WISCONSIN STATE COLLEGE AT LA CROSSE

GRADUATE SCHOOL

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A STUDY OF THE RELATIONSHIP OF BOWLING GRIP STRENGTH AND BOWLING SKILL

by Yvonne Meyer

The purpose of this study was to investigate the relationship of bowling grip strength and bowling skill. Data were collected on bowling grip strength before and after bowling, and pinfall for thirty male adult bowlers for six weeks. The Preston hand dynamometer was used to determine the bowling grip strength of subjects.

By using the Pearson product-moment and the Spearman rank-order correlation coefficient formulas, a positive, but low correlation was determined between bowling grip strength and bowling skill. A "t" test was applied to the means of the extremes of each variable. Little difference in means showed the gomogeneity of the group.

A STUDY OF THE RELATIONSHIP OF BOWLING GRIP STRENGTH AND BOWLING SKILL

A Seminar Report

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Master of Science in Physical Education

By

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CHAPTER I

INTRODUCTION

Bowling is rapidly becoming a popular sport as a leisure time activity. People who take part in bowling, do so for the pure enjoyment it brings them. Because of its popularity with the general public, bowling has become important in the school curriculum.

As a physical education teacher and bowling instructor, the researcher feels qualified to make this study. This interest in bowling research began when beginning junior high school bowlers had difficulty in proper delivery of the ball.

Statement of the problem. It was the intent of this study to objectively measure the strength of the bowling grip and record the total pinfall to determine the relationship of the two. Sub-problems involved were selection of an objective measurement instrument, method of applying the measurement instrument, selection of a group to be tested, and analysis and interpretation of the raw data.

Purpose of the study. The purpose of this study was to determine if bowling grip strength was important in bowling skill. If this were the case, increasing grip strength should relate to an increase in bowling skill.

Need for the study. This research has been undertaken for the investigator's personal use in presenting a better program of bowling instruction.

Delimitations of the study. The thirty subjects bowled on Wednesday nights at 7:00 p.m. at the Hub City Lanes at Marshfield, Wisconsin. The bowling grip strength of each subject was measured before and after bowling.

Limitations of the study. The original study was to include the adult men's group and the girl's junior high school group. The girl's group was not used because the scores were too skewed to be statistically treated. Sixty adult men bowled in the group chosen for study, but only thirty were used for the study because the time factor would not permit the application of the instrument to all of them. Since nine of the bowlers were absent at various times, they were dropped from the study. The validity of the study may have been increased by the use of more subjects.

Definitions of terms used.

Bowling Grip. The bowling grip is the grip of the hand with the second and third fingers and thumb of the hand used in delivering the bowling ball.

Bowling Skill. Bowling skill is the bowling pinfall of each subject in the six weeks of the study.

Total Pinfall. Total pinfall is a grand total of all pinfall by all the subjects in the six week period.

Dynamometer. The dynamometer is a manumometer, which is used in measuring muscle strength. In regard to the study, the instrument that was used to measure the bowling grip strength.

Basic Assumptions. The investigator began this research with the hypothesis that bowling grip strength and bowling skill are significantly related.

CHAPTER II

REVIEW OF THE LITERATURE

The literature on measurement devices for measuring human strength was reviewed. A study by H. Harrison Clarke compared instruments for recording muscle strength. This study showed the cable tensiometer to have the greatest precision for strength testing indicated by objectivity coefficients, and was the most stable and useful. It was found to be free of most of the faults of the other devices tested. The Wakim-Porter strain gauge was superior to the cable tensiometer in the amount of strength it recorded, but was extremely sensitive to changes in room temperature. The spring scale was inferior in the amount of strength it could record. The Newman myometer was limited to strength efforts not exceeding sixty pounds and had low objectivity.[1] For this study, because of reasons of size or economy, all above mentioned instruments could not be used. The spring steel instrument used for this study was too recent in origin to have been used in Clarke's study.

