Chapter II

REVIEW OF RELATED LITERATURE

Physical fitness is one of the objectives of physical education and evaluation of physical fitness has been the constant challenge to this profession. Several tests and norms have been evolved to assess the physical or motor fitness through out the world. Numerous normative studies confirm the need of norms for specific target population. An abstract of such literature is included in this chapter. The related literature has been given separately for India and abroad. The related literature abroad has been further divided into five sub-heads namely studies related to tests and norms, age, height, weight and sex, socio-economic and rural urban factors, related comparative studies and validity and reliability of different tests or test items.

Related Literature in India

Unfortunately, literature on physical fitness or motor fitness in India is negligible whatever is found, is only in the post independence period. In eightys there seems a sharp rise in this respect but far beyond satisfaction.

The history of physical fitness, especially fo school children in India, is perhaps related to the development of
physical education profession in the country. The development of physical education in India started at the beginning of the 20th Century. The Y.M.C.A. in Calcutta was started in 1908 followed by the Y.M.C.A. college of physical education, Madras in 1920. Prior to the establishment of Y.M.C.A. college of physical education, Madras, the physical education programme in schools and colleges was in the hands of retired army personnel who laid great stress on the physical fitness of the students. Tirunarayan and Hariharasarma\(^1\) state the first All India Educational Conference was held at Amaravati in 1946 under the Presidentship of Late Shri Sarat Chandra Bose. The National Association of Physical Education and Recreation was inaugurated in this seminar.

The Rajkumari Sports Coaching Scheme which later took the shape of the National Institute of Sports (Patiala) was started in 1953.

All India Council of Sports was established in 1954 to act as a liaison between the Government and the National Federations for various games and sports. The poor performance and the poor physical fitness of players were the root causes of the establishment of the Rajkumari Sports Coaching

scheme and the All India Council of Sports.

School Federation of India was inaugurated in 1954. The Krira-O-Shakti Sangh of Calcutta took initiative in the formation of this federation. The federation aims at promoting physical education and sports for school students in India. The federation annually conducts the National School Games.

A National Plan of Physical Education and Recreation was prepared by the Central Advisory Board of Physical Education and Recreation. It suggested the following physical efficiency test items for boys and girls age group 10 to 17.

**Boys - Age Group 10 to 12**

Items:

**Boys - Age Group 13 to 17**

Items:

**Girls - Age Group 10 to 12**

Items:
1. 50 Metres Run, 2. Skipping - 30 secs, 3. Ball Bouncing

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\(^2^A\) National Plan of Physical Education and Recreation

30 secs, (4) Cricket Ball Throw, (5) Sit-ups - 30 secs.

Girls - Age Group 13 to 17
Items:
(1) 100 Metres Run, (2) Cricket Ball Throw, (3) Long Jump,
(4) Sit-ups (1 minute).

The All India Seminar on Physical Education Institutions\(^3\) recommended the motor ability test as prescribed on
the National Plan to be conducted in schools all over the
country to ascertain its validity and supply proper norms
for various age groups. The seminar also recommended
to achieve norms for Kraus Weber and the Canadian Fitness
tests, to validate them and use them as standards in India.

A National Physical Efficiency Drive\(^4\) was launched
in 1959 by the Union Ministry of Education. The purpose of
this drive was to create consciousness and enthusiasm amongst
the youths for physical fitness and stimulate their interest
in physical welfare which would assist them for a better health-
ful living.

\(^3\)Report of All India Seminar on Physical Education
for Principles of Physical Education Institutions, Ministry
of Education, Government of India (New Delhi: Government of
India Press, 1959).

\(^4\)National Physical Efficiency Drive, Ministry of
Education and Youth Services, (Faridabad: Government of
There were two batteries namely 'A' and 'B'. The 'A' battery with athletic events consisted of 100 mtr. run, 800 mtr. run, Long Jump, High Jump and Putting the Shot. In the 'B' battery some of the athletic field items were replaced by indigenous items like Dands, Baithaks, carrying weight etc. so that youths from rural areas could also take part. This alternative battery was also useful to youths from urban area not having experience and facilities for items drawn from athletics.

A participant could select either of the battery according to his/her choice. He/she had to take part and give a minimum performance (as laid down) in each item before qualifying for any award. Depending upon performance, one was awarded star pins namely one-star, two-star, and three-star and a certificate.

Twenty National Awards were also made to twenty top performers each year in the National Physical Efficiency test.

The National Physical Efficiency Scheme was initially organised for two years on experimental basis. A seminar was organised every year for State Liaison Officers in N.P.E.D. and the scheme was regularly evaluated. The items had been changed a number of times as a result of the deliberation at these seminars.
However, the 'A' battery consisting of purely athletic items, had been more or less constant. The ad hoc norms prescribed for three levels of recognition had remained unchanged. Attempts to evolve norms on scientific basis has not yet been successful.

The National Physical Efficiency Drive included some athletic events in 'A' battery. A physical fitness test battery should avoid skilled items. Motor Fitness Test batteries including the American Association of Health, Physical Education and Recreation (AAHPER) Youth Fitness Test are without skilled items.

Poor performance by Indian teams in international competitions has also lead to various schemes from time to time for raising the level of physical fitness of players. All the committees, probing the reasons for the poor performance of the Indian teams at international levels have laid great stress on the physical fitness of players.

A workshop on curriculum Development in Physical Education for all levels of education and Professional Preparation in Physical Education was organised in 1971 at the Lakshmibai College of Physical Education, Gwalior.
The Central Board of Secondary Education took lead in introducing physical education as an academic subject at school stage. The board appointed a committee with Sri S.D. Chopade as the chairman to form a curriculum of physical education. It was first introduced as an elective subject in the three years course of All India Higher Secondary Education. Later it was introduced as a required common subject for junior secondary (ninth and tenth classes) and senior secondary (eleventh and twelfth classes) education. The Syllabi and Courses (1980) for secondary school examination, physical fitness plays an important part in the curriculum of physical education. Among the various objectives of physical education, the physical fitness can be realised only through physical education activities. Physical fitness is also essential for achieving better success as in other areas of physical education curriculum as mastery in sports.

There are no special periods allotted for Physical Fitness in the syllabus of the Central Board of Education. It is expected that students would develop a certain amount of physical fitness through participation in other physical education activities. However, there is provision for assessing physical fitness.

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In the scheme of examination, a student is permitted to sit for examination at the end of class ten only when he has obtained grade 4 (fair) in health and physical education. Maximum of seventyfive marks are allotted for physical education. Twenty marks are allotted for theory and fiftyfive for practical out of which ten marks are for fitness.

The battery 'A' of N.P.E.D. has been adopted as the standard test for evaluating physical fitness in classes ninth and tenth in the schools under the Central Board of Secondary Education. There is no local norm. The battery 'A' is an adoc norm. Therefore, a computed norm on the basis of performance of comparable student group is needed. Though the scheme of required physical education got implemented over a number of years, yet no State Board of Education has taken any research project of preparing suitable norms.

Thomas states that the Madras Physical Efficiency Test was constructed for secondary school boys. The physical ability of boys is assessed in five item tests comprising basic natural activities like 1) climbing, 2) jumping, 3) running, 4) running long jump, 5) running high jump, 6) 100 metres run, and 7) throwing cricket ball for distance.

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Only medically fit students were allowed to take part. Students were graded class I, class II, and class III in each event and consolidated grading was given under "All round efficiency."

Thomas states that Bombay Achievement tests prepared by P.M. Joseph was a very progressive type of test. The tests were conducted in 50 yards run for elementary and sub-juniors, 75 yards run for seniors, jump and reach (vertical jump test) ball throw for distance, pull-ups and running broad jump. Marks were allotted separately for each part (a) achievement tests, (b) tests in physical activities, and (c) attendance. The performance were converted into points by using a scoring table prescribed by him.

Thomas also states about Bengal Athletic Test which is conducted to assess physical efficiency of the high school students in each district by the District Organiser of Physical Education. Successful candidates are awarded certificate of merit.

Events of the Test are:

<table>
<thead>
<tr>
<th>Event</th>
<th>Standard</th>
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<tbody>
<tr>
<td>100 yards</td>
<td>13.4 sec.</td>
</tr>
<tr>
<td>50 yards</td>
<td>7 sec. or less</td>
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<tr>
<td>880 yards</td>
<td>3 min and 30 sec.</td>
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<tr>
<td>Running High Jump</td>
<td>4 feet</td>
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<tr>
<td>Running Broad Jump</td>
<td>14 feet</td>
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<tr>
<td>Press-ups</td>
<td>8 times</td>
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<tr>
<td>Pull-ups</td>
<td>5 times</td>
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</tbody>
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Professor Karan Singh devised four simple exercises for general fitness, especially for athletes and players to maintain their fitness during off season. These exercises are known as KS (Karan Singh) set of exercises.

A set is completed when all the four exercises are done non-stop one after the other with 10 repetitions each. Depending upon the body's condition and need, one can go for four sets non-stop.

These exercises are:

1. Full Squat and Trunk Bending.
   Starting Position: Feet slightly apart, hands by the side.
   Count One - Performing full squat with hands raised forward.
   Count two - Back to starting position.
   Count three - Bending forward from trunk and touching the ground by fingers.
   Count four - Back to starting position.

2. Burpee.


4. Push-ups (against floor or ground)

Assessment:
- 2 sets - Fair
- 3 sets - Good
- 4 sets - Excellent.
Robson et al.\textsuperscript{7} prepared a simple physical fitness test battery for elementary school children. The subjects were 152 boys and 150 girls of Kendriya Vidyalaya, Gwalior. The test battery measures most of the essential motor qualities of elementary school children. The norms are for selected items and can be used for classifying the children into ability group by assessing their physical fitness.

Uppal and Khare\textsuperscript{8} took a study on "Relationship of Body Composition to Agility and Speed of Movement." They concluded:

1. Agility and speed of movement significantly affect performance in those games and sports where speed as a motor component plays a vital role.

2. The efficiency of agility and speed depends to a larger extent on the nervous system and the muscles. All the nerves, nerve processes and the muscles have to work actively to execute quick movements and also change the body position and direction quickly.


3. Fat also adversely affects performance in motor activities. The weight of the inactive fat produces more work load and does not provide any benefit during active work specially in activities where quick movements are executed.

