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Original Article

Comparative Effect of Fartlek Training and Sand Running on the Performance of Long-Distance Runners

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Abstract

This study compared the effects of fartlek training and sand running on cardiovascular endurance in male long-distance athletes. Forty-five inter-college male athletes from Utkal University, aged 18 to 22 years, were randomly assigned to three groups of 15 each: Experimental Group I (fartlek training), Experimental Group II (sand running), and a control group. All participants completed a pre-test and post-test using Cooper's 12-minute run/walk test. The two experimental groups trained for six weeks on alternate days, three sessions per week, while the control group did not receive special training. The data were analysed using analysis of covariance (ANCOVA) at the 0.05 level of significance. Both training programmes produced significant improvement from pre-test to post-test. The adjusted post-test means also showed significant overall group differences. Post-hoc comparison indicated that both experimental groups outperformed the control group, whereas the difference between fartlek training and sand running was not statistically significant. These findings suggest that both methods are effective for improving cardiovascular endurance over a six-week period, and that neither method demonstrated clear superiority within the duration of the study.

Keywords: *fartlek training; sand running; long-distance running; cardiovascular endurance; Cooper 12-minute run.*

Introduction

Endurance performance in long-distance running depends heavily on the capacity to sustain work over time. For this reason, coaches frequently use aerobic training methods that challenge the cardiovascular and respiratory systems while also improving running economy and tolerance to fatigue. Selecting an appropriate method is important because training effects depend not merely on effort, but on the way effort is organised and repeated over time.

Among the many conditioning methods used in athletics, fartlek training and sand running are especially relevant. Fartlek combines variations of pace within continuous running, allowing athletes to alternate faster and slower efforts in a natural rhythm. This method can stimulate aerobic development, speed endurance, and recovery between surges. Sand running, by contrast, adds resistance through an unstable surface. Because the foot sinks and propulsion becomes less efficient, the athlete may need to produce greater effort for the same forward movement, thereby increasing physiological demand.

Training adaptation is influenced by a wide range of factors including intensity, frequency, recovery, surface, and technique. It is therefore not enough to assume that all endurance work produces the same result. Comparative studies are valuable because they help coaches identify which methods are most useful under specific conditions and which approaches can be adopted when facilities or environmental constraints limit training choice.

The present study was undertaken to compare fartlek training and sand running with reference to cardiovascular endurance among inter-college male athletes. The investigation used a controlled experimental design so that the effects of the two training programmes could be examined against a non-training group.

Statement of the Problem

The purpose of the study was to examine the effect of fartlek training and sand running on the performance of long-distance runners.

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Delimitations

- The study was confined to male inter-college athletes of Utkal University.
- The age range of the participants was 18 to 22 years.
- Only two training methods were examined: fartlek training and sand running.
- Cardiovascular endurance was assessed through Cooper's 12-minute run/walk test.
- No special motivational technique was employed beyond instructing participants to give their best effort.

Significance of the Study

This investigation has practical value for teachers of physical education, coaches, and trainers who need effective methods for improving aerobic fitness. A comparison between fartlek training and sand running may help in selecting appropriate conditioning strategies for endurance athletes, especially where training environment and equipment vary.

Methodology

Participants

The sample consisted of 45 male inter-college athletes from Utkal University. The average age of the participants was around 20 years, with an overall age range of 18 to 22 years.

Design

A random group design was adopted. The athletes were assigned to three groups of 15 each: Group A (fartlek training), Group B (sand running), and Group C (control group).

Criterion Measure

Performance in Cooper's 12-minute run/walk test was used as the criterion measure for cardiovascular endurance.

Training Programme

After the pre-test, the two experimental groups followed their respective training programmes for six weeks. Training was conducted on alternate days, three days per week. The control group did not receive the experimental training and continued its normal routine.

Statistical Procedure

The data were analysed through analysis of covariance (ANCOVA) to compare pre-test, post-test, and adjusted post-test means. The level of significance was set at 0.05. The numerical values below are retained from the source manuscript and reorganised into clearer tables.

Results and Interpretation

Table 1 shows the change from pre-test to post-test within each group. The fartlek training group improved from a mean score of 2173 to 2279, producing a significant t-value of 15.86. The sand running group improved from 2127 to 2259, with a significant t-value of 8.88. The control group changed only slightly, from 2052 to 2062, and the t-value of 0.84 was not significant. These results indicate that both training interventions improved cardiovascular endurance over the six-week period, whereas ordinary routine activity did not.

Table 1. Significance of the difference between pre-test and post-test means in cardiovascular endurance

Group	Pre-test Mean	Post-test Mean	Mean Difference	SEMD	t-ratio
Fartlek training	2173	2279	106	6.68	15.86*
Sand running	2127	2259	132	14.85	8.88*
Control group	2052	2062	10	11.82	0.84

*Note. * Significant at the 0.05 level. t at 14 df = 2.14.*

Table 2 presents the ANCOVA results. The pre-test and post-test F ratios were not significant, indicating that the groups did not differ meaningfully at the start of the study and that raw final means alone did not capture the training effect adequately. However, the adjusted post-test means yielded an F ratio of 4.39, which exceeded the required value at the 0.05 level. This confirms a significant difference among the three groups after adjusting for initial variation.

Table 2. Analysis of variance and covariance for cardiovascular endurance

Particular	Means (A / B / C)	Sum of Squares (B / W)	df (B / W)	Mean Square (B / W)	F-ratio
Pre-test	2173 / 2127 / 2052	0.29071 / 22.0007	2 / 42	0.145350 / 0.523826	0.27
Post-test	2279 / 2259 / 2062	0.43150 / 15.2687	2 / 42	0.215750 / 0.363540	0.59
Adjusted post-test	2244.76 / 2253.05 / 2102.18	1.45332 / 6.789272	2 / 41	0.726660 / 0.165592	4.39*

Note. A = fartlek training; B = sand running; C = control group. Between-group and within-group values are shown in paired form. Required F at the 0.05 level = 3.22.

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Table 3 provides the post-hoc comparison of adjusted final means. The difference between the fartlek and sand running groups (-8.29) was smaller than the critical difference of 66.58 and therefore not significant. In contrast, the sand running group differed significantly from the control group (150.87), and the fartlek group also differed significantly from the control group (142.58). Thus, both training methods were effective, but neither demonstrated clear statistical superiority over the other within the study period.

Table 3. Post-hoc comparison of adjusted final means

Comparison	Adjusted Mean 1	Adjusted Mean 2	Mean Difference	Critical Difference	Result
Fartlek vs Sand running	2244.76	2253.05	-8.29	66.58	NS
Sand running vs Control	2253.05	2102.18	150.87	66.58	Significant
Fartlek vs Control	2244.76	2102.18	142.58	66.58	Significant

Note. NS = not significant at the 0.05 level.

Discussion

The findings show that structured endurance training, whether through fartlek or sand running, can produce meaningful gains in cardiovascular endurance among inter-college athletes. Fartlek training likely improved performance by exposing athletes to repeated pace changes, which challenge aerobic power, recovery ability, and overall running economy. Sand running may have produced similar improvement because the soft and unstable surface increases the effort needed for propulsion and places additional demand on the working muscles.

Although both experimental groups improved, the comparative analysis did not reveal a statistically significant difference between the two methods. This suggests that, over a six-week period, both programmes were effective to a similar degree. The practical implication is that coaches may select either method depending on training context, athlete preference, surface availability, and the phase of the training cycle.

The overall null hypothesis of no difference was not supported when the experimental groups were compared with the control group, because significant differences emerged after adjustment for initial scores. However, the direct comparison between the two experimental groups did not reach significance. In practical terms, both methods appear valuable, but the available evidence from this study does not establish one as definitively superior within the time span used.

Conclusion

- Both fartlek training and sand running significantly improved cardiovascular endurance.
- The control group did not show significant improvement.
- Both experimental groups were superior to the control group on adjusted post-test scores.
- The difference between fartlek training and sand running was not statistically significant within the six-week training period.

Recommendations

- Coaches and physical education teachers may use either fartlek training or sand running to improve cardiovascular endurance.
- Future studies may include female athletes and participants from other age groups.
- A longer training duration may help determine whether one method becomes superior over time.
- Sand running may be incorporated as a useful conditioning method for developing aerobic capacity.
- Further research may involve larger samples and additional training methods.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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