A study on the relationship of hand size and lower arm girths to hand grip strength was conducted by Louis E. Bowers. It was found that measurements of the length of the hand and fingers and forearm girths

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[1]H. Harrison Clark, "Comparison of Instruments for Recording Muscle Strength," Research Quarterly of the American Association for Health, Physical Education and Recreation, 25:398-411, December, 1954.

were significantly related to hand grip strength.[2]

Tinkle and Montoye concluded that grip strength is related to, and probably dependent upon, body weight and only indirectly related to height.[3]

Pierson and O'Connell concluded that for men in condition and within the limits of their study, grip strength is significantly related to weight, but not to height or age.[4]

Beatrice Sabol studied the relationship among anthropometric, strength, and performance measures of college women bowlers. This research was done to determine the validity of a subjective rating of the ability to handle a given weight ball as a criterion measure of bowling ability. Data was collected for each subject on height, weight, arm length, grip, pull, push, three fingered bowling grip, velocity, first ball average, and game score. This research showed all groups were significantly different in all variables at the one or five percent

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[2]Louis E. Bowers, "Investigation of the Relationship of Hand Size and Lower Arm Girths to Hand Grip Strength as Measured by Selected Hand Dynamometers," Research Quarterly for the American Association for Health, Physical Education and Recreation, 32:308-314, October, 1961.

[3]W.F. Tinkle and H.J. Montoye, "Relationship Between Grip Strength and Achievement in Physical Education Among College Men," Research Quarterly of the American Association for Health, Physical Education and Recreation, 32:238-242, May, 1961.

[4]William R. Pierson and Eugene R. O'Connell, "Age, Height, Weight, and Grip Strength," Research Quarterly of the American Association for Health, Physical Education and Recreation, 33:449-443, October, 1962.

level when an analysis of variance was computed.[5]

Norma Johnson did research on testing achievement in bowling for ninth grade girls. She devised three tests of increasing difficulty and tested these for reliability. The tests were: rolling shadow balls, on the alley bed, recording the pins downed on the first ball in each frame, and recording the number of times the head pin was hit with the first ball in each frame. Reliabilities were too low for individual or group measurement, but Miss Johnson stated that rating scales prepared from scores at different stages of instruction might have motivational value.[6] The researcher thought studies of this kind might suggest a more definite way of determining bowling skill, but none were found. This lead the researcher to decide on the use of pinfall as a measure of bowling skill.

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[5]Beatrice Sabol, "A Study of the Relationship Among Anthropometric, Strength, and Performance Measures of College Women Bowlers," (unpublished Master's thesis, The University of Wisconsin, Madison, 1962), 113 p.

[6]Norma Jean Johnson, "Tests of Achievement in Bowling for Beginning Girl Bowlers," (unpublished Master's thesis, The University of Colorado, Boulder, 1962) 55 p.

CHAPTER III

PROCEDURE

After the investigator determined the problem to be studied, the best available method of objectively measuring hand grip strength was determined. Available literature on measurement instruments revealed the hand dynamometer was best suited for the study. The physical therapist at the Marshfield Clinic, Miss Gray, was interviewed. She indicated that from the opinions she received from the doctors on the clinic staff, that the instrument which was in use at the present time was suitable for clinical therapy. The researcher obtained this oval shaped, German made, spring steel, Preston dynamometer for the study. It was of a convenient size, required a short span of time for its use, and its numerical readings could be statistically treated.

The Preston dynamometer was obtained through a medical supply company at a cost of thirteen dollars and seventy-five cents.[7] The investigator had to determine whether the instrument could be objectively applied to test a subject. The dynamometer was applied to test groups by the investigator. In taking the trial readings, some of the subjects were so strong the instrument was compressed beyond the point of measurement. Since this study concerned bowling, the bowling grip with the thumb, the second and third fingers of the subject's bowling hand was

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[7] J.A. Preston Corporation, Equipment of Physical Medicine and Rehabilitation, 71 Fifth Avenue, New York 3, New York.

used. The readings were taken with the researcher placing the instrument in the subject's hand in the correct position. It was found that the dial of the instrument should be placed face down in the palm with the protruding button on one side between the second and third fingers at the first joint of the fingers. The other side of the instrument was placed at the heel of the hand. The subject took one step forward with the foot in opposition to the bowling hand and brought his arm down and forward with the same type of action he used to deliver the ball. The dynamometer was compressed as he stepped forward.

To see if temperature had any effect on the instrument, the researcher took a reading on two subjects. The instrument was placed in the refrigerator at a temperature of thirty-eight degrees Fahrenheit for thirty minutes. The readings were taken again on the same subjects, and it was found that temperature had no effect on the instrument. This test was necessary because the instrument had to be transported to the lanