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A Study on Physical Fitness Profile of Hammer Throwers

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Abstract – A throw is accomplished by performing a series of winds, an entry into the turns, followed by three to four turns, ending in the release of the implement. Athletes alternate between single and double foot support as they move through the turns of the throw. Errors in any of the four components negatively affects the distance the implement is thrown. Proper technique is crucial to each throw. This depends upon some qualities i.e. speed, quickness of legs and co-ordination combined with a gymnastic type application of power are the major qualities vital to this event.

The technique used in the shot put today is aimed at increasing speed by using complimentary rotation and translation across the ring to move the implement forward at a high rate. Understanding the physical characteristic of hammer thrower, technique and implement modifications helped to improve distances. Too tall persons do not fit in this event because of the problem of speed and coordination. An average hammer throwers in the international class may possess a weight about 100 kg and plus but height should be about 190 cm. The important characteristics of hammer throwers are the hips and shoulders, length of the arms. Height and long arms help make for a longer effective radius. Bear in mind that centrifugal force is a function of turning speed and the hammer radius; a shorter thrower will have to turn fast than taller.

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INTRODUCTION:-

The hammer throw is said to have its roots in Scotland and Ireland history. People are familiar with the Scottish Highland Games, where events like the sheaf toss, weight throw for distance, and tossing the caber are the events and highlight the strength and power of the participants. Another competition at these games finds men throwing the working sledge hammer or long hammer. The long hammer is a metal ball attached to a 3/8" x 4 foot long wooden handle. The predecessor to this implement was a quarry rock attached to varying lengths of wooden handles. Organizers eventually made a standard for the length of the hammer handle. The event evolved and split into two different forms: the working sledge hammer throw and the modern hammer. Both forms continue today.

Science tells us there are specific factors helping determine success in any event. These factors are anthropometric and physical fitness qualities occurring in the right combinations for the athlete. Also, it is dangerous heavier to increase loading until the growth points or epiphyses of the long bones have closed growth has ended. This occurs at approximately 16-18 years. The optimum age for learning the skills and developing speed is between 8-13 years. The loading they are expected to lift are kept to less than 60% of maximum. Such lifting stimulates both skeletal and muscular growth.

Hammer throwers need to be strong like the shot putters; however they must be quick and technically sound due to the complexity of the event. Distinct anthropometrics differences occur between the sexes throwing the hammer. The differences in mass and size between the sexes has a distinct relationship on hammer throw technique. The time for overall throw, distance throw and time for each individual turn are variables anthropometric differences will affect. Men being larger and throwing a heavier implement have to overcome larger amounts of inertia, centripetal and centrifugal forces to achieve throw success. Men throw an implement weighing 7.26 kg. Women throw an implement weighing 3.26 kg. less than the men. The difference in implement weight does factor into the amount of force needed to overcome inertia and to balance against the centripetal forces. The men have greater differences in time for each individual turn as they progress through the throw. Due to larger amounts of inertia, men begin slowly and increase their speed at a greater rate than women early in the throw. Men turn more rapidly during the last two turns than women.

Another anthropometric characteristic is the location of the center of mass. Center of mass location for the

thrower is different between the sexes due to differences in weight and mass distribution. Smaller body mass and a lighter implement take women less energy to develop the counter against the forces acting upon them. Men sit lower to counter the greater forces placed upon the system. The three determining factors of throw success are the velocity, height and angle at release. The most important factor is velocity at release. Men typically are capable of generating more force. This allows males to increase velocity to higher levels than females. In the hammer, the ability to maintain ground contact with both feet for as long as possible will enhance the acceleration of the ball.

NEED OF THE STUDY:

Hammer throwing is an exciting, challenging and fitness demanding event in the athletics. The performance standard of Indian men hammer throwers stayed around 65 ± 5 meter , while the international performance standard is around 84 meter. So to fill this gap, there is a need of diagnosis of the conditions under. But unfortunately in India, no study has been done in this regard. Therefore, the present investigation is conducted. This present study is done to know morphological characteristics and physical fitness level of men and women hammer throwers in India.

REVIEW OF RELATED LITERATURE:

The quest to enhance physical performance has led to very specific and multifaceted modes of training. The primary purpose of this investigation is to evaluate the level of different fitness components in relation to performance of Indian hammer throwers. The importance of knowing more about the athletes and their athletic potential implies an organized, systematic and consistent evaluation. All evaluation procedure and means of testing should aim at objectively quantifying the athlete's evolution, stagnation or eventual performance deterioration.

Every event comprises of its own particular characteristics. These characteristics determine the structure of performance. Performance structure is the physical physiological mechanical and psychic structure of the motor action or actions done during the competition. Depending on the nature of sport qualitative and quantitative values of different selected parameters of this multi-dimensional process are recorded and measured in order to get an idea of this process.

Sports performance depends on particular performance prerequisites and their harmonious relationship. These are personality, condition technique/coordination, tactics and constitutions condition i.e. physical fitness consists of strength speed, endurance and their complex forms is their main object of this study and analysis. Therefore, in the present study , the attention is given to the physical fitness prerequisites needed for good performance in hammer throw and training for the development of their prerequisites, their tests, test norms and studies related morphological characteristics of hammer throwers.

RESEARCH METHODOLOGY:

In the present study an attempt has been made to study the Physical fitness and morphological characteristics of hammer throwers in India. In this study, the selection of sample, selections of variable, reliability of the data have been described.

a) Sample:

For the study, a total number of 60 male and 30 female hammer thrower from the different places of India during the course of various coaching camps, training sessions; they were attending in connection with the national and international competitions were selected as subjects for the study.

In the study, the performance data of each subject in all tests was obtained as a part of the Hammer throw training programme. However it was not possible to conduct the tests of all the subjects at the period same time.

The data collected on all throwers were grouped into two group men and women Hammer throwers. Major groups were further divided into sub groups, 5 groups each, such as 40m-45m, 45m-50m, 50m-55m, 55m-60m and 60m-65m for men and 30m-35m……50m-55m for women category.

b) Selection Of Variable:

The investigator thoroughly went through scientific literature related to hammer throwers that was available from books, magazines, journals and periodicals. Keeping in view the relevance of the variables to hammer throw performance and feasibility criteria, the variables were selected for the study.

c) Reliability Of The Data:

All the hammer throwers taken in the present study on the present performance with the standard implement of both men and women. The performance in hammer throws of the subjects ranged between 40m to 65m for men and 30m to 55m for women. The sample selected for the study was considered appropriate as per the purpose of the investigation.

d) Collection Of Data:

The throwers were tested carefully arranging the tests and other training requirements in rotation on separate days. The investigator tried his best to conduct the tests for all the subjects, under similar

and standard conditions; the tests were grouped and arranged in a sequence, which formed an integral part of training. The tests were planned as an integral part of the training in consultation with the coaches. The tests pertaining to barbell exercises were conducted during morning hours from 7.00 AM onwards. All the other tests such as throwing, jumping and spiriting were conducted in one session. The technical assistance of the qualified coaches and fellow master students were taken for the administration of the tests.

All the equipment needed for the tests were checked and counter checked to ensure accuracy and standardization. The shots with specific weights were weighted on standard weighing machine and were specially marked for the purpose of conducting the tests. A steel tape was used for the measurement of distances. Battery operated digital watches for the accuracy of 1/100th of was used in order to record the time. Standard barbell sets from the respective department's weight-training hall were utilized for the maximum strength and power tests.

DATA ANALYSIS

The present study have been analyzed with the help of Mean, SD, SEM and the comparison between the groups was done with the help of t-ratios. In the present study, analysis and interpretation of the data and result obtained through the application of statistic of analysis are presented.

On the basis of t test applied the finding of the study concluded that hammer throwers show a significant different in possessing the speed & agility, power, strength, flexibility and endurance. The medalist weight lifter were found significantly possessing higher degree of speed ability, agility ability, power ability, flexibility ability and endurance ability, as compare to non-medalist weight lifter.

Keeping in view the research criteria of availability, reliability and validity the following tools were used to collect the data. The selected physical fitness components speed, strength, endurance, flexibility were measured by different means and method. Speed and agility were measured by zigzag run test, power were measured by standing broad jump test, strength measured by eight pounds shot-put test, flexibility measured by bend & reach test and endurance was measured.

Muscle samples were obtained with suction from the middle portion of vastus lateralis of the right leg, 20 cm from mid patella. Samples were aligned, placed in embedding compound and frozen in isopentane, which was pre-cooled to its freezing point. All samples were kept in liquid nitrogen until the day of analysis. Serial cross-sections, 10 m thick, were cut at -20^{o}C and stained for myofibrillar AT Pase after pre-incubation at pH 4.3, 4.6 and 10.3. Samples from all athletes were incubated at the same time in the same jar for each specific pH. A mean of 679 ± 68 muscle fibres were classified as type I, IIA, or IIX, from each sample. The cross sectional area (CSA) of all the classified fibres from each sample was measured with an image analysis system (ImagePro, Media Cybernetics Inc, Silver Spring, MD, USA) at a known and calibrated magnification. Furthermore, the lesser diameter (e.g. "the maximum diameter across the lesser aspect of the muscle fibre", Dubowitz and Sewry, 2006) was measured for all the classified fibres. The ICCs for the percentage of type I, IIA and IIX fibres in our laboratory is R = 0.96, R = 0.95, R = 0.93, respectively. This was calculated in 14 muscle biopsies by analyzing the percentage distribution of different fibre types in two distinct micro-images of the same biopsy, each containing at least 200 fibres.