4. To improve agility and speed, the amount of body fat should be reduced through a vigorous activity programme.

5. Agility and speed of movements have a significant negative co-relation with percentage of body fat.

Some normative studies given below on physical fitness have also been carried out by Master Degree students in physical education.

Swami\(^9\) conducted a normative study of the Youth Physical Fitness Test for the boys in grades nine through eleven in Greater Gwalior.

Das\(^{10}\) prepared norms in physical fitness for boys of classes nine to eleven of the Government Schools of the Delhi Administration.


Sree Devi\textsuperscript{11} also constructed norms for a motor fitness test for class VIII and IX girls of Kendriya Vidyalaya, Gwalior.

Two normative studies mentioned below have also been carried out in Panjab University, Chandigarh for the award of Ph.D. Degree.

Singh\textsuperscript{12} conducted a normtive study on physical fitness of Panjab State high school boys.

Singh\textsuperscript{13} took up a normative study of physical fitness of Panjab University men students.

\textbf{Related Literature Abroad}

There is a lot of literature on normative studies of physical or motor fitness specially in U.S.A. Luxurious life in advance countries is responsible for the increase in

\begin{itemize}
\item \textsuperscript{11}\textsuperscript{R. Sree Devi, "Construction of Norms for A Motor Fitness Test for Secondary School Girls," (Unpublished Master's Thesis, Jiwaji University, 1984).}
\item \textsuperscript{12}\textsuperscript{Reet Mahinder Singh, "Physical Fitness Norms of Punjab State High School Boys," (Unpublished Doctoral Thesis, Panjab University, 1986).}
\item \textsuperscript{13}\textsuperscript{Ajmer Singh, "Normative Study of Physical Fitness of Panjab University Men Students," (Unpublished Doctoral Thesis, Panjab University, 1986).}
\end{itemize}
numbers of soft citizens. These citizens are unfit, causing great concern to their respective governments.

During World War II U.S.A. found that large number of its citizens were not fit enough to be recruited in their armed forces. Since then there has been a even increasing interest in adopting fitness programmes especially in school going children. Tests have been devised to evaluate physical fitness both as a diagnostic tool to identify those who are in need for vigorous programme to develop the fitness as well as motivation to their physical fitness by comparing themselves with others in their group as well as with their previous performances.

The American Association for Health Physical Education and Recreation (AAHPER) has given active leadership in promoting the concept of physical fitness in U.S.A. It has inspired similar movements in other countries and even in international sphere.

The AAHPER Youth Fitness Test\(^\text{14}\) was evolved and developed in 1957 under the chairmanship of Dr. Paul A. Hunsicker. The national norms were computed in 1958. The test became so popular that in 1965 norms were revised.

\(^\text{14}\) American Association for Health Physical Education and Recreation, "AAHPER Youth Fitness Test Manual" (Washington D.C., 1976)
This generated number of research projects in U.S.A. Performances of many states were compared to those of national norms. The performances of children of U.S.A. have been also compared with those of the children of other countries.

The AAHPER Youth Fitness Test Project^{15} was the first of its kind by the physical education profession in any country. The test consists of the following items, for both boys and girls age group 10 to 17 and college men and women as follows:

1. Pull-ups
2. Sit-ups
3. Shuttle Run
4. Standing Broad Jump
5. 50 Yards Dash
6. Softball Throw
7. 600 Yards Run-Walk.

Corrigan and Morton^{16} state that in U.S.A., Australia and other countries a staggering percentage of young men called up for national service are rejected as physically

^{15}Ibid.

unfit. These 20 year olds, who should represent the cream of the nation in general health and fitness, failed because they never took any interest in their physical education. The situation became so alarming in America that the late President John A. Kennedy appointed a committee to improve the national level of physical fitness. Mr. Kennedy personally directed the U.S. General staff officers in the Pentagon to get out from behind their desks and exercise daily - or accept demotion."

Williams\textsuperscript{17} states that, "physical fitness is essential not only in terms of general health, but also for the special physical requirements for competitive sports and certain highly specialised and demanding occupations. As a result of current work, particularly in the field of ergonomics and physical education, it is becoming increasingly obvious though, not generally appreciated that the achievement and maintenance of high levels of physical fitness produce significant efforts on the working of the human body."

Schewegler and Engle\textsuperscript{18} state that United States Military Academy Physical efficiency Test was constructed and

\begin{itemize}
\item[R.A. Schewegler and J.L. Hardt Engle, "A Test of Physical Efficiency," \textit{American Physical Education Review} Vol.29 (November 1924):102.]
\end{itemize}
developed for Military Academy. The test is designed to measure muscular strength, agility, power, co-ordination, endurance, speed and skill. The battery items included vertical jump, bar vault, dodge run, standing broad jump, sit-ups, chins, dips, softball throw, 300 yards run and rope climbing. A physical aptitude test was proposed as a basis for admission to the academy. Cadets are required to meet minimum standards. Cadets performing poorly tended to drop. This necessitated development of tests. The plan calls for the physical aptitude test to be administered with other entrance examinations. A number of events were studied and scaled and exact items in the battery varied from year to year. Typical Batteries used were: Battery I: Vertical jump, Medicine ball put, Chinning, Dodge run, Sit ups and 300 yards Shuttle run. Battery II: Standing Broad Jump, Medicine ball put, Dipping, Dodge run, Sit ups, 300 yards Shuttle run.

