Holding Bow Digital Test for Strength and Endurance Arm Muscles of Archery

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Abstract--this research has to do with the study of a special tool known as the Holding Bow Digital Test. This tool is used to take measurements of the strength and endurance of the arm muscles in kilograms and seconds respectively. Based on expert validation: (1) Archery material experts (2) Archery media experts and (3) Electro experts, this tool is open for further improvement. The Holding Bow Digital Test is visibly a new product innovation.

Keywords--test, strength, endurance, arm muscle, archery, digitec

I. INTRODUCTION

Archery is a smooth and at the same time a rough motor sports, in which success is determined by the capacity to shoot at targets repeatedly with great precision and accuracy. It is quite evident that for an athlete to achieve victory in sports, a certain level of physical fitness and optimal motor skills are required [1]. From Previous findings, the mastery of certain physical fitness variables and motor skills such as core body strength, upper body strength, handgrip, leg strength and static balance can lead to the desired result for a particular sports performance [2]. Athletes involved in Archery, need to develop certain muscles most importantly, the arm muscles. [8]. In previous studies, we learnt that the strength and endurance of the arm muscles has a significant effect to the accuracy of archery [1, 3, 5]. In order to achieve a perfect score, every archer only needs to keep his movements consistent from the start to the finish. To achieve the perfect score requires strength and endurance of the prime muscles [4]. The strength and endurance of the arm muscle is very essential because it helps to determine the criteria of the arc suitable for archers. [6]. However, there is no particular gauge / test used to measure the strength and endurance of arm muscles. Arm muscle strength could be measured by push-ups [1] but this does not provide a valid data because of the various types of push-ups and shooting movements. A tool for measuring arm muscle strength for archery sports was developed. It is known as the Dacin's exciting test [7], but this tool still needs to be worked on. Muscular endurance of the arms can be measured by draw the bow and then hold it test [3, 5]. The test of bow drawing is done manually. The "Holding Bow Digital Test" is designed to help the archery trainers in testing the strength and endurance of their arm muscles.

II. METHOD

In the early development of this tool, researchers distributed questionnaires to 12 National archery trainers in order to seek input and suggestions for the production of this tool. After the inputs and suggestions stage or phase, the next stage had to deal with the development of the prototype of the tool, field trials of the athletes and the archery trainers was conducted and a lot of feedbacks were gotten from the test results. After which the tool was tested and updated for about four times. The next stage had to deal with validation by archery experts, electronics experts, and archery media experts. Validation of data generated feedbacks and suggestions that was used to revise this instrument.

III. RESULT

A measuring tool or instrument called the Holding Bow Digital Test was created. This instrument is used to measure the strength and endurance of the arm muscle. . The unit for the measurement of strength is in kilogram while the unit for the measurement of endurance is in seconds. The shape of this test tool is suitable to the standard archery equipment and the procedures adapted from the use of archery techniques were able to produce valid data.

Fig. 1. Illustration of Holding Bow Digitec Test

Fig. 2. Illustration of Holding Digital Test Implementation.

In The implementation of the Digital Holding Bow, the test is linear when the athlete performs archery techniques. This test is aimed at getting valid measurement results.

The purpose of this test is to measure the strength and endurance of the arm muscles.

A. Implementation Procedures
1. Athletes assume a standing position   when shooting with their   legs in a parallel position. (using a square attitude / open);
2. the 3 pulling fingers (index finger, middle finger and ring finger) are affixed on the tool, with the index finger on the top, while the middle finger and ring finger are affixed below;
3. Then the athlete starts the arc lifting movements (extend);
4. Athletes should also perform extended movements;
5. The athlete should   maintain   the pull as long as possible;
6. The tool records how strong the athlete is able to pull and this is confirmed on the LCD in units (kg). The tool also records how long the athlete can withstand the pull in units of time. (Second).

B. Assessment
1. The current athletic technique is not yet complete: the body positioning is unbalanced, and the left test module bends;

2. The running time on the tool has stopped. (when the athlete decreases the pulling force by 1kg, this automatically completes the test);
3. The View of the measurement results that appear on the LCD tool, with the measurement of Strength in kilogram and endurance in seconds.
4. Press the Black Button to make the next measurement, the indicator weight and time indicator on the tool returns to the number "0" and the data recorded in the previous measurement automatically becomes stored in the memory of the Holding Bow Digital Test tool.

Fig. 3. Illustration Test Result

C. Transfer of Data Results to a Computer

Data stored by the tool can be transferred to a computer with the help of an application. The process of data transfer is done by connecting the device to a computer using a USB cable and activating the applications that have been installed on the computer.

TABLE I.   COMPARISON BETWEEN OLD AND NEW MEASURING INSTRUMENTS

No	Old measuring instrument	New measuring instrument
1	Manual	Digital
2	Need a stopwatch	No stopwatch required
3	The measurement results are less accurate	Accurate measurement results
4	Measurement data is recorded manually	The measurement data is stored in memory
5	Less specific for archery sports	Specific for archery sports

IV. CONCLUSION

From the input of experts, archery trainers and through the initial trial stages   a tool for measuring strength and endurance of arm muscles for archery sports called "Holding Bow Digital Tests" was developed. This tool is an innovation and can be tested more widely.

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