CHAPTER 2
REVIEW OF RELATED RESEARCH

As related to this problem under investigation, the research done in the past is not much but several studies are selected to give a brief review and some essential details are narrated, in order to offer an appreciation concerning the effects of warming-up on running performance.

Blank,\textsuperscript{1} Teslenke, Simon son and Gorkin\textsuperscript{2} investigated various types of warm-up to be effective in improving the speed of running. Other investigators, Hipple,\textsuperscript{3} and Lotter\textsuperscript{4}

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found no improvement from various warming up procedures. This conflicting evidence leaves the picture rather unclear.

The experiments of Asmunssen and Boje⁵ in 1945 showed that progressive increase on the amount of work in a warm-up exercise progressively improved performance on the bicycle ergometer, even though they used amounts as large as 20,000 Kg. metres in 30 minutes. In 1946, Muido⁶ reported improved performance using a warm-up exercise of 10,800 Kg.m. in 10 minutes. The statistical interpretation of these findings is less reliable, since the first study used only for two individuals, and the second only three. Subsequent studies using preliminary exercises for warm-up have not been sensitive to the above quantitative aspects, with the notable exception of the one by Pacheco⁷ in 1957, who used adequately heavy work with positive results.


Consider, for example, the conflicting results of the following experiments. DeVries\(^8\) used swimmers of the University of Southern California Swimming team as subjects in attempting to determine the value of various types of warm-ups on swimming times in 100 yard events. Each man swam under the

**Following Conditions** - (1) no pre-trial warm-ups, (2) swimming warm-up, (3) hot shower warm-up, (4) calisthenic warm-ups, and (5) massage warm-ups. It was found that as a group, the swimmers made significantly better time after warm-ups than without any warm-up. However, in a breakdown of (free style, dolphin, breast stroke, and back stroke, all were compared according to type of warm-up procedure), inconsistent results were obtained. The investigator, therefore, calls for an individual approach to warm-up methods.

Karpovich and Hale\(^9\) conducted two experiments dealing with warm-up prior to performance. After massage, digital stroking, or running exercises, college track men were tested

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for time in the 440 yard dash. No significant difference in performance effects was noted between the warm-up methods.

Since the report by Massey, Johnson and Kramer\textsuperscript{10} in 1961, which included a brief but extensive review of the literature of warm-up exercises, no formal resume is needed here. In this study the type of preliminary exercise was classified as simple muscular activity of short duration (including throwing, jumping, and making standard limb movements) or as muscular activity of considerable complexity and duration (running, swimming, or bicycle riding). The investigators did not attempt to make a critical review of the 26 studies they cited. In several of them, particularly in the simple short-duration category, the influence of learning was uncontrolled and may well have caused the apparent warm-up effect.

Emerson\textsuperscript{11} studied on, "the relationship of formal, informal, and to lack of warm-up exercises to performance involving speed, of movement". A running test pattern was divided


into four equal parts. The first was preceded by a 10 minutes rest and calisthenic warm-up equivalent in time to the time required for the first three parts of the run. The running test was again timed in 4 parts. Both an all out formal warm-up and an all-out informal warm-up were found to detrimental to running speed. Moderate general warm-up did not have an immediate effect on running speed but did have a detriment effect on continued performance. An all out formal warm-up was more detrimental to running speed than was moderate general warm-up.

Hanson\textsuperscript{12} did a comparative study on the "relationship of different types of warm-up to performance in 440-yard run". The varsity a three freshman members of the State University of Iowa track squad served as subjects. Each subject ran a 440-yard run after no warm up, a 10 minute warm-up, and a 5 minute application of cold packs followed by a 10 minute warm-up. After running, each subject walked and jogged for 20 minutes and then ran another 440 yards. Each subject was tested three times for each procedure. No significant relationship was found between the time required for a 440 yards run and the three procedures used before each run.

Grosswiler\textsuperscript{13} studied on "the effect of attitude toward warm-up on the speed of elementary school children". Fifth and Sixth grade students (N = 196) were given an attitude survey concerning the value of warm-up exercises. On the basis of these scores, each student alternated running a 50 yard indoor circuit without a warm-up period and a 5 minute warm-up period. They performed under one condition the first day and the alternate condition the second day. Results indicated that while the second run was significantly better than the first neither attitude nor condition of run was a significant factor.

