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## Effects of fartleks training to improving endurance ability in male kho-kho players

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### Abstract

Kho-kho is Indian team sports which needs high endurance, good motor, sensory skills, neurological, cardio-respiratory, and musculoskeletal systems. The motor skills focus on good speed, agility, co-ordination, strength, and sudden variations in paces. The present study is to see the effects of fartleks training to improve endurance ability in male kho-kho players. A randomized controlled clinical trial study, 12min Walk/Run Test as a measuring tool to assess endurance ability. 60 male kho-kho players were selected and divided equally in control and experimental group. The statistical analysis was done using Paired and Unpaired T test resulted increase in endurance with significant difference (p value<0.0001), resting pulse rate (p value<0.0001), resting respiratory rate (p value<0.0226), 3min pulse rate (p value<0.0002) 3min respiratory rate (p value <0.0030) with confidence level set as p value <0.0001. Fartleks training improve early endurance ability in male kho-kho players, enhanced recovery phase and delayed early fatigue.

**Keywords:** Physical Fitness, Endurance Training, Fartleks Training, Kho-Kho, 12min Walk/Run Test

### Introduction

Endurance is ability to perform the task in least maximum effort exerted by the body. When endurance is improving there are many physiological changes taking place in the body which shows positive effects like Cardiac changes like increase in stroke volume, cardiac output, Respiratory changes include increase in respiratory cycle, tidal volume, more surface area for gaseous exchange. In musculoskeletal, when there is excessive load on skeletal muscle fibres, these fibres increase its diameter and volume called Hypertrophy. There are micro tears taking place in skeletal fibres which is healed and repaired by the satellite cells produced by daughter nuclei after cell multiplication and fusion<sup>[14]</sup>.

Fartleks is a term used for “speed play” in Swedish language. It is training method in which there is mixed sessions of slow and fast segments of paces”. This training can include walking, brisk walking, jogging, running, and sprinting. Fartleks training can be arranged or planned in any manner as per subject’s endurance ability.

Unstructured fartleks can be used for beginners and elite runners due to its Unstructured pattern protocol. The fluctuation in pace and intensity will help all the 3 body systems active that is Aerobic system, Anaerobic system and lastly Anaerobic alactic system. A fartlek session can be completed alone or with another runner or in a group and improves speed and running tactics. The subject can keep challenging by accelerating the pace and replacing the earlier protocol for progressing<sup>[13]</sup>.

As there are high chances of early fatigue, trauma, muscle soreness, runner’s knee, dehydration, it is important to practice this in proper running shoes, maintain proper diet, rest between the sessions, drinking plenty of water, and ample amount of rest. As it is slight high intensity workout for subject, it can be done alternate days or 3 times a week to avoid the risk of injuries.

Kho-kho is Indian team sports which is based on the athletic training which needs high endurance, good motor and sensory skills, neurological, cardio-respiratory, and musculoskeletal systems. The motor skills focus on good speed, agility, co-ordination, strength<sup>[13]</sup>. It is played in 4 innings of 9mins alternately by both the team (chaser and runner). The

total game time is 36mins. In which the runner's job is to keep saving himself from the chaser for maximum time he can, within the boundary lines. Therefore, the player must change the pace from walking to sprinting suddenly. Thus, unstructured fartleks training will help these players to increase endurance ability. This training can be done on any sports like soccer, rugby, throwball, volleyball, skating, lawn tennis, badminton etc which required good speed, agility, co-ordination, strength<sup>[23]</sup>

The unstructured fartleks training combined with conventional kho-kho training was carried out by the participants in experimental group. Instead of running for continuous running in same pace, it was replaced by the unstructured fartleks protocol. Whereas in control group the players were running for 30mins continuously in same pace.

### Statement of the Problem

Problem is stated as "Effects of Fartleks Training to improving Endurance ability in male Kho-Kho Players"

### Purpose of the study

The purpose of the study is to find out the effects of fartleks training to improving endurance ability in male kho-kho players.

### Hypothesis

Researchers hypothesized that there might be significant effect of fartleks training to improve endurance ability in male kho-kho players

### Limitations

1. Only male kho-kho players were selected
2. Age group considered was 17-24 years.
3. 60 subjects were selected for study
4. To collect data Pre-Test and Post-Test (before and after 6weeks training)12min Walk/ Run Test was used to record endurance ability
5. Paces could not be recorded.

### Methods

#### Subjects

All subjects had training experience of maximum 2-3 years. The players were not on specific diet before the selection for study. The study protocol was approved from the ethical committee of College of Physiotherapy, Wanless Hospital, MMC, Miraj on 21<sup>st</sup> March 2019. Informed written consent form was obtained from study setting and subject stating the whole title, study protocol and risk to study setting.

We selected Total 60 participants and divided them equally into Experimental group (n=30) and control group (n=30), using a computer-generated random-allocation.

### Procedure

#### 12 Min Walk/Run Test

The reliability and validity of 12 Min Walk/Run test is 0.9. It is reliable measuring tool to estimate the endurance capacity of the subject<sup>[25]</sup>

Before starting with training, both groups went under 12Min Walk/ Run test. Markers were placed on 100 meters intervals around the 400 meters track on ground to calculate the distance completed. The participants must be encouraged to push themselves as hard as they can to maximize the distance covered. Respiratory Rate, Pulse Rate, Spo2 and Blood Pressure was recorded at rest, immediately and 3mins.

Fingertip Pulse Oximeter was used to record Respiratory

Rate, Pulse Rate, Spo2. Mercury Sphygmomanometer and Stethoscope was used to record blood pressure. Inch tape to record distance and height. Weight machine to record weight. Coloured marker cone used to mark 100 meters interval on 400 meters ground.

After 6 weeks training the Post 12 Min Walk/Run Test was done again with same procedure as Pre Test. This data was considered for analysing the endurance ability of the male kho-kho players.

Strict diet plan was maintained by each player from both the group which included carbohydrates, vitamins, minerals, protein, glucose drinks, fruits etc to maintain the health and reduce chance of dehydration, deficiency. Proper Running Shoes were maintained for players to decrease the chance of injuries.

### Training Protocol: ("Fig. Table. 1")

This is a training session table was followed every week for next 6 weeks consistently.

Week 1, 2, 3, 5, 6	Control Group	Experimental Group
Day 1	Conventional Training	Fartleks Training + Conventional Training
Day 2	Conventional Training	Conventional Training
Day 3	Conventional Training	Fartleks Training + Conventional Training
Day 4	Conventional Training	Conventional Training
Day 5	Conventional Training	Fartleks Training + Conventional Training
Day 6	Conventional Training	Conventional Training
Day 7	Rest	Rest

### Experimental Group Training protocol

Fartleks training (3 alternate days/ per week for 6 weeks) + Conventional training (6days/week for 6weeks) both on same day. One day rest was given per week.

UNSTRUCTURED FARTLEKS TRAINING included Walking, Jogging, Running, Sprinting for 30-40mins. These training was replaced with conventional training running protocol. Fartleks was done according to how the subjects body feels. If the subject felt tired or fatigue, walking was initiated, as body recovered jogging, running, or sprinting was performed. So, there was no specific segments or combination of the paces for any of the participants. Conventional training included Warm Up, Pre-Training Stretching, Standing Broad Jumps, Half Squat jump, Vertical Jump, Burpee Jump, Hop Jump, Shuttle Run, Post-Training Stretching, Cool down exercises.

Week 1: 10repetitions in each set\* 3sets

1. Week 2: 15repetitions in each set\* 3sets
2. Week 3: 20repetitions in each set\* 4sets
3. Week 4: 25repetitions in each set\* 4sets
4. Week 5: 30repetitions in each set\* 5sets
5. Week 6: 35repetitions in each set\* 5sets

**15 seconds rest between the sets. No Walking, Jogging, Running, and Sprinting was added to days in absence of fartleks training.**

Control Group Training Protocol:

Conventional Training (6days/week for 6weeks). One day rest was given per week.

CONVENTIONAL TRAINING included Warm Up, Pre-Training Stretching, Standing Broad Jumps, Half Squat jump, Vertical Jump, Burpee Jump, Hop Jump, Shuttle Run, Post-Training Stretching, Cool down exercises. 20-30mins continuous running was added everyday instead of fartleks training.

- Week 1: 10repetitions in each set\* 3sets
  - Week 2: 15repetitions in each set\* 3sets
  - Week 3: 20repetitions in each set\* 4sets
  - Week 4: 25repetitions in each set\* 4sets
  - Week 5: 30repetitions in each set\* 5sets
  - Week 6: 35repetitions in each set\* 5sets
- 15seconds rest between the sets.

