT) or more specific training to develop the maximum speed for good finish by elite rowing athletes. To develop better metabolism, the high intensity training is part and parcel of 2kms rowers at national and international levels (Korman et al., 2020). The component of fitness especially the speed and strength plays a significant role to achieve desired performance for elite rowers in today's competitive environment (Sadeghkhani et al., 2021). The coaches and trainers are to be well aware of the fact; about advance training methods being used and implemented by latest sports nations. The timings of elite rowing athletes all over the world are surprising and attracting the professionals towards this prestigious fitness sport (Anjum et al., 2020). Besides the fitness, coordination during training for elite rowing athletes also plays a vital role to achieve the set objectives and peak performances.

Literature Review

The game of rowing mainly depends upon fitness and coordination. The advance European nations are leading in this fitness sports due to latest periodization techniques and achieving milestone of improvements and standards (Arunprasanna et al., 2019). Training mechanics are improving gradually, and attracting the coaching staff, to comprehend the latest training versions, including the high intensity methods to compete at international levels (Bompa & Buzzichelli, 2019). According to research, the high intensity training can improve the an-aerobic capacity of elite rowing athletes, which is ultimate requirement in competitive environment. The trainers and coaches needs to grant, due weightage to scientific training techniques for elite athletes to attain standards. The understanding of fitness and principal of individualization in training, sometimes coincide with optimal performance, which needs to be studied by the trainers to achieve individualized performances (Kikuchi & Nakazato, 2017). The performance of elite rowers, can differ at ergometer machine and pure water training due to multifarious reasons including the, environment of water, wind direction and quality of boats being used for experiment. The fitness issues may arise at early development of rowing athletes, if not conditioned and addressed during conditioning and pre-competition phases of the periodization (Issurin, 2016). According to study, most of the coaches face difficulties not only in achieving peak performance but also fails to maintain peak performance during competition for a longer period of time (Huebner & Perperoglou, 2019). The development of female rowing athletes is even more complex and difficult in comparison with male athletes, due to many un-discovered reasons, particularly in South Asian countries due to communication gap, gender differences and social compulsions(Anjum et al., 2022b). According to research, maintenance of peak during competition is an up-hill task for the trainers and coaches, if not understood mechanics of recovery through diet and training (Braun-Trocchio et al., 2022). Moreover, recovery of athletes through diet, rest and massage therapy depends upon the principle of individualization. According to one of the research, which denote the importance of strength training even for endurance athletes, also states the importance of an-aerobic training for optimal performance (Anousaki et al., 2021). Most of the European countries are working on speed and strength training instead of pure endurance or aerobic training for peak performance before and during the competition phases, particularly for the elite rowing athletes (Becerril, 2018). Another research, on the optimal performance of track and field athletes also signify the importance of strength and high intensity training for optimal and peak performance (Anjum et al.,

2022b). Study on the performance of track and field plyometric athletes, significantly improved the fitness standards and actual event performance during eight weeks intervention of strength and speed intervention periodization (Sadeghkhani et al., 2021). According to study, the combination of strength and speed, ultimately improve the important fitness component of explosive training, which is vital during the start of (2km) of rowing elite professionals (Bazyler et al., 2017). Moreover, the combination of different training patterns especially the strength training significantly improve the overall standards of elite rowing athletes (Wang et al., 2014).

