

ORIGINAL ARTICLE



The Effect of Using Vibration Training on Some Physical and Skill Variables in Basketball Players

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Submitted 11 May 2022; Accepted in final form 21 July 2022.

ABSTRACT

Background. Basketball has become one of the most popular sports in the world because it is an intermittent team sport with frequent transitions between activities performed at low, medium, and high intensity. **Objectives.** The aim of this research was to identify the effects of vibration training on certain physical and skill variables of basketball players at King Faisal University. **Methods.** The researchers used the experimental method on a sample of 20 basketball players from King Faisal University. All of them were male volunteers. They were randomly divided into two groups, one experimental and the other controlling, consisting of 12 players. In the research variables, the proposed vibration training program was applied for ten weeks at the rate of three weekly training units for 30 - 45 minutes in each training unit of the group experimental, excluding the control. The group, who trained traditionally. The follow-up measurement was performed in the control and experimental groups in the same type of cardiac measurement. **Results.** The most important results were that the proposed training program positively influenced the physical variables and skill variables, where the percentage of the physical variables ranged between (5% to 42%) and an improvement in the skill variables under study, where the percentage ranged between (21% to 81%). In the percentage of improvement between the experimental and control group in the physical and skill variables under study, where the differences in the percentage of improvement of the physical variables ranged between (3% to 27%) and improvement in the skill variables under research, where the percentage ranged between (9% to 36%) in favor of the experimental group ($p < 0.001$). **Conclusion.** The researchers concluded from the findings that vibration training should be included in the players' training program components as a basis for developing fitness and basketball skills, as it has positive effects on fitness and performance.

KEYWORDS: *Vibration Training, Basketball, Physical Variables, Skill Variables.*

INTRODUCTION

Basketball has grown over the years to become one of the most popular sports in the world. One can find a basketball hoop in the backyards of homes and schools in every continent and every corner of the world. History was made on a cold early December day in 1891, when Canadian James Naismith, a physical education professor at the (YMCA) Training School. Over the years, basketball has emerged as one of the most

demanding team sports regarding the variable skills involved and physical demands (1). Basketball is an intermittent team sport with frequent transitions between activities performed at low, moderate, and high intensities. Movements completed during basketball gameplay differ in the structure, intensity, distance, frequency, and duration at which they are performed. In particular, pronounced changes

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in movements occur when transitioning between defense and offence. Furthermore, the given movement patterns during basketball gameplay are punctuated with multidirectional running and shuffling bouts, intertwined with frequent jumps occurring almost every minute, which is more frequent than most other team sports (2).

The use of vibrating training dates back to the second half of the last century, the Russians used it in spacecraft as a desire to maintain muscle strength and reduce the side effects of being in spacecraft by exposing the whole body to mechanical vibration during exercise in static or dynamic conditions, as an alternative way to improve the physical performance of healthy individuals. It has been observed that there is a development in strength and the ability to jump and sprint, in addition to improving balance and motor stability in healthy individuals (3). This type of training has become popular in many sports and rehabilitation fields to obtain adaptation, rehabilitation, and general health. It is suggested that vibratory training is a guide to resistance training to develop muscular strength of skeletal muscles (4), while the other indicates forces subjected to relatively little vibration do not show any physiological changes from muscle stimulation (5). Some studies suggested that vibrating training (energy board) stimulates sensory muscle receptors, increasing muscle contraction strength and the stability of tendons, improving balance and dynamic muscle work between the working muscles and the corresponding muscles (4, 6, 7). While another mentioned that Vibrational training has an effective effect on both the blood circulation and the lymphatic cells because the vibration includes the processes of contraction and relaxation within the muscle fibers, which helps to increase the blood supply within the muscles, which ensures positive effects on the nerve endings located in the muscles (8). While the results of some other studies indicated that vibration training works to develop the ability to run, jump power, and perform agility exercises, in addition to many functional improvements, especially in the locomotor system of athletes in football, basketball, Ice skating, and volleyball, which leads to more effective motor transfer when performing motor skills in these various sports (3, 4, 9-11). Annino et al. confirmed that vibration training had positive effects on ballet dancers' explosive strength of the knee extensor muscles

(3). Through the analysis of basketball matches, it becomes clear that it is a sport that requires many physical and skill capabilities that a basketball player must possess. These components include aerobic endurance, anaerobic endurance, muscular endurance, the ability to jump and jump, and rapid runs with the ability to change directions (6, 12). Colson et al. confirmed that the new rules of basketball have necessitated the player to perform more explosive actions represented in jumping to the top with the ability to change direction, which means optimal exploitation of the work of the extensor and opposite muscles during the extension of the joints of the lower extremity. (13, 14). The results of several studies also proved that the development of isometric explosive force for players of sports that require explosive power, mainly weighted by volleyball and basketball, has been confirmed after four weeks of electrical stimulation (11, 15, 16). The use of vibration training increases the ability to The deep jump, which is an essential requirement for basketball players during the shooting of all kinds, as well as follow-up skills, and from the previous and through the experience of researchers in the field of sports training and preparing the basketball player, they decided to conduct this study by integrating vibration training within the training program for the players of the research sample to identify its effect on some of the physical and skill variables of basketball players, the research sample what extent would the proposed program vibration training in developing some of the material and skill variables under study for basketball players?

The current study aims to identify the effect of vibration training in developing some of the physical and skill variables under investigation for basketball players. Accordingly, the present study attempts to answer the following question: "To what extent would the proposed program vibration training develop some of the physical and skill variables under investigation for basketball players.

MATERIALS AND METHODS

Experimental Approach to the Problem.

The researchers used the practical method with two groups, one experimental and the other controlling. The program proposed by the researchers was used for a period of 10 weeks to improve some of the physical and skill

components, as the details of vibration training were included in the training program. This program was implemented in the experimental sample consisting of 12 basketball players participating in the training of the King University team Faisal, who is preparing to participate in the Saudi Universities League for the academic year 2019-2020. Their ages ranged from 18.92 ± 0.58 . The research experience included a control group consisting of 12 players who train in the traditional method that does not include vibration training to identify the effect of vibration training by comparing the results between the experimental and control groups. The experiment was carried out during the pre-preparation period for the competitive season, which amounts to 12 weeks, where ten weeks were determined, starting from the third week, where the first two weeks were a general preparation for all sample members and measurements were made for the research (tribal size) (integrated preparation period), Where all

the players trained their traditional basketball training under the supervision of their coaches (5 times a week), three of them were allocated to vibration training only for the members of the experimental group for a period of (30-45) minutes.

Participants. Twenty KFU basketball players agreed to participate in this study. They were randomly distributed into two groups, one of the experimental, and their specifications were according to [Table 1](#).

All players have been in regular basketball training during the last four years and have competed regularly in local basketball competitions (in the Eastern Province) for at least three years. None of them have undergone training programs for muscle strength or vibration training during the last three months. All instructions related to the experiment and the program in question were explained, and all volunteers in the sample agreed to participate in the program.

Table 1. Specifications of the Research participants (n=24)

Measure	Mean	Skewness
Age (y)	18.92	0,58
Height (cm)	177.17	1,17
Weight	71.63	1,53

Procedures. The training program consisted of 30 units distributed over (5) weeks, and the unit time ranged between (30 - 45) minutes. All exercises were carried out on the vibration-training platform that was used in the study of Schuhfried et al. whole-body vibration at low frequency (2.0_/4.4 Hz oscillations at 3-mm amplitude) in five series of 1 min each with a 1-min break between the series (17) and Pérez-Turpin et al. 20-minute bursts of very-low-magnitude, high-frequency vibration (18) ([Table 2](#)):

1. The training intensity is fixed for the first four weeks
2. Changed again during the 5th and 6th weeks
3. The last four weeks have been changed, with the training days fixed in a way that does not contradict the basketball training, as it was on the following days (Sunday - Tuesday - Thursday).
4. The training style was (1:1) throughout the training sessions for the first four weeks (30-sec rocking - 30-sec rest)
5. The total duration of the shaking was 15 minutes.

6. Week 5 and 6 (40 shakes - 30 breaks)
7. Duty cycle: 60%: 40% and total duration of exposure to vibration: 17.5 minutes.
8. Duty cycle: 70% 30%, and the total duration of vibration was 20 minutes
9. For The first two weeks, the program consisted of alternating between two fixed positions:
 - High squat (knee angle 110; 180 corresponds to the full extension of the knee)
 - Same high squat position while standing on toes (same knee angle; ankle angle constant at 90) for the total time of exposure.
10. During the fifth and sixth weeks, follow the same method as before, with the knee angle changed to (90 degrees).
11. The knee angle was continuously monitored using the knee joint genome meter during the training sessions.
12. During exposure to vibration, the center position was taken with the torso slightly tilted forward at an angle of 13 degrees.

Table 2. Training Protocol

Week	Set Numbers	Capacity	Effect Period	Intensity	Rest
1	3	1/2	30 sec	30 hz.	30 sec
2	3	1/2	30 sec	35 hz	30 sec
3	4	2/3	30 sec	35 hz	30 sec
4	3	2/3	45 sec	40 hz	30 sec
5	4	2/3	45 sec	45 hz	30 sec
6	3	2/3	45 sec	40 hz	30 sec
7	4	3/4	45 sec	35 hz	30 sec
8	4	3/4	60 sec	50 hz	30 sec
9	4	3/4	60 sec	55 hz	30 sec
10	4	3/4	60 sec	50 hz	30 sec

Testing Procedures. Before starting the program, a pre-measurement was conducted for all the research variables in the two groups as follows:

1. Uniform warm-up for ten minutes• Walking - running - jumping - running short distances - jumping. All exercises were done individually and without getting tired.
2. The tests were carried out in a random way to avoid fatigue from one test to another
3. Verbal encouragement was given to motivate the research sample to perform each test optimally.

Tests of physical abilities (Appendix A):

Isometric Back Strength Test.

Standing Long Jump (Broad Jump).

Isometric Leg Strength Test.

Vertical Jump.

Overhead Medicine Ball Throw (forwards).

Standing Medicine Ball Throw.

Shoulder Static Flexibility Test.

Sit and Reach Flexibility Test.

Skillful tests (Appendix B):

One-handed Scrolling Test.

Dribbling Ended with Shooting on the Basket.

Shooting for Half a Minute Test.

Free Throwing Test.

Defensive Footwork Test.

Appendix C. This supplement contains the distribution of exercises over the days, weeks, and months of the training program, and each training has intensity, volume, frequency, and sets. Each group of these exercises represents a training unit rated according to the style of vibration training.

Appendix D. This supplement contains vibration training exercises and modes, which are selected according to the work of the muscles and the physical requirements for performing skills in basketball.

Statistical Analysis. The statistical package for the social sciences (SPSS) (IBM SPSS Statistics 26.Ink, Chicago, IL, USA) was used for statistical

analyses. The mean and deviation were calculated. T-test and the percentage of improvement in this study. The level of significance was set at $p < 0.05$.

RESULTS

It is clear from the results presented in Table 3 that there are statistically significant differences in the mean scores of the experimental group in some physical abilities (Physical Back Strength, Broad Jump, Leg Strength, Vertical Jump, Overhead M.B. Throw, Standing M.B. Throw, Shoulder Flexibility, Sit and Reach) respectively in the pre-measurement, which reached (32.65, 191.58, 38.93, 38.93, 28.40, 4.62, 4.80, 75.69, 24.65), and in the post-measurement it reached (42.87, 201.58, 52.08, 35.90, 6.35, 6.83, 85.87, 31.53) and the skill variables (Skillful One-Handed Scrolling, Dribble End Shooting, Shooting 0.5 Minute, Free Throwing, Defensive Footwork), where the pre-measurement was (13.65, 17.69, 6.69, 3.22, 14.75), while in the post-measurement it was (18.54, 13.6, 9.39, 5.83, 11.58) and the percentage of improvement in favor of the telemetry.