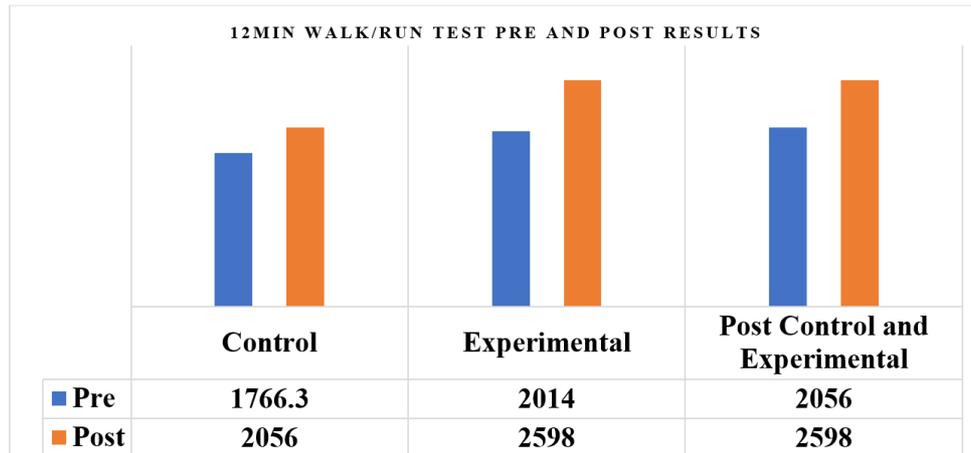
**Statistical Analysis**

Data was collected using 12min Walk/Run Test Pre-training and Post-training. Statistical analysis was performed using Paired and Unpaired T test on Instat Software.

**Results / Discussion**

When data was analysed, after 6 weeks Unstructured Fartleks training programme showed extremely significant difference (p value<0.0001). There was also significant difference in resting pulse rate (p value <0.0001), resting respiratory rate (p value <0.0226), 3min pulse rate (p value <0.0002) 3min respiratory rate (p value <0.0030).

This study is done to see the effects of fartleks training to improve endurance ability in male kho-kho players (“Fig. Table. 2”)

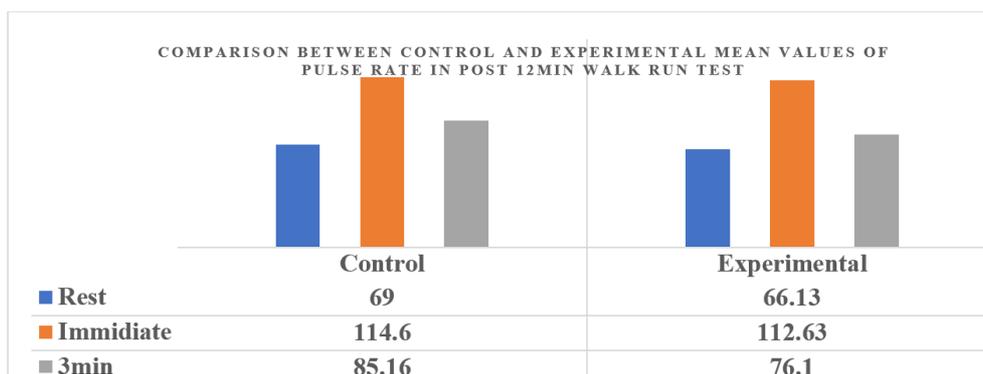


Bar Diagram 1 shows Comparison between the Experimental and control group before and after 6 weeks training programme in 12 min Walk/Run Test.

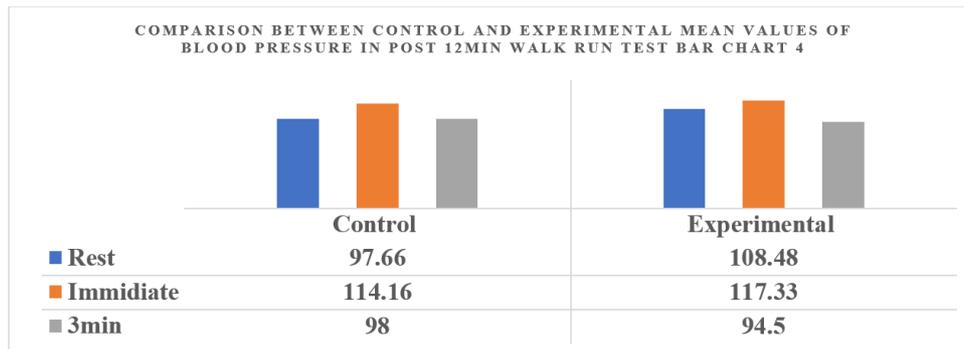
Fartleks training focused on both long durations (walking/ jogging) as well as short duration run (sprinting) which is observed in the KHO-KHO sport as well. As we can see in there was increase in the endurance ability in both the groups, but experimental group was able to improve more and early endurance than control group (“Fig. Table. 2”). It might be the results of 3 different types of muscle fibres (Type 1, Type 2 and Type) alternately activating. The type 1 muscle fibres are responsible for the high vascularity and control posture, hence gets less fatigue. Type 2 are fast twitching which are responsible for high intensity work for many repetitions like weight-lifting, jogging, running etc but gets fatigue slowly. They are responsible for long duration exercises. The type 3 fibres are responsible for the short term high intensity workout like sprinting, dead lift etc. These fibres work only for few seconds. During, 6 weeks exercise training, these