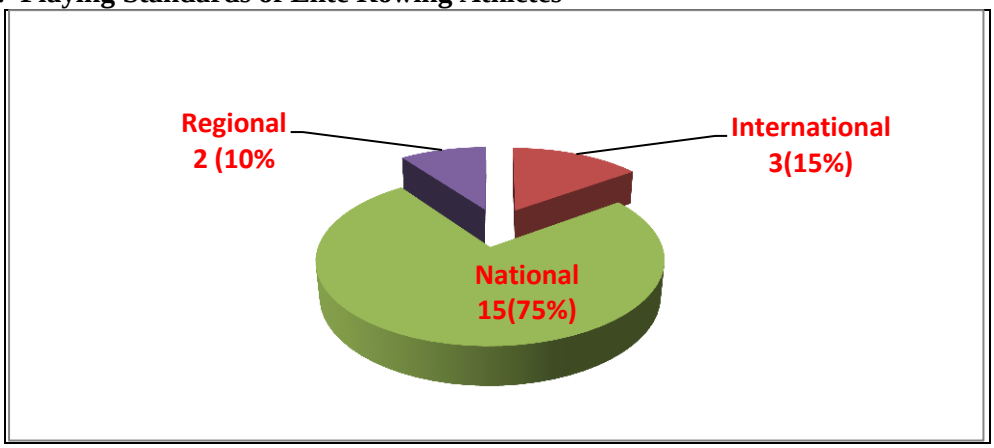
Materials and Methods

Total 20 male rowing athletes, aged from 17-32 years participated during this quasi-experimental intervention of 8 weeks. The convenient sampling technique was incorporated to facilitate the athletes and officiating staff. Athletes declared physical un-fit, coaching staff, with any trauma and disease were excluded from the study. Eight weeks high intensity interval training (HIIT), program was designed and implemented in true letter and spirit during intervention. The consent of all athletes and coaches were obtained on the on-set of the training. The pre & post fitness tests of VO2Max (Beep), the actual performance of 2Km in rowing event including demographic variables were analysed through SPSS (***Version-23***). The data was analysed through *one Sample T-Test* to compare the per-post performance of elite rowing athletes.

Results

The results of the intervention study are of two fold, one demographics and secondly the descriptive. Besides the actual event performance analysis, few demographic details have also been mentioned, below. Total 20 male athletes participated during this study which experienced different playing levels, staring from regional to internationals.

Figure 1: Playing Standards of Elite Rowing Athletes



In Figure 1, the representations of playing levels of all respondents have been reflected. Out of total 20 athletes 3 (15%) athletes were international, 2 (10%) were regional and 15 (75%) participants were national level athletes. Most of the athletes were experienced with minimum of national level exposure.

Table 1: Descriptive Statistics of Performances

The descriptive statistics of pre-post performances are conferred below of all the participants.

Variables	Minimum	Maximum	Mean	Std. Deviation
Training Age (Years)	2.00	10.00	5.3500	2.68083
Biological Ag(Years)	18.00	32.00	24.2000	3.70774
Pre-VO2Max (mL / Kg/ Min)	42.00	57.80	48.6150	4.69011
Post-VO2Max (mL / Kg/ Min)	45.10	60.90	52.8900	4.85873
Pre-2KM Rowing (Mins)	6.34	7.35	6.848	0.346
Post-2KM Rowing (Mins)	6.08	7.03	6.408	0.242

The table-1 showed the statistics descriptive of all quantitative variables have been highlighted. The pre-post Vo2Max *(Mean ± SD*) of all participants is 48.615±4.690 and 52.890±4.858 (mL/kg/min) respectively. Similarly, the actual performance of 2KM of all respondents (*Mean ± SD)*

was assessed 6.84 ± 0.346 and 6.40 ± 0.242 minutes respectively. Besides this, the pre-post beep levels value and training age means of the all participants were also highlighted in this table.

Table-2: Pre-Post Analysis through *One-Sample t-Test*

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean	*P-Value*
Pre Experiment Actual Performance 0f 2Km Rowing	20	6.8485	.34640	.07746	0.001
Post Experiment Actual Performance0f 2Km Rowing	20	6.4085	.24238	.05420	
Pre Experiment BEEP(Levels)	20	10.4850	1.35230	.30238	0.001
Post Experiment BEEP(Levels)	20	11.6700	1.55126	.34687	

In table 2, One Sample t-test was implemented to assess the significance of pre-post Vo2Max and actual performance of (2KMs) rowing event for all the participants. The pre-post of both the variables found two tailed significant in post experiment training implementation of 8 weeks. The strong correlation between pre-post Vo2Max and actual performance was also observed while testing through one *Sample t-Test and Pearson co-relation.*

Discussion

No sports completely considered as fitness or skill game but it is always a combination of fitness and skill to achieve the desired sports performances across globe. Same is, in the case of fitness components, few dominate, while others can contribute towards overall fitness of professional athletes. The main objective of this study was to evaluate the effects of high intensity interval training (HIIT) on the performance of male (2Kms) elite rowing athletes. The training of rowing athletes is considered versatile all over the world to compete at international levels (Ali et al., 2020). The traditional methods of training like aerobic (endurance) training are being modified and adapted with speed and strength endurance (da Silva et al., 2015) and (Anjum et al., 2022a). The high intensity and high intensity interval training (HIIT) encompassed in today's elite rowers training to improve the fitness levels (Korman et al., 2020). The eight weeks intervention periodization was planned and implemented on elite rowing male athletes at Pakistan Sports Board. The pre-post beep (VO2Max) tests, after 8 Weeks intervention, were 48.61 and 52.89 (ML/Kg/min), respectively. Moreover, the pre-post actual events 2Km rowing (Mins) were established, *Mean*± *SD* of 6.8 ± 0.34 and 6.4± 0.24 (Mins), respectively. The comparison of current study was also conducted to analyse the alignment and trend of the available studies. Related studies also confirmed the accuracy and validity of current research work. Many studies are available to compare the alignment of current study, particularly the fitness of elite rowing athletes(Kikuchi & Nakazato, 2017).

Table-3: Comparison of Current Study for Alignment with Related available Work

Fitness Tests	Related Study (*Mean* ± *SD*)		Current Study (*Mean* ± *SD*)	
	Pre	Post	Pre	Post
VO2Max	55.72±3.07	59.45±4.02	48.61 ± 4.69	52.89 ± 4.85
Beep Levels	11.05±2.1	13.04±1.7	10.04 ± 1.3	11.06 ± 1.5
2Km Rowing	6.7±0.52	6.5±0.39	6.8± 0.34	6.4± 0.24

The table-3 shows the alignment of current study with available research work on the elite performances of rowing athletes.

Furthermore, the current research work is found fully aligned with available and related studies on the fitness and actual event performance of elite (2Km) rowing athletes. The efficacy of the current research work is significant and useful for advance professional coaches. The future researchers can further explore the combination of strength and speed training, effects of physical and mental recovery on the performance of elite athletes.

Significance of the Study: The significance of high intensity interval training (HIIT), study not important only for elite rowing athletes, but it is fully applicable on all fitness dominance sports including the endurance running athletes and marathon runners of Track and Field.

Conclusions

The study significantly concludes that 8 weeks high intensity interval training (HIIT) not only improved the fitness standards of all athletes but also shrunk the timings in 2kms rowing specific event. The coaches of elite rowing athletes' can implement, high intensity training to achieve the competitive results. High intensity interval training was the hallmark of eight weeks training periodization during the intervention program. Moreover, this study is fully aligned with latest available research work, which needs to be implemented in current training environment. Last two weeks of intervention used to reduce the training load, to obtain peak performance from each athlete, during the intervention program Maximum training load were prearranged and implemented during first four weeks, out of eight week intervention. Standard diet program was ensured during the complete intervention program of eight weeks research work is useful for fitness dominance sports including all endurance and aerobic sports. Besides this, future research may be extended towards the specific diet of rowing athletes before and during the competition phases, of the periodization.

Suggestions & Recommendations

According to current study, the high intensity training for rowing athletes plays a vital role in the overall performance of elite professionals. The inculcation and improvement of anaerobic capacity besides the aerobic training during pre-competition phase will also pay dividends in performance enhancement of endurance rowing athletes. The post experiment suggestions are listed below.

a. **Transition or Off Season**. The trainers and coaches of 2Km rowing athletes, pay attention to incorporate high intensity training especially during transition phase or during "Off Seasons" to improve upon the consumption of oxygen in elite professionals which will ultimately improve stamina or endurance besides the explosive in times to come.

b. **Conditioning Phase**. The conditioning phase is an important to improve the stamina and adaptation of lungs about consumption of oxygen for prolonged training sessions. Coaches must include the aerobic and high intensity both training versions during this phase of the preparation for competition.

c. **Competition Phase**. Most of the trainers fail to train elite professionals with the understanding that, during competition phase elite endurance athletes don't require high intensity and cardiovascular training which is misunderstanding of this important fact or reality. Coaches are recommended to include speed endurance training even during competition phases which will help to maintain the peak performance for a longer period of time.

d. **Inclusion of Other Sports.** Other sports like cycling, swimming and uphill / downhill training also important to improve the aerobic power and strength of elite professional rowing athletes which must be incorporated to avoid monotonous in training which keep the motivation level high for performance.

Limitations of the Study: The few limitations, the researcher came across are mentioned below.

a. The researcher failed to manage quality international athletes' participation for intervention program.

b. Could not manage the quality equipment for test and measurement, only beep or bleep test was implanted to calculate the VO2Max capacity of rowing athletes.

c. It was limited to elite male rowing athletes, limiting the gender equality.

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