It is evident from the results presented in Table 4. There are statistically significant differences in the mean scores of the control group members in some physical abilities (Physical Back Strength, Broad Jump, Leg Strength, Vertical Jump, Overhead M.B. Throw, Standing M.B. Throw, Shoulder Flexibility, Sit and Reach), respectively, in the pre-measurement was 32.53, 191, 38.84, 26.28, 4.59, 4.78, 75.53, 24.49, and it reached 39.55, 194.88, 47.13, 28.41, 5.40, 5.50, 80.29, 27.89, and the skill variables (Skillful One-Handed End scrolling Shooting, Dribble-Handed Scrolling , Shooting 0.5 Minute, Free Throwing, Defensive Footwork), where the pre-measurement was 13.48, 17.60, 6.56, 3.12, 14.62, while the post-measurement was 16.20, 15.38, 8.27, 4.53, 12.88, and the percentage of improvement was in favor of the post-measurement.

Table 3. Differences Significance between Means of the Pre – Post Measurements for the Experimental Group and Improvement Percent in Variables under Research (n=12)

Variables	Units	Mean Pre	Mean Post	(T) Value	Imp. Percent
Physical Back Strength	Kg	32.65	42.87	28.41*	31
Broad Jump	Cm	191.58	201.58	20.83*	5
Leg Strength	Kg	38.93	52.08	62.61*	34
Vertical Jump	Cm	28.40	35.90	18.76*	26
Overhead M.B. Throw	m	4.62	6.35	43.27*	37
Standing M.B. Throw	m	4.80	6.83	67.67*	42
Shoulder Flexibility	Cm	75.69	85.87	72.70*	13
Sit and Reach	Cm	24.65	31.53	34.42*	28
Skillful One-Handed Scrolling	Score	13.65	18.54	18.11*	36
Dribble End Shooting	Sec.	17.69	13.6	51.08*	23
Shooting 0.5 Minute	Numbers	6.69	9.39	19.29*	40
Free Throwing	Numbers	3.22	5.83	28.69*	81
Defensive Footwork	Sec.	14.75	11.58	18.60*	21

*Statistically significant; **Imp. Percent:** Improvement Percent; **M.B.:** Medicine Ball.

Tabulated (T) value (freedom degree of 11 and significance level <0.05) = 1.796

Table 4. Differences Significance between Means of the Pre – Post Measurements for the Control Group and Improvement Percent in Variables under Research (n=12)

Variables	Units	Mean Pre	Mean Post	(T) Value	Imp. Percent
Physical Back Strength	Kg	32.53	39.55	21.94*	22
Broad Jump	Cm	191	194.88	13.84*	2
Leg Strength	Kg	38.84	47.13	12.42*	21
Vertical Jump	Cm	26.28	28.41	12.50*	8
Overhead M.B. Throw	m	4.59	5.40	26.83*	28
Standing M.B. Throw	m	4.78	5.50	35.92*	15
Shoulder Flexibility	Cm	75.53	80.29	6.71*	6
Sit and Reach	Cm	24.49	27.89	24.28*	14
Skillful One-Handed Scrolling	Score	13.48	16.20	11.34*	20
Dribble End Shooting	Sec.	17.60	15.38	12.31*	13
Shooting 0.5 Minutes	Numbers	6.56	8.27	9.53*	26
Free Throwing	Numbers	3.12	4.53	14.13*	45
Defensive Footwork	Sec.	14.62	12.88	21.76*	12

*Statistically significant; **Imp. Percent:** Improvement Percent; **M.B.:** Medicine Ball. Tabulated (T) value (freedom degree 11 and significance level <0.05) = 1.796

The results of [Table 5](#) indicate that there are statistically significant differences between the averages of the subsequent measurements of the experimental and control groups in some physical abilities (Physical Back Strength, Broad Jump, Leg Strength, Vertical Jump, Overhead M.B. Throw, Standing M.B. Throw, Shoulder Flexibility, Sit and Reach) respectively for the experimental group, which reached 42.87 ± 1.08 , 201.58 ± 1.08 , 52.08 ± 0.45 , 35.90 ± 1.54 , 6.35 ± 0.11 , 6.83 ± 0.04 , 85.87 ± 0.49 , 31.53 ± 0.50 , and for the control group it was 39.55 ± 0.73 , 194.88 ± 0.61 , $47.13 \pm$

0.91 , 28.41 ± 0.46 , 5.40 ± 0.04 , 5.50 ± 0.05 , 80.29 ± 2.46 , 27.89 ± 0.34 and the skill variables (Skillful One-Handed End scrolling Shooting, Dribble-Handed Scrolling, Shooting 0.5 Minute, Free Throwing, Defensive Footwork), For the experimental group, it was 18.54 ± 0.32 , 13.6 ± 0.19 , 9.39 ± 0.38 , 5.83 ± 0.39 , 11.58 ± 0.46 , while for the control group it was 16.20 ± 0.33 , 15.38 ± 0.62 , 8.27 ± 0.36 , 4.53 ± 0.09 , 12.88 ± 0.16 And the percentage of improvement in favor of the experimental group.

Table 5. Differences Significance between Means of Two Post Measurements for the Experimental and Control Groups and Improvement Percent in Variables under Research (n=24)

Variables	Unit	Experimental Group		Control Group		(T) value	Differences in Improvement	
		Mean	SD	Mean	SD		Percent %	
Physical Back Strength	Kg	42.87	1.08	39.55	0.73	845*	9	
Broad Jump	Cm	201.58	1.08	194.88	0.61	17.92*	3	
Leg Strength	Kg	52.08	0.45	47.13	0.91	16.17*	13	
Vertical Jump	Cm	35.90	1.54	28.41	0.46	15.46*	18	
Overhead M.B. Throw	m	6.35	0.11	5.40	0.04	26.92*	9	
Standing M.B. Throw	m	6.83	0.04	5.50	0.05	68.89*	27	
Shoulder Flexibility	Cm	85.87	0.49	80.29	2.46	7.38*	7	
Sit and Reach	Cm	31.53	0.50	27.89	0.34	19.97*	14	
Skillful One-Handed Scrolling	Score	18.54	0.32	16.20	0.33	16.88*	16	
Dribble End Shooting	Sec.	13.6	0.19	15.38	0.62	9.10*	10	
Shooting 0.5 Minute	Numbers	9.39	0.38	8.27	0.36	7.10*	14	
Free Throwing	Numbers	5.83	0.39	4.53	0.09	10.77*	36	
Defensive Footwork	Sec.	11.58	0.46	12.88	0.16	8.85*	9	

*: Statistically significant; **M.B.:** Medicine Ball. Tabulated (T) value (freedom degree 11 and significance level <0.05) = 2.074

DISCUSSION

We examined the effects of vibration training on some physical and skill variables for basketball players at King Faisal University. The statistics show the differences between the average results of the pre- and post-measurements of the experimental group and the control group in the physical and skill variables under study. As the program created an improvement in those variables.

There are statistically significant differences in the degrees of the experimental group in some physical abilities, respectively (Physical Back Strength, Broad Jump, Leg Strength, Vertical Jump, Overhead M.B. Throw, Standing M.B. Throw, Shoulder Flexibility, Sit and Reach) with an improvement rate of (31%, 5%, 34%, 26%, 37%, 42, 13%, 28%), and the skill variables (Skillful One-Handed Scrolling, Dribble End Shooting, Shooting 0.5 Minutes, Free Throwing, Defensive Footwork) in percentages, respectively (36%, 23%, 40%, 81%, 21%) in the post-test when compared to the pre-test. The researchers attribute this progress in physical and skillful variables (under research) to the sports program is based on physical exercises similar in its work to the muscular and kinetic performance of basketball skills and designed in a way that combines competition, performance and fun,

which had a major role in improving physical variables. This is consistent with the study of Rubin et al. (19), Torvinen et al. (20) stated that whole-body vibration is a method of neuromuscular training to improve muscle strength, body balance, and bone mechanical efficiency as these mechanical stimuli are transmitted to the body where they stimulate sensory receptors. This causes the activation of motor neurons and is consistent with the results of Colson et al. (13) that a 4-week full-body vibration training program added to the traditional pre-season basketball training is an effective short-term stimulus to enhance knee extensor strength and squat jump performance and adds Ma Luo et al. (7) indicated that vibrating training has a positive effect in improving balance and muscular strength. It depends on the training method through the intensity and volume of the exercises and the training program in order to ensure a greater improvement in the balance and strength of the quadriceps muscle groups.

There are statistically significant differences in the scores of the control group in some physical abilities respectively (Physical Back Strength, Broad Jump, Leg Strength, Vertical Jump, Overhead M.B. Throw, Standing M.B. Throw, Shoulder Flexibility, Sit and Reach) by Improved (22%, 2%, 21%, 8%, 28%, 15%, 6%, 14%), and

skill variables (Skillful One-Handed Scrolling, Dribble End Shooting, Shooting 0.5 Minute, Free Throwing, Defensive Footwork) In percentages, respectively (20%, 13%, 26%, 45%, 12%) in the post-test compared to the pre-test. We attribute this progress in physical and skillful variables (under research) to control group members' attendance at study, as well as implementing their training program involving drills used in learning and training skills. The researchers also attribute this progress to control group member's competency since attendance and continuity in practice, in addition to continuous competition between athletes to offer the best physical and skillful performance has a great influence in raising the level of physical abilities in which its effect was reflected in developing skill performance.

There are statistically significant differences in the scores of the experimental group and the control group in the post- measurements, as the results showed the superiority of the experimental group over the control group with a difference in the percentage of improvement, as it appeared in some physical abilities (Physical Back Strength, Broad Jump, Leg Strength, Vertical Jump, Overhead M.B. Throw, Standing M.B. Throw, Shoulder Flexibility, Sit and Reach) the difference of improvement, respectively, with rates (9%, 3%, 13%, 18%, 9%, 27%, 7%, 14%), and skill variables (Skillful One-Handed Scrolling, Dribble End Shooting, Shooting 0.5 Minute, Free Throwing, Defensive Footwork) in percentages, respectively (16%, 10%, 14%, 36%, and 9%). We attribute this to the vibration training program, which contained appropriate and gradual exercises, which contributed to the improvement of the physical and skill aspects. Also, changing the method in training creates a kind of enthusiasm and enthusiasm for training. In addition to gaining the advantages of vibration training and its ability to improve muscle strength, body balance and mechanical efficiency of the bones, as these mechanical stimuli are transferred to the body, where they excite sensory receptors, and this causes the activation of motor neurons. These results are consistent with Albasini et al. that the vibration training showed an improvement and an increase in strength in the upper and lower extremities, where the maximum strength increased by 8.1% to 16.1% for the experimental group after 10 weeks of training, which confirms the positive effects of vibration training (9). It agrees with Bosco et al. (22), and Luo et al. (7)

vibrational training on the Power Plate sends excess vibrations to the body and muscles to stimulate sensory receptors to activate the largest number of muscle fibers and increase muscle contraction to develop balance and strength for the muscles. Mahieu et al. Mentioned that vibrates the whole body constitutes an exciting complementary form of training within the scope of strength training (4); and also Paradisis and Zacharogiannis reported the improvement in the running speed of the experimental group at a distance of 0-10m significantly by 4.9%, and it improved in the distance From 50-60 m significantly by 2.2% after six weeks of training and an improvement in explosive power is better than the control group (23).

CONCLUSION

The vibration training program using the Power Plate device used in this study had a significant positive effect on an improvement in some physical abilities (Physical Back Strength, Broad Jump, Leg Strength, Vertical Jump, Overhead M.B. Throw, Standing M.B. Throw, Shoulder Flexibility, Sit and Reach) and the skill variables (Skillful One-Handed End scrolling Shooting, Dribble-Handed Scrolling, Shooting 0.5 Minutes, Free Throwing, Defensive Footwork). We recommend emphasizing the use of vibrational training for basketball players and generalizing it to other sports with the inclusion of these exercises in the preparation of training programs with their use in preparing and qualifying players, conducting studies in the field of basketball using vibrational training to improve the physical and skill side.

APPLICABLE REMARKS

- Using vibrating exercises and linking them to different parts of the body in light of the nature and requirements of each specialized sport because of their effective impact on performance.
- Doing other research to identify the effect of vibration training using the Power Plate device to rehabilitate sports injuries for players.
- Conducting various researches to identify the effect of vibration training for different sports and to identify its effect on performance during competition.
- Using modern scientific methods in preparing training programs for players in proportion to their abilities and preparations.

ACKNOWLEDGMENTS

We would like to thank the subjects who participated in the study and thank the Deanship of Scientific Research at King Faisal University Al-Ahsa (31982) for their moral, financial support and their cooperation during the study, Track Annual Research no (GRANT62).

AUTHORS' CONTRIBUTIONS

Study Concept and Design: Ahmed K. Hassan. Acquisition of data: Ahmed K. Hassan. Analysis and interpretation of data: Khaled M. Zahran.

Drafting of the manuscript: Ahmed K. Hassan. Critical revision of the manuscript for important information: Mahmud A. Abd El-Rahman. Statistical analysis: Khaled M. Zahran. Administrative, technical, and material support: Ahmed K. Hassan. Study supervision: Ahmed K. Hassan.

CONFLICT OF INTEREST

This manuscript contains no material that could be considered a conflict of interest by the authors.

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(Appendix A)

Tests of physical abilities

1. Isometric Back Strength Test:

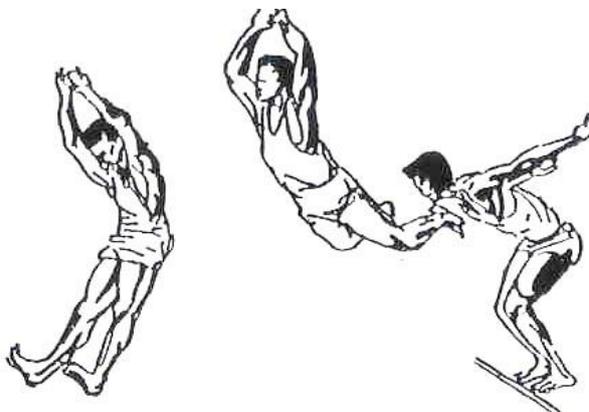
Purpose this test measures back strength equipment required strength dynamometer, usually composed of a cable tensiometer. Procedure Make sure the dial is reset to zero before you start. Stand upright on the base of the dynamometer with your feet shoulder width apart. Let your arms hang straight down to hold the center of the bar with both hands, and with the palms facing toward the body. Adjust the chain so that the knees are bent at approximately 110 degrees. In this position your back should be bent slightly forward at the hips, your head should be held upright, and you should look straight ahead. Then without bending your back, pull as hard as possible on the chain and try to straighten your legs, keeping your arms straight. Pull against the weight steadily (no jerky movements), keeping the feet flat on the base of the dynamometer. Maximum performance will result when your legs are almost straight at the end of the lift. If not, adjust the chain length and starting position. Scoring read the result from the dynamometer.

2. Isometric Leg Strength Test:

Purpose this test measures back and leg strength equipment required strength dynamometer, usually composed of a cable tensiometer. Procedure Make sure the dial is reset to zero before you start. Stand upright on the base of the dynamometer with your feet shoulder width apart. Let your arms hang straight down to hold the center of the bar with both hands, and with the palms facing toward the body. Adjust the chain so that the knees are bent at approximately 110 degrees. In this position your back should be bent slightly forward at the hips, your head should be held upright, and you should look straight ahead. Then without bending your back, pull as hard as possible on the chain and try to straighten your legs, keeping your arms straight. Pull against the weight steadily (no jerky movements), keeping the feet flat on the base of the dynamometer. Maximum performance will result when your legs are almost straight at the end of the lift. If not, adjust the chain length and starting position. Scoring read the result from the dynamometer.

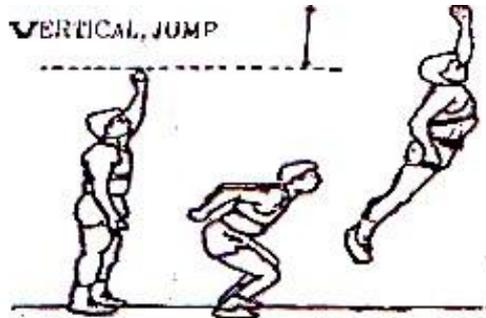
3. Standing long jump (Broad Jump):

The purpose of this Test to measure the explosive power of the legs, the athlete stands behind a line marked on the ground with feet slightly apart. A two-foot take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without falling backwards. Three attempts are allowed. See some. The measurement is taken from take-offline to the nearest point of contact on the landing (back of the heels). Record the longest distance jumped, the best of three attempts. The table below gives a rating scale for the standing long jump test for adults, based on personal experiences.