skeletal muscles were overloaded consistently which resulted in hypertrophy. In hand, satellite cells were also activated and repairing process was ongoing, thus micro tears were healed time to time. Unstructured fartleks training, enhanced sudden variation in paces, which focused on all these 3 muscle fibres and body system (aerobic, anaerobic and alactic anaerobic system) at different time span, giving them ample amount of time to recover and generate a new ATP synthesize cycle which played major role in helping these muscle fibres to revive energy when other muscle fibres types supported and compensated to complete the task. This will decrease the chances of overload on any specific type of muscle fibres. The energy consumed during the exercise is at its high peak thus distributing among the fibres which was reserved and used later.

(“Fig. Table. 3”)

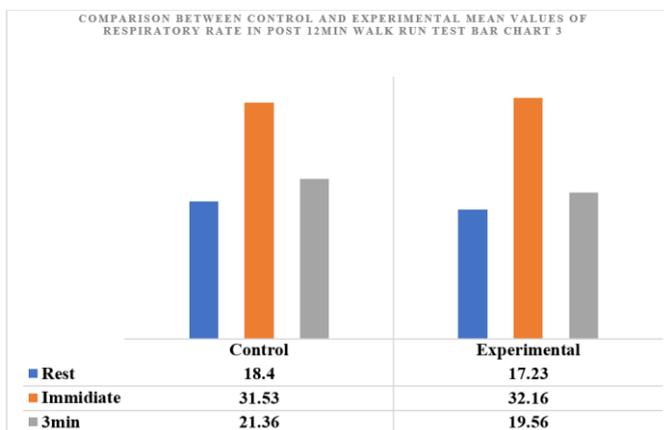


("Fig. Table. 4")



We can observe in there is significant results in resting heart rate and recovery phase ("Fig. Table. 3, 4"). It could be the results of high intensity exercises performed by the body. The amount of blood pumped it and out in one single heartbeat increases resulting, increase in stroke volume and cardiac output as proved in earlier studies (Patel et.al., 2019) Continuous contraction and relaxation of the cardiac muscles during exercises gets adapted with the time, which simultaneously strengths the cardiac muscles. Therefore, the baseline requirement of blood by the body is fulfilled in lesser heart rate. Hence the resting heart rate also decreases. The results achieved in the study proves it. With this same phenomenon, the recovery time also decreases. When activity is stopped, extra need of blood also cesses. As heart is already adapted to pump more blood in single heartbeat at resting position, the difference is recovered early.

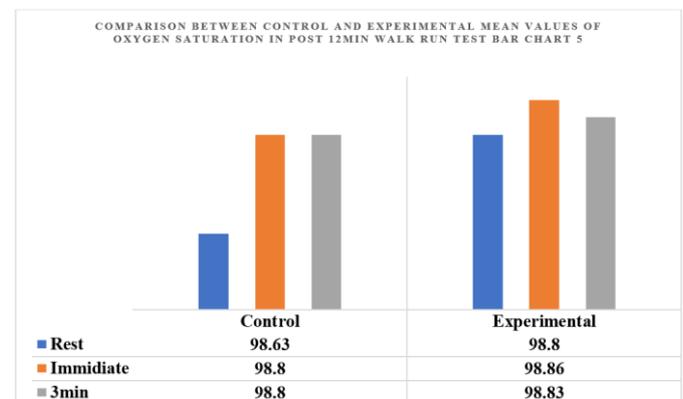
("Fig. Table. 5")



There were also significant results in resting respiratory rate and recovery phase ("Fig. Table. 5"). In resting position, the breathing rate is low hence the diaphragmatic and pump handle movement is also low. The previous study states that there is increase in gaseous exchange during exercises, due to oxygen inhalation and carbon dioxide exhalation are elevated to fulfil the extra oxygen need by the body enhancing tidal volume and full thoracic expansion. This expansion creates the more space in lower part of lungs by dilating the alveolar, decreasing dead space during perfusion. Hence the oxygen supply to the body also increases. (Patel et al., 2019) [14] (Begum et al., 2013) [1] (Kulothungan et al., 2014) [4]. In fartleks training the variation in pace targets on the intercoastal muscles and thoracic movement. When subject is walking the thoracic movement is low and then sudden increase in the pace will enhance the mobility of intercoastal

muscle. This exercise will help the muscles to get adapted and strengthen them. Leading to increasing the efficiency level during recovery phase.