**Studies Related to Tests and Norms**

Schewegler and Engle\(^{19}\) of the University of Kansas, reported variation of the Sargent test. The subject jumps as many times as possible in fifteen seconds staying with in

\(^{19}\)Ibid., p. 501-505.
a two feet ring while jumping. An apparatus automatically records the height of the successive jumps on a paper record-sheet. They have found that the most satisfactory formulae for computing the physical fitness index are:

a) For College Men:

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\text{Index} = \frac{\text{The sum of jumps during 15 secs. } X}{\text{Weight}} \div \frac{\text{Height}}{\text{Weight}}
\]

b) For Junior High School Boys:

\[
\text{Index} = \frac{\text{The sum of jumps during 15 secs. } X}{\text{Weight}} \div \frac{\text{Age } X}{\text{Height}}
\]

The Education Department of United States recognised the importance of motor fitness in the total physical fitness programme. A special committee was appointed on war time physical education for high school and college to contribute to physical fitness of pupils and students as a part of the war effort. The test items for high school boys were push-ups, pull-ups, dips on parallel bars, rope climb (15 and 20 feet) bar vault, sit-ups, leg lift, forward bend, hanging half level, back twist, potato race, jump and reach, standing broad jump, running broad jump, running high jump, 100 yards dash, 800 yards dash and 440 yards dash. Standard based upon the use of the exponent plan as suggested by Cozens et al. are

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available for most items in this battery.

The Indiana Physical Fitness Test\(^{21}\) for high school boys and girls included four items to measure component of motor fitness. The test items were not time consuming. They were easy to administer. The items included staddle chins, squat thrust, push ups and vertical jump. A physical fitness score was obtained by multiplying the sum of the scores on the first three items by the score of the vertical jump. Norms were based upon classification index divisions for boys and height-weight class divisions for girls. The norms were established for each six classification groups. The groupings were determined arbitrarily from classification Index scores, computed from the best combination of age, height and weight.

A Research Committee of the National Section on Women's Athletics U.S.A. devised a Motor Fitness Test\(^{22}\) that includes 1) standing broad jump, 2) basketball throw, 3) potato race (shuttle run), 4) push-ups, 5) pull-ups, (base 42 inches) above floor, reverse grasp., (pull to chest to bar position), 6) sit-ups (feet 24 to 30 inches apart, fingers touching behind neck), 7) squat thrust (10 sec. to indicate

\(^{21}\)State of Indiana, Physical Fitness Manual for the High School Boys (Indiana: Department of Public Instruction, 1944), pp. 5-13.

agility, and 8) squat (30 sec. as a partial measure of endurance) when limiting factors do not permit to give this 8 item test, a short form consisting of standing broad jump, basketball throw, potato race, squat thrust, sit-ups and push-ups or pull-ups may be given. A sigma scale scoring-table is available along with a table of expected improvement of 4500 girls in 25 different high schools.

Corner and Cureton\(^23\) make a mention of a motor fitness test for high school girls. This test is associated with illinois tests. The test consists of two forms - a single period test of 6 items and a double period test of 12 items. The test comprise of the following paired items, foot and toe balance and dazziness recovery, trunk extension and trunk flexion, kneeling and jump and illinois agility run, sit ups and kneeling push-ups, basketball throw and standing broad jump, and squat thrust (30 seconds) and Brouha step test. Test item co-relations with the composite item score ranged from .39 to .62. Norms based on a limited sample are available.

John\(^24\) prepared National norms for the one minute basketball throw for goal, pull-ups, potato race, standing


hop-step, and jump, push up, standing broad jump and softball
target throw items of the Y.M.C.A. National athletic achieve-
ment programme. Different centres of Y.M.C.A. tested 2,000
boys in each group throughout the United States. The author
obtained five percent of the score at the Salem Y.M.C.A.
Oregon.

A physical fitness test with 19 items was conducted
by Karvener\textsuperscript{25} on Finish Secondary School children. The test
battery included balance, flexibility, agility, strength,
power and endurance. Several tests were of pass fail type.
The following major results were obtained:

1. Balance test, squat stand and dizziness recovery
were the tests that were included in the study.

2. Tests like floor touch, man lift and endurance hops
were very easy and extended press-up was found very difficult.

3. The standing broad jump showed improvement with the
age. The test battery on the whole was not satisfactory.

Leonard\textsuperscript{26} took an International Research Programme for
standardization of physical fitness test was undertaken in 1964

\textsuperscript{25}M.J. Karvener, "Physical Fitness of Finnish School
Children," International Research in Sports and Physical
Education Edt. E. Jokl and E. Simon Israel, Springfield,

\textsuperscript{26}A. Larson Leonard, "An International Research Progra-
mme for the Standardization of Physical Fitness Tests," ICHPER
Tenth International Congress Canada (July-August 1967):52.
at Tokyo by the International Council of Health, Physical Education and Recreation (ICHPER). The recommendations were discussed at the meeting held in Naglingen, Switzerland in August, 1967. The performance tests were developed in two parts; the basic combination of test items included endurance (1000 metre run-walk, 800 metre run-walk), the 50 metre sprint, pull-ups or flexed arm hang, standing broad jump and grip strength. Some additional items stated below for application under special circumstances were also included. 50 metre sprint, two minutes sit-up, repetition bench press, (25, 20 and 15 kilogram press) one minute trunk curl, vertical jump, 50 meter shuttle run, back strength and arm flexion strength.

Bitcon\textsuperscript{27} undertook a normative study for high school boys in the state of Iowa. He selected four items, used correlation technique with the AAHPER Youth Fitness Test and established validity and reliability. The four item test and the AAHPER Youth Fitness Test were conducted on eighty-four high school boys. The degree of relationship between the two tests was found by computing and correlating the composite scores. The reliability of the four item test was determined by test-retest technique. The co-efficient of co-relation

\textsuperscript{27}Lawrence Eugene Bitcon, "Validation of A Four Item Physical Fitness Test and Norms for High School Boys in the State of Iowa," Dissertation Abstracts International 26:7 (January 1966):3741-42.
between the AAHPER Physical Fitness Test and composite score, and between the test-retest composite scores of the four item test were 0.934 and 0.961 respectively. Percentile norms were constructed for each of the items and composite scores.

David\textsuperscript{28} prepared percentile norm tables for selected measures of strength, power, agility, flexibility, body composition, and cardio-vascular and muscular endurance from data collected in five schools of the Unity Christian School System at Hudsonville.

John\textsuperscript{29} conducted a study for testing physical proficiency of the USAF Academy. Two hundred randomly sampled subjects were given twice the USAF Physical Fitness Test (PFT) and USAF Academy's Candidate Physical Aptitude Examination (PAE). The variability of the test items was analysed by the inter class co-relation technique. The reliabilities of the test retest were determined by the zero-order co-relation technique. Walter concluded that:

1. In multi-trial test items of PAE and PFT, the average score of the appropriate trial appeared more proper method than the best score.

\textsuperscript{28}L. Boss David, "Physical Ability Testing of Male Students in Grades Four through Twelve," Completed Research in Health Physical Education and Recreation Vol.7 (1967):77.

2. The PAE, PFT and 1.5 mile test were reliable and valid.

Barrow and McGee\(^{30}\) have reported that Glover constructed a physical fitness test battery for primary grade children. The items were: 1. standing broad jump (to measure power and leg strength), 2. shuttle run (to measure leg strength, speed and endurance), 3. seal crawl (to measure arm and shoulder girdle strength, endurance and speed), 4. sit-ups (to measure abdominal strength, endurance and speed). The test was meant for measuring essential components of motor qualities. The norms were prepared for four items and were also used for classifying the children into ability groups by assessing the physical fitness.

A motor fitness test battery was constructed by Patrick\(^{31}\) for girls in lower elementary grades. The following items were included in this test. Clarke's strength composite, McCloy's endurance ratio, leg extension and flexion, Well's sit and reach, dodging run, bass length wire stick balance, and


vertical jump. The test measured the essential components
of motor fitness such as muscular strength, muscular endurance
cardio-vascular endurance, flexibility, agility, balance and
power.

Shore\textsuperscript{32} constructed a motor fitness test battery with
thirty test items for lower classes of elementary school boys.
Two test batteries with seven items each were developed on
the basis of the rotated factor loading of the test items.
The test battery one consisted of highest loaded test items
for each factor: 1. Clarke's strength composite, 2 McCloy's
endurance rate 3. Well's sit and reach 4. Bass balance on
stick, 5. Leg flexion and extension flexibility, 6. Arm flexion
or the back flexibility, 7. Modified push-ups. The test battery
two consisted of more feasible test items: 1. Grip strength,
2. 300 Yard run, 3. Well's sit and reach, 4. Bass balance on
stick lengthwise, 5. Leg flexion and extension flexibility,
6. Arm flexion or the back flexibility, and 7. Modified push-
ups.

Alexander\textsuperscript{33} determined the factors contributing to
motor performance. He administered 34 variables on male and
female subjects numbering 220. There were six factors in male

\textsuperscript{32} John Roger Shore, "The Construction of a Motor Fit-
ness Test Battery for Boys in The Lower Elementary Grades," Dis-

\textsuperscript{33} Rex Eugene Alexander, "Difference in Factor Patterns
in Tests of Physical Fitness, Motor Ability, and Skill of Men
and Women Physical Education Majors," Dissertation Abstract
group namely: leg strength and speed, arm and shoulder girdle strength and endurance, explosive strength, basketball skill, muscular strength and endurance, and grip strength. In female group, the factors were: muscular endurance and agility, leg power, explosive strength, balance, and static strength of arms.

Bissonnette\textsuperscript{34} administered a twentyfour item test on 112 seven and eight year and 117 eleven and twelve year old boys and identified the nature of physical fitness of elementary school boys through factor analysis. The data collected was co-related and the variance criterion for Rotation was used to maximize 3 loadings on each factor. Five similar physical fitness factors namely body fat, body dimensions static strength, hip flexibility, recovery pulse, and muscular endurance were identified for all ages.

A physical fitness norm for South African boys was prepared. Their physical fitness level was compared with Canadian boys by Andrews.\textsuperscript{35} He administered AAHPER physical


fitness battery (1966). The mean scores of the South African and Canadian boys were compared. The South African boys performed better than Canadian boys significantly.