Haley\textsuperscript{14} studied on "the effects of warm-up on the two-hundred metre free style". Age group swimmers (N = 28) served as subjects. Each participant completed five trials following three warm-up procedures. The warm-up procedures used were: no warm-up, sprint warm-up, and continuous warm-up. Five measurements (pulse rate, systolic, diastolic, blood pressure and oral and rectal temperatures) were secured following each warm-up procedure and performance. Performance times were recorded following each performance. The recorded measurements were used to determine the effects of the warm-up procedure that preceded the


performance. The findings of this study show that warm-up does not affect many of the body functions. Yet, the study indicated that the warm-up procedures used had little or no significant effects upon the subsequent performance.

Phillips\textsuperscript{15} studied on the influence of fatiguing warm-up exercises on speed of movement and reaction latency\textsuperscript{a}. Related warm-up exercise of moderate intensity failed to improve arm speed in a large muscle criterion movement, while heavy but non-related warm-up exercise did improve the speed by 16 percent. Three groups, each consisting of 25 male college students, were measured under both test and control conditions. Neither of the warmup exercises influenced reaction latency. The correlation between RT and MT scores has been non-significant ($r = 17$). For the heavy exercise (stool-stepping), highly reliable individual difference were observed in stepping rate drop-off before fatigue ($r = .93$) and after 37 percent fatigue ($r = .98$), but the two types of drop-off scores were not significantly correlated\textsuperscript{16} ($r = -.24$) In the arm motion exercise, the correlation between initial rate of movement and rate out 24 percent fatigue was nonsignificant ($r = 0.08$).

McDuffie\textsuperscript{16} did an experimental study on "the effects of isotonic, isometric, and isokinetic exercise training programmes on times of individuals running 100 yards". College male students ($N = 30$) were randomly assigned to either isotonic, isometric or isokinetic exercise training groups. Following pre-tests on speed in a 100 yard dash, subjects were trained for 4 weeks (3 days/week) on exercises to strengthen knee extension. Isometric and isokinetic groups performed maximum repetitions in knee extension within a 10 second period (3 sets). The isometric group performed a maximum contraction (10 sec.), in knee extension at angles of $112^\circ$, $135^\circ$ and $158^\circ$. Post test scores indicated the isokinetic group ($P < 0.01$) and isometric group ($P<0.05$) improved in running speed. ANOVA indicated no difference existed between groups.

Day\textsuperscript{17} studied on "the effects of three selected training programmes on running speed". An initial test and retest measuring running speed for 30-yard were administered to 3


experimental groups and one control group. Following the initial test, the experimental group received particular running programmes including repetition sprinting, interspersed sprinting, and stair-running in addition to a standard weight-training programme. The control group received only the weight training each class period. The 30 yard dash test was readministered after 8 weeks of training. All groups significantly, with no differences noted between the groups.

Gibson\textsuperscript{18} did an experimental study on "relative effect of two training programmes on sprinting speed". Freshman male subjects (N = 54) were randomly assigned to 3 groups and treatment programmes. Group 1 had training for 22 days by running 3 all-out sprints/day of 100 yards each. The second group followed the same training programme but ran each sprint with $1\frac{1}{2}$ lb weight attached to each ankle. The control group did not participate. Before and after the training programmes, all subjects were tested on their ability to sprint 85 yards, with flying start. No significant differences existed among groups before or after training but both experimental groups improved their performances significantly. Thus, it was concluded that both training variables were equally effective in improving speed of running.

Groff\textsuperscript{19} did an experimental study on “the effect of attitude toward performance exercise on fifty-yard dash time”. Ninth grade male Physical Education students (N = 91) served as subjects. Their attitudes toward performance exercises were determined by the Smith-Bozymowaki Attitude Inventory. Subjects were classified as having favourable, Unfavourable, or undecided attitudes for two preperformance conditions, warm-up and no warm-up. Each ran the 50 yard dash under each performance condition. The results showed the groups with favourable and undecided attitudes had significantly better dash times. These two groups also performed significantly between when they were allowed to warm-up.

Smith\textsuperscript{20} did an experiment on “a study on the effect of warmup on speed of running”. Twenty subjects were used to determine the effect on speed in running of various warm-up techniques (body temperature showers, 110° F. showers, and a formal warm-up procedure). No statistically significant differences were found between the mean time required to run five yards at maximum speed (after running 30 yards).


without warm-up, and the mean time required to run the same distance after using the three warm-up procedures.

Generally speaking, most of the investigations have been conducted on track men and swimmers, and the data have variously supported or denied the value of warm-ups. Warm-up might be more beneficial, however, for events involving accurate movements or fast and accurate movements than for activities, such as track and swimming that are performed at a more physical and mechanical level. There is more room to improve in complex skills than in simple ones. An actual physiological basis for the use of warm-ups to improve motor performance has yet to be satisfactorily determined.