("Fig. Table. 6")



There was no significant difference seen in the oxygen saturation in both the groups ("Fig. Table. 6"). In previous study, it proved that oxygen saturation decreases in acute exercises. As there is increase in oxygen demand in acute exercises, the oxygen dissolving level in blood increases leading to fall in the oxygen saturation. This can be observed in beginners or the players with gap of months. With sustained exercises the body gets adapted to the cardio-respiratory changes. (Eroglu et al., 2018) [24]. In this study the players were already under a training protocol for 2-3 years before getting selected for the study. Hence there was no significant in oxygen saturation.

It is observed that control group subjects were running with the same pace or increased pace gradually. Even though the players were able to cover more distance than earlier, the control group showed no significant results in physiological vitals or early recovery phase. The subjects felt more fatigue due to lack of support of cardio-respiratory endurance resulting in lesser distance covered in test. As this was an additional effect achieved by the experimental group during the fartleks training. The diet and the proper training shoes also helped to achieve more accurate results in both the groups. The subjects were healthy, and no injuries took place throughout the study.

In ("Fig. Table. 7") Pre and Post 12min Walk/Run Test physiological parameters like Pulse Rate, Respiratory Rate, Blood Pressure, Oxygen Saturation is recorded of both Control and Experimental Group. The values clearly proves that there is not significance enhancement.

("Fig. Table. 7")

**Comparison between the Mean Results of Physiological vitals in Pre 12min Walk/Run Test and Post 12min Walk/Run Test of Control and Experimental**

Physiological Vitals	PRE Test	POST Test	PRE Test	POST Test
	Control	Control	Experimental	Experimental
Pulse Rate Rest	74.76	69	75.4	66.13
Pulse Rate Immediate	123.4	114.6	123.4	112.63
Pulse Rate 3min	92.1	85.16	92.1	76.1
Respiratory Rate Rest	18.13	18.4	16.93	17.23
Respiratory Rate Immediate	34.16	31.53	36.96	32.16
Respiratory Rate 3min	23.96	21.86	23.36	19.56
Blood Pressure Rest	96.66	97.66	98.5	108.48
Blood Pressure Immediate	125	114.16	129.66	117.33
Blood Pressure 3min	102.16	98	100.16	94.5
SpO2 rest	98.4	98.63	98.36	98.8
SpO2 immediate	98.56	98.8	98.56	98.86
SpO2 3min	98.73	98.8	98.7	98.83

**Justification of the Hypothesis**

From the above findings achieved in the study proves that there is no need of daily 20-30mins running in conventional training. Early endurance can be developed using alternate Fartleks training protocol. This training can be used in any team sports like volleyball, badminton, lawn tennis, rugby, soccer, cricket etc. which focuses on motor skills focus on good speed, agility, co-ordination, strength, and sudden variations in paces

**Practical Implications in Physiotherapeutic Treatment**

- The major use of this training is in sports, but it can also be included in daily physiotherapeutic treatment as well.
- As fartleks can be started with walking as short term goal, later by adding brisk walking and jogging in Long Term Goals, we can develop cardio-vascular endurance and simultaneously maintain the achieved Muscle and Joint Integrity.
- With its unique characteristics, it can be modifiable for every individual's according to endurance ability it will not be stressful either, Therefore, it can be included in Rehabilitation for any patient who is advised for improving Muscle and Joint Mobility. Once patient achieves the capabilities of independent mobility, he/she can perform on any surface under the guidance.
- This will encourage patients by releasing endorphins which will help to decrease anxiety and patient will willingly incorporate the rehabilitation.

**Conclusion**

- There was significant difference in results between the Pre and Post 6 week training protocol of Experimental Group.
- There was significant difference in results between the Post 6 week training protocol of Control Group and Experimental Group.
- Fartleks training helps in improving early endurance ability in male kho-kho players.
- It also postpones early fatigue and enhances early cardio-respiratory recovery phase.

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