Barbanti prepared physical fitness norms for Brazilian school children and compared the same with the norms of American boys and girls. The test items conducted on 2,342 were: sit and reach test, modified sit up test, nine minutes run, twelve minutes run, 50 metre dash and standing long jump. American boys and girls were taller, heavier, and with higher scores in sit and reach test, modified sit ups test, 50 meter dash test and standing long jump test. On the other hand Brazilian children scored higher on the nine minute run test than American children.

Robins conducted a normative study for Alabama students in 1-9. 2,545, 6-14 years old boys and girls were given AAHPER Youth Fitness Test (YFT) and AAHPERD Health Related Fitness Test (HRFT). Percentile tables were constructed for each item based on age and sex. Alabama and national means were compared. Alabama students scored better on events


measuring agility, speed, and cardio-vascular endurance but the national score in abdominal muscular endurance and flexibility was better.

Studies Related to Age, Height, Weight and Sex

Glassow and Krause\textsuperscript{38} conducted a study on motor performance for 6 to 14 year girls. The group achievement scores for elementary school girls for the 30 yards run, the standing broad jump and the over arm throw were presented to add to the limited information available on children. Reliabilities of with in day scores were reported. The co-relation of year to year scores and of the first grade scores with those of grades three through five showed that individual girl tends to remain in the same relative position with in the group during the elementary school years.

Groes and Casciani\textsuperscript{39} conducted a study on the value of age, height and weight as a classification device for

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\textsuperscript{39}Elmer A. Groes and Jerome A. Casciani, "The Value of Age, Height and Weight as a Classification Device for Secondary School Students in the Seven AAHPER Youth Tests," \textit{Research Quarterly} 31:1 (March 1962):51.
\end{flushright}
secondary school students. They concluded that age, height and weight have negligible value for classification purposes for the battery as a whole. Classification indexes are to be calculated.

Shondell\textsuperscript{40} established the relationship of selected motor performance and anthropometric traits to successful volleyball performers.

Haley\textsuperscript{41} studied the effect of age on physical performance of elementary school boys in grades one through six. Thirty subjects were randomly selected from each class. The age of subjects ranged from 5 year 9 months to 12 year 2 months. Twelve tests were conducted to judge the motor performances of subjects. The study showed that 1) motor performance score increased with age and 2) flexibility tended to decrease with age.

Moris et al.\textsuperscript{42} studied age and sex difference in motor performance of 3 through 6 years old children. Seven motor

\begin{itemize}
\item \textsuperscript{40}Donald Stuart Shondell, "The Relationship of Selected Motor Performance and Anthropometric Measurement to Successful Volleyball Performance," Dissertation Abstracts International 32 (March 1972):5026-A.
\item \textsuperscript{42}Arlene M. Morris et al., "Age and Sex Differences in Motor Performance of 3 through 6 Year Old Children," Research Quarterly 53:3 (September 1982):214-221.
\end{itemize}
test items were administered and the Scheffe's post hoc analysis procedure was employed to test all the possible mean difference where significant ANOVA, F ratio were obtained. Significant age and sex difference were found on most of the tests. However, age generally influenced the performance more than gender. The performances of 3 and 4 years of boys were similar except in balance test. The differences in performances of girls were more significant from year to year.

Studies Related to Socio-Economic and Rural Urban Factors

Paradis and Berger\textsuperscript{43} compared the physical fitness scores of white and black seventh grade boys of similar socio-economic levels. They reported that black male students of similar socio-economic levels when compared with white students had higher levels of physical fitness.

Pontheux and Barker\textsuperscript{44} established the relationship between socio-economic status and AAHPER Physical Fitness

\textsuperscript{43}Robert L. Paradis and Richard A. Berger, "Comparison of Physical Fitness Scores of White and Black Seventh Grade Boys of Similar Socio-Economic Levels," Research Quarterly 40 (December 1964):590.

\textsuperscript{44}N.A. Pontheux and D.G. Barker, "Relationship Between Socio-economic Status and Physical Fitness Measures," Research Quarterly 4:4 (December 1965):464-467.
scores. They conducted necessary tests on 329 girls and 304 boys of age 10, 11 and 12. Significant relationships were found. However, they did not favour any one status group in all the components of fitness. There were indications that lower status girls were faster, better co-ordinated, and had more endurance. The upper status girls were stronger in arm and shoulder girdle strength, abdominal and hip flexor muscles, and muscular explosiveness. The lower status boys were faster and better co-ordinated and the higher status boys scored better in combined agility, speed and strength of abdominal and hip flexor muscles.

The physical fitness of urban and rural boys was compared by Herman. He found urban boys superior to rural boys. The difference was significant at the .01 level.

Jasper studied the relationship of socio-economic status and physical fitness. Sixteen girls of grade six each from families having annual income below dollar 5000, from dollar 5000 to dollar 9999 and above dollar 10,000 were used


as subjects. The girls were tested in flexed arm hang, sit-ups, squat thrust, standing broad jump and 200 yard run. Analysis of variance showed no significant difference among three groups.

Ross\(^{47}\) in his study of 'selected life experience and social factors as related to choice of leisure activities' selected thirteen social factors and concluded that students' family income and education of their fathers were two strong influences on the rate of participation of the students in recreational activities.

Cole\(^{48}\) found that an individual's socio-economic status does not lead to the prediction of his attitude towards physical education activities and his gross motor performance ability.

Thomas\(^{49}\) studied the relationship, if any between physical fitness level of seven and eight grade girls. The

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parameters included aspects of intellectual qualities, academic performance, co-curricular participation and occupation status of the subjects. The study did not show any significant influence of socio-economic status on the physical fitness.

Davis\textsuperscript{50} identified the physical fitness level and socio-economic level of each child and determined their relationship. He also found factors of each socio-economic and physical fitness level contributing to the child's physical fitness. He concluded that social level does not contribute to the total physical fitness.

Lashley\textsuperscript{51} undertook a comparative study of Negro and Caucasian boys on the factors of personality, socio-economic status, and physical fitness. He found some significant relationship between the personality characteristics and the levels of physical fitness. He also found some significant relationship between the socio-economic status and the levels of physical fitness. He further concludes:

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1. Negro junior high school boys are significantly better in pull-ups than Caucasian junior high school boys.

2. Caucasian junior high school boys have a significantly higher socio-economic status than do Negro junior high school boys.

3. Negro junior high school boys are significantly better in sit-ups than the Caucasian junior high school boys.

4. Caucasian junior high school boys are significantly better in 600 yard run-walk than Negro junior high school boys.

5. There is no significant difference between the two groups on the shuttle run, standing broad jump, fifty yard dash, and the softball throw.

Gruneau\textsuperscript{52} in his "sports social inequalities and ideology" included 184 British male olympic athletes. He found that professional and high status occupants were strikingly over represented.

Williams\textsuperscript{53} studied the relationship between race and social-economic status to the early development of motor


ability in elementary school children. The subjects were given the Georgia Adaptation Children Physical Development Scale. The study showed a significant difference between blacks and whites, and their socio-economic status levels. Further analysis of data showed that the motor ability scores in blacks increased with the increase of level of socio-economic status. However, when socio-economic levels were compared on motor performance with regard to race, non-significant difference was observed.

Using AAHPER Youth Fitness Test Toddonico\(^5\) studied physical fitness of public school students from economically backward areas with national norms. He also did comparative study of the physical fitness of public school students from the high poverty and low poverty areas. The findings revealed that there was no difference in the physical fitness of boys or girls from the economically deprived areas and boys and girls represented by the 1975 national norms. Again, there was no difference in physical fitness of subjects from high poverty areas and low poverty areas.

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Related Comparative Studies

Anna \(^{55}\) found that the children who failed in one or more items on Kraus Webber Test, scores more poorly in running, jumping, throwing, and sit-ups than those who got through all the items.

Fahrner \(^{56}\) compared physical fitness and academic achievement and saw little or no relationship between physical fitness and academic and intelligent quotient.

Knuttgen \(^{57}\) compared Danish children with Americans and concluded that the scores of seventy percent Danish boys and eightysix percent Danish girls exceeded that of American mean score respectively.

Arright conducted physical fitness test on varsity female players immediately after competitive season. He found

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\(^{56}\) Carl J. Fahrner, "A Comparison of Physical Fitness with the out of School Fitness Activity Academic Achievement and Intelligent Quotient of High School Students," Completed Research in Health, Physical Education and Recreation 11 (1960):33.


significant improvement in all the items except arm and grip strength. However, controlled groups also gave similar results.

Carl\textsuperscript{59} compared physical fitness norms of children of Delaware with the National norms. He found that between 25th and 75th centiles, the Delaware norms were equal or higher than the National norms. However, Delaware norms tended to be higher on the 50th and 100th centiles except for shuttle run.

Alston\textsuperscript{60} studied the performance of high school girls on the Virginia Physical Fitness Test, AAHPER Youth Physical Fitness Test and North Caroline Physical Fitness Test. The co-relation was .89 and .80 between the Virginia and the AAHPER Tests and AAHPER Test and the North Caroline Test respectively.

Using AAHPER Youth Fitness Tests, Hunsicker and Reiff\textsuperscript{61} compared the physical fitness of American boys and girls of the years 1965 and 1958. They found that level of physical fitness of 1965 boys and girls was higher than that of 1958.

\textsuperscript{59}Bolcock F. Carl, "Physical Fitness of Delaware Boys and Girls in Grades Five through Twelve," Completed Research IN Health, Physical Education and Recreation 6 (1964):60.


Rasmussen\textsuperscript{62} compared the fitness level of South Dakorta Boys of all the ages with that of National sample. He found that the median score of South Dakorta Boys was higher than the national score in all items except pull-ups and shuttle run.

A study on the relationship between the physical performance and academic achievements was conducted by Roger.\textsuperscript{63} He found no established relationship between the two.

Chapelle\textsuperscript{64} conducted a study to determine the inter-relationship between selected physical variables and academic achievement. He did not find high relationship between the two. However, he suggested that greater health and vitality aid-students in achieving academic potential.

Breg\textsuperscript{65} compared academic achievement and participation in intramural activities. He found significant difference in


favour of participants in intra-mural activities over non-
participants.

Burhman\textsuperscript{66} conducted a study on the relationship between
athletic participation and academic achievements. He found
that experienced athletes participating for many seasons and
years were academically better than the athletes participating
for a few seasons.

Heart\textsuperscript{67} studied the relationship between Physical
Fitness Tests Scores, Intelligence Quotients, and Grade Point
Averages for selected High School students. He found an $r$ of
43 between physical fitness and academic performances but the
$r$ was not significant.

Robinson\textsuperscript{68} studied the relationship between Physical
Fitness, Scholastic Achievement and Sports Participation among

\textsuperscript{66}Hans G. Buhrman, "Longitudinal Study of the Rela-
tionship between Athletic Participation, Various Social,
Psychological Variables and Academic Achievements of Junior
High School Boys," Completed Research in Health, Physical

\textsuperscript{67}Edward D. Heart, "Relationship Between Physical
Fitness Tests Scores, Intelligence Quotients and Grade Point
Averages for Selected High School Students," Completed Research

\textsuperscript{68}Marlene Ann Robinson, "The Relationship between
Physical Fitness, Scholastic Achievement and Sport Participa-
tion among Secondary School Girls," Completed Research in
Secondary School Girls. He found a significant relationship between all the variables but an r between scholastic achievement and participation in intra-murals.

Hollingsworth\textsuperscript{69} undertook a comparative study of Motor Ability of Mentally Retarded Children of Specific Mental and Chronological Age and Normal Children. He concluded that:

1. When tested according to chronological age, mentally retarded children were found intellectually lower than the normal children.

2. When tested according to mental age, the mentally retarded children were found significantly superior to the intellectually normal children.

Dowell, Landiss and Mamaliga\textsuperscript{70} conducted a study on A Twenty-years study of the Physical Fitness of Entering Freshmen at Texes A and M University. They concluded that the


performance in sit-ups measuring muscular endurance had improved over the past twenty years. Arm strength also got increased from 1948 to 1963 but decreased from 1963 onward. The running speed and agility did not show any definite trend.

Dahl\(^{71}\) studied the Relationship of Selected Factors and Physical Fitness of White and Negro Students at Two Different Levels. He administered sit-ups, standing broad jump and soft ball throw of AAHPER Youth Fitness Test on grade fifth, fifth-sixth, and ninth-tenth grade White and Negro boys. He found scores of Negro boys significantly higher than that of White boys at both levels.

Wilson\(^{72}\) studied the effects of Individualised Instruction in Physical Education upon Physical Fitness, Motor Ability and Physical Education knowledge. He found superiority of individualised instruction over non individualised instruction.


White\textsuperscript{73} studied the Inter-relationship between Measures of Physical Fitness and Measures of Self concept of Male Students. He included strength flexibility and cardio-vascular respiratory endurance as measures of physical fitness and certain factors of self concept measured by the Tennessee Self-Control Scale. He found a significant relationship between various physical fitness measures and certain factors of self concept.

Young\textsuperscript{74} compared the effect of two different programmes; an experimental porogramme of physical education and the present curriculum of physical education for physical fitness. He included five test items namely 1.5 mile run, 440 yards run, sit-ups, push-ups, and sit and reach test. Young concluded that there was no significant difference between the two types of physical education programmes.

Shrida\textsuperscript{75} undertook a comparative study of physical fitness of Iraqi and American children aged 10-17 years.

\textsuperscript{73} Alan Jones White, "The Inter-relationships Between Measures of Physical Fitness and Measures of Self Concept of Selected Mississippi State University Male Students," Dissertation Abstracts International 34:8 (February 1974):4849.


Smith and Miller\textsuperscript{76} studied the effect of Head Positions (up or down) on Sit and Reach Performance. They found the difference quite small and did not recommend any particular head position.

\textbf{Studies Related to Validity and Reliability of Different Tests or Test Items}

Ismail and Cowell\textsuperscript{77} conducted a study on the Purdue Motor Fitness Batteries and Development to Profile for Pre-Adolescent Boys. They devised four batteries for ten to twelve years boys. The regression equation for battery one were 3.319, standing broad jump + softball throw (distance) 15.371, chins + 188.640. The validity for battery one was 817 and for other batteries it ranged from .876 to .904.

Miller\textsuperscript{78} determined the validity of 300 yards run as a measure of endurance. He conducted 300 yard run on the gymnasium floor and a quarter mile track. He corelated both


tests with 12 minutes run-walk test and Howard Step Test and established 300 yard run as a valid measure of endurance. The surface of the test did not influence the value of the test.

Burke⁷⁹ determined the validity of selected Field Tests to measure the physical working capacity. He conducted ten lab tests and seven field tests and found that 600 yard run, one mile run, and 12 minutes run were valid for measuring aerobic capacity. He also validated 10 yard run, 50 yard run and 50 yard drop-off tests as measures of anaerobic working capacity.

⁸⁰ Doreelak validated four, eight and twelve minutes running tests in estimating Aerobic Power of college women. The distances covered in these three tests were co-related with maximal oxygen consumption. The correlation between max VO₂ and three tests were .867, .87, and .89 in four, eight and 12 minutes run tests respectively.


Massicotte and Markon\(^8\) conducted a research on Prediction of VO\(_2\) max from the running performance in children. They selected 1600 meters run for 10-12 year children and 2400 meters run for 13 to 17 year children. The bicycle ergometer was used to measure the VO\(_2\) max. The co-relations between the time taken to finish the run tests and the VO\(_2\) max varied from 0.62 and 0.84 for different groups. In 1600 meters run, the co-relation for both the sexes were similar but in 2400 meters, the value for girls was higher.