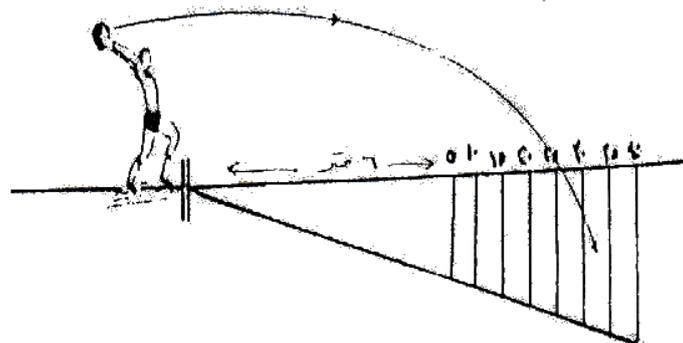
4. Vertical Jump:

The vertical jump consists of a singular maximal jump attempt. Each athlete will have two attempts. The vertical jump is an indicator of leg strength and power. conduct the test must be Perform the vertical jump test on a hardwood surface. Stand with the feet parallel and jump straight up - no additional steps are allowed. Warm up before you jump. Only those sticks that have been touched will count toward the height of the vertical jump.



5. Overhead Medicine Ball Throw (forwards):

purpose: to measure upper body strength and explosive power. equipment required 2-5 kg medicine ball depending on the age group being tested, tape measure. **procedure:** The subject stands at a line with the feet side by side and slightly apart and facing the direction to which the ball is to be thrown. The ball is held with the hands on the side and slightly behind the center. The throwing action is similar to that used for a soccer/football sideline throw-in. The ball is brought back behind the head, then thrown vigorously forward as far as possible. The subject is permitted to step forward over the line after the ball is released and is in fact encouraged to do so in maximizing the distance of the throw. Three attempts are allowed. **scoring:** The distance from the starting position to where the ball lands is recorded. The measurement is recorded to the nearest 0.5 foot or 10 cm. The best result of three throws is used.



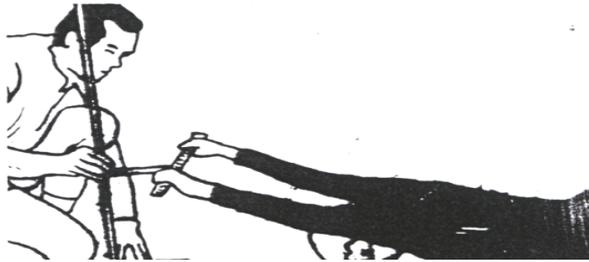
6. Standing Medicine Ball Throw:

Purpose this test measures upper body coordination, strength and power. equipment required: 2 or 3 kg power ball, tape measure, foam pad for kneeling, clear open area for testing. procedure the athlete starts in a kneeling position with the back erect and facing the direction they are going to throw. The thighs should be parallel and the knees at the start line. Ensure that the toes are pointed backwards, as curled up toes can be used for greater traction. Starting with the ball grasped with both hands at the sides and held out and above the head. The ball is brought down to the chest as their hips are brought back to the heels, then in one motion the ball is pushed forward and up (optimally between 30-45 degrees). A practice trial is allowed to learn the correct movements and get the best trajectory for maximum distance. They must not throw favoring one arm or rotate about the spine. The athlete is permitted to fall forwards over the line after the ball is released. The knees are not to leave the ground. Two attempts are allowed, with at

least 45 seconds recovery between each throw. **scoring** the distance from the starting position to where the ball lands is recorded. The measurement is recorded to the nearest 0.5 foot or 10 cm. The best result of three throws is used.

7. Static Flexibility Test – Shoulder:

The objective of this test is to monitor the development of the athlete's shoulder. Required Resources 18" Stick, Meter Ruler and Assistant. To conduct the test, the athlete warms up for 10 minutes. The athlete lays prone on the floor, forehead on the ground, and arms extended holding the 18" stick with both hands shoulder-width apart. The assistant measures and records the athlete's arm length from the acromial extremity to the stick. The athlete raises the stick as high as possible while keeping their forehead on the ground. The assistant measures and records the vertical distance from the ground to the bottom of the stick. Repeat the test 3 times recording the vertical distance achieved. The assistant subtracts the longest recorded vertical distance from the recorded arm length, and the result is used to assess the athlete's performance.



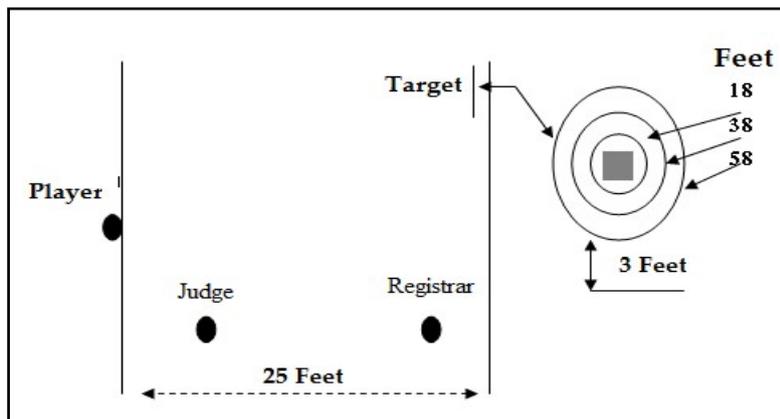
8. Sit and Reach Flexibility Test:

The sit and reach test is the most common flexibility test. It measures the flexibility of the lower back and hamstrings. It requires a box about 30cm (12 inches) high and a meter rule. Sit on the floor with your back and head against a wall. Legs should be out straight ahead and knees flat against the floor. Have someone place the box flat against your feet (no shoes). Keeping your back and head against the wall, stretch your arms out towards the box. Have someone place the ruler on the box and move the zero end towards your fingertips. When the ruler touches your fingertips, you have the zero point and the test can begin. Lean forward slowly as far as possible, keeping the fingertips level with each other and the legs flat. Your head and shoulders can come away from the wall now. Do NOT jerk or bounce to reach further. Slowly reach along the length of the ruler 3 times. On the third attempt, reach as far as possible and hold for 2 seconds. Have your training partner read the score. Repeat twice and compare your best score with the table below [17].