Hammer throwing performance was significantly correlated with backward overhead shot throw ($r = 0.95$, $p < 0.01$) as well as with total body ($r = 0.81$, $p < 0.05$), leg ($r = 0.84$, $p < 0.05$) and trunk ($r = 0.85$, $p < 0.05$) lean body mass. In contrast, low and non-significant correlations were found between hammer throwing performance and body fat ($r = 0.14$, ns), bone mineral density ($r = 0.17$, ns) and body weight ($r = 0.35$, ns). In addition, hammer throwing performance was significantly correlated with the CSA of type I muscle fibres ($r = 0.93$, $p < 0.01$) type IIA muscle fibres ($r = 0.96$, $p < 0.01$), and type IIX muscle fibres ($r = 0.90$, $p < 0.01$). In contrast, the correlation between hammer throwing performance and fibre type composition was low and nonsignificant ($r = 0.41$, ns).

HYPOTHESES:

The study has been conducted with the following hypothesis:

1. There will be significant differences in Physical Fitness profile of men and women Hammer throwers at different level of performance.

2. There will be significant differences in body morphology of men and women hammer throwers.

3. There will be significant differences in body Morphology of men Hammer throwers with the standards based on Olympic game athletes criteria.

4. There will be differences in Physical Fitness profile at different levels of performance of Indian men and women hammer throwers with norms.

OBJECTIVES OF THE STUDY:

Present study has been conducted with the following objectives:

1. To find out the significant differences in Physical Fitness profile of men and women Hammer throwers at different level of performance.

2. To access the significant differences in body morphology of men and women hammer throwers.

3. To explore the significant differences in body Morphology of men Hammer throwers with the standards.

4. To find out the differences in Physical Fitness profile at different levels of performance of Indian men and women hammer throwers with norms.

DEFINITION AND TECHNICAL TERMS:

1. PHYSICAL FITNESS PROFILE:

It refers to the athlete's status on those components which are essential for efficient functioning in the psycho-motor domain. These components are performance oriented and are dependent upon functioning of different system of the body in an integrated manner.

MOTOR ABILITY:

Motor ability indicates the present athletic ability and is denoted as the immediate state of the individual to perform a wide range of motor skill.

2. Angle Of The Hammer At Release:

The angle of trajectory the hammer head is following at the time of release relative to horizontal.

3. Height of the Hammer at Release.

The height the hammer head is from the ground at the time of release.

4. Speed:

Speed is the capacity of moving a limb or part of the body's system or the whole body with the greatest possible velocity.

5. Maximum Strength:

It is the ability to overcome or act against maximum resistance. It is measured by finding out maximum resistance which can be overcome or maximum force which can be applied by the muscles.

6. Explosive Power:

Explosive power is an action where maximum muscular force is released at maximum speed. It is also said to an Elastic strength.

7. Reactive Power:

It is the ability to release maximum force with the body weight in the fastest possible time. It is also known as all body power.

8. Low Load Speed Strength:

It is defined as the ability to overcome the resistance in minimum possible time with low load.

9. Heavy Load Speed Strength:

It is defined as the ability to overcome the resistance in minimum possible time with heavy/high load.

SIGNIFICANCE OF THE STUDY:

This study will lead to important training guidelines for improving the performance of Indian Hammer Throwers. It will be helpful for selecting Hammer Throwers at early ages. The results study will be helpful for guideline and counseling about the body Morphology and physical fitness of hammer throwers. The study will be helpful for talent identification of novice throwers. Conclusions may be helpful to the coaches to identify the training selected changes. Results of present study may serve as yard sticks for other hammer throwers to have to same morphological characteristics of physical fitness tests.

FINDINGS:

The findings of the study are discussed under the following headings:

- Physical fitness tests
- Morphological characteristics

PHYSICAL FITNESS TESTS:

The following findings were arrived of physical fitness tests from the result of the study:-

1. There was found significant differences among the present hammer thrower on bench press test.

2. While comparing the mean value of bench press of all the male groups, it was noticed that only low performance group was better

with the norms based on Olympic game athletes criteria

3. It has also been observed that women hammer throwers differ significantly as the F-ratio was significant at 1% level.

MORPHOLOGICAL CHARACTERISTICS:

The following findings of morphological characteristic were arrived at from the results of the study:

1. It is concluded that F-ratio of ANOVA for age has been found significant differences among all the five groups of men hammer throwers.

2. On compared with Olympic counterpart, the present Indian men Hammer throwers were found younger and student t - value was found significant between Indian and Olympic throwers.

3. In women hammer throwers, F- ratio was found significant among five groups.

4. Indian women hammer throwers were found in the same age range as shown by the different Olympic throwers and t- value was found non-significant between Indian and Olympic women throwers.

RESULTS:

1. Results pertaining to physical fitness tests for men and women hammer throwers.

2. Results pertaining to morphological characteristics for men and women hammer throwers.

3. Results pertaining to significant difference between morphological characteristics of present hammer throwers with standards of Olympic throwers.

4. Results pertaining to difference between physical fitness tests for men and women hammer throwers and norms.

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