(Appendix B) Skillful tests

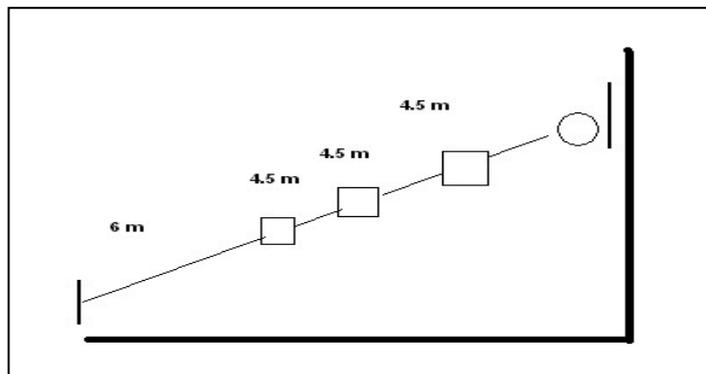
1. One-Handed Scrolling Test:

The purpose of the test: to measure the accuracy of the pass with one hand. The attempt that hits the small circle is calculated by three degrees, while it is counted by two degrees if it hits the middle circle, and it is counted by one degree if the outer circle is hit.



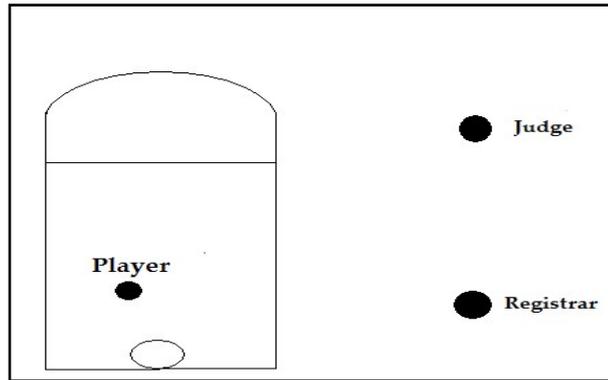
2. Dribbling Ended with Shooting on the Basket:

The purpose of the test is to measure the player's ability to finish the dribble by shooting the largest number of times in the shortest time possible. The tester calculates the time he has taken from the moment of the start signal until it crosses the starting line after implementing the steps previously indicated in the performance specifications.



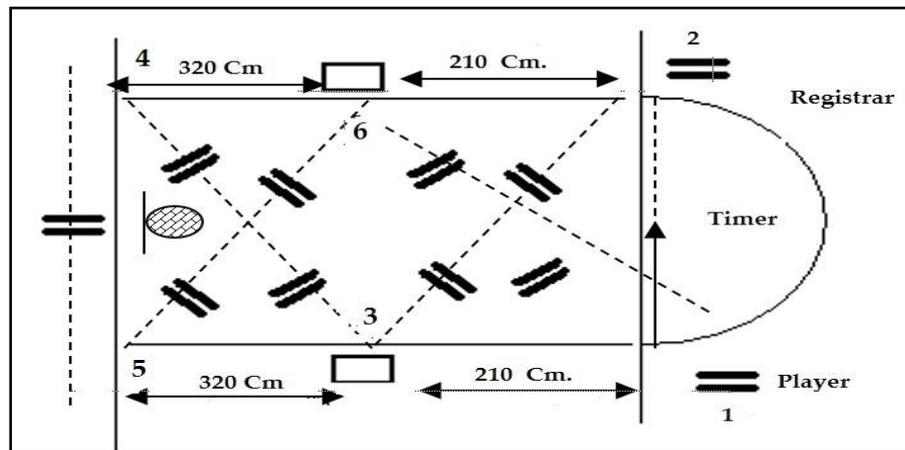
3. Shooting Test for Half a Minute:

The purpose of the test: to measure the accuracy of aiming shooting. Calculates the number of successful attempts that hit the target during the scheduled performance period, which is 30 seconds.



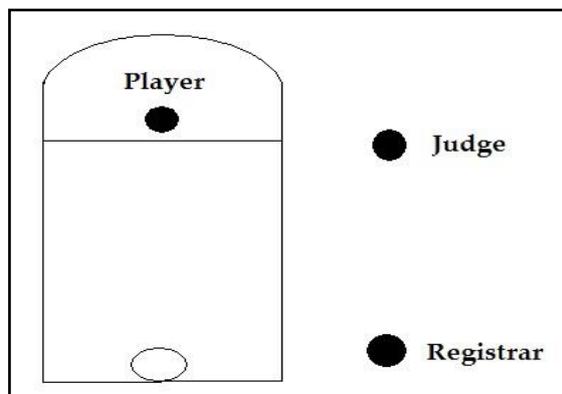
4. Defensive Footwork Test:

The purpose of the test: To measure the performance of basic defensive footwork. It records the time it takes for the player since giving him the signal to start until the completion of the legal phase of the test approved by 1/10 of a second.



5. Test of Free throwing:

The purpose of the test is to measure the skill of the free shooting, behind the free throw, and each player has twenty attempts, and the player has the right to perform free shooting using any method of shooting [1].



(Appendix C)
Vibration training program

program	drills	Week 1									Week 2									Week 3												
		Sun	Tue	Thu																												
Vibration	1	3/30/30/30						4/30/30/35				3/45/40/30				3/45/40/30				4/45/35/30			4/60/50/30			4/60/50/30			4/45/35/30			
	2		3/30/30/30							4/30/30/35				3/45/40/30						3/45/40/30		4/45/35/30		4/60/50/30				4/60/50/30	4/60/50/30		4/60/50/30	
	3			3/30/30/30						4/30/30/35			3/45/40/30				3/45/40/30				4/45/35/30					4/60/50/30	4/60/50/30					
	4				3/30/30/30					4/30/30/35			3/45/40/30				3/45/40/30				4/45/35/30			4/60/50/30			4/60/50/30			4/45/35/30		
	5	3/30/30/30							4/30/30/35			4/30/30/35					3/45/40/30				4/45/35/30		4/60/50/30			4/60/50/30		4/60/50/30	4/60/50/30		4/60/50/30	
	6		3/30/30/30										3/45/40/30			3/45/40/30				3/45/40/30					4/60/50/30							
	7			3/30/30/30						4/30/30/35						3/45/40/30				3/45/40/30		4/45/35/30		4/45/35/30		4/60/50/30			4/60/50/30		4/45/35/30	
	8				3/30/30/30								3/45/40/30				3/45/40/30				3/45/40/30											
	9		3/30/30/30							4/30/30/35				3/45/40/30						3/45/40/30		4/45/35/30		4/60/50/30			4/60/50/30				4/60/50/30	
	10					3/30/30/30						4/30/30/35				3/45/40/30			3/45/40/30			4/45/35/30		4/60/50/30				4/60/50/30	4/60/50/30	4/45/35/30		
	11						3/30/30/30						3/45/40/30			3/45/40/30				3/45/40/30					4/60/50/30							
	12							3/30/30/30		4/30/30/35						3/45/40/30						4/45/35/30		4/60/50/30			4/60/50/30					
	13	3/30/30/30			3/30/30/30												3/45/40/30				4/45/35/30		4/60/50/30								4/60/50/30	
	14		3/30/30/30			3/30/30/30			4/30/30/35			4/30/30/35					3/45/40/30										4/60/50/30		4/60/50/30	4/60/50/30		
	15			3/30/30/30									1	3/45/40/30						3/45/40/30		4/45/35/30		4/60/50/30			4/60/50/30					
	16						3/30/30/30						3/45/40/30			3/45/40/30				3/45/40/30				4/60/50/30							4/60/50/30	
	17	3/30/30/30				3/30/30/30			4/30/30/35							3/45/40/30					4/45/35/30		4/45/35/30		4/60/50/30			4/60/50/30			4/45/35/30	
	18						3/30/30/30							3/45/40/30				3/45/40/30			3/45/40/30											
	19		3/30/30/30											3/45/40/30						3/45/40/30		4/45/35/30		4/60/50/30			4/60/50/30				4/60/50/30	
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	21	3/30/30/30										4/30/30/35				3/45/40/30					3/45/40/30		4/45/35/30				4/60/50/30	4/60/50/30	4/45/35/30			
	22						3/30/30/30							3/45/40/30						3/45/40/30		4/45/35/30		4/60/50/30								
	23					3/30/30/30				4/30/30/35										3/45/40/30		4/45/35/30						4/60/50/30				
	24		3/30/30/30											3/45/40/30			3/45/40/30				3/45/40/30				4/60/50/30		4/60/50/30				4/60/50/30	
	25			3/30/30/30					4/30/30/35													4/45/35/30					4/60/50/30					
	26						3/30/30/30					4/30/30/35				3/45/40/30				3/45/40/30		4/45/35/30					4/60/50/30	4/60/50/30	4/45/35/30			
	27				3/30/30/30								3/45/40/30	3/45/40/30				3/45/40/30	3/45/40/30					4/60/50/30								
	28	3/30/30/30							4/30/30/35												4/45/35/30				4/60/50/30		4/60/50/30					
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	30						3/30/30/30		4/30/30/35					3/45/40/30						3/45/40/30		4/45/35/30				4/60/50/30						
	31		3/30/30/30													3/45/40/30	3/45/40/30					4/45/35/30		4/60/50/30						4/45/35/30		
	32						3/30/30/30		4/30/30/35							3/45/40/30					4/45/35/30				4/60/50/30		4/60/50/30					
	33			3/30/30/30								4/30/30/35												4/60/50/30				4/60/50/30	4/60/50/30		4/60/50/30	
	34					3/30/30/30							3/45/40/30			3/45/40/30				3/45/40/30	3/45/40/30	4/45/35/30		4/60/50/30								
	35	3/30/30/30							4/30/30/35							3/45/40/30							4/45/35/30				4/60/50/30			4/45/35/30		
	36				3/30/30/30						4/30/30/35			3/45/40/30						3/45/40/30		4/45/35/30		4/60/50/30		4/60/50/30		4/60/50/30	4/60/50/30	4/60/50/30	4/60/50/30	
	37						3/30/30/30		4/30/30/35												4/45/35/30						4/60/50/30					
	38			3/30/30/30								4/30/30/35				3/45/40/30						4/45/35/30						4/60/50/30	4/60/50/30	4/45/35/30		
	39					3/30/30/30							3/45/40/30				3/45/40/30			3/45/40/30		4/45/35/30			4/60/50/30							
	40	3/30/30/30							4/30/30/35				3/45/40/30							3/45/40/30				4/60/50/30			4/60/50/30			4/60/50/30	4/60/50/30	
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	42				3/30/30/30				4/30/30/35				3/45/40/30			3/45/40/30				3/45/40/30		4/45/35/30				4/60/50/30						
	43		3/30/30/30						4/30/30/35						3/45/40/30		3/45/40/30				3/45/40/30		4/45/35/30		4/60/50/30			4/60/50/30		4/45/35/30		

m / sets t / hz effect / intensity t / rest

(Appendix D)
Vibration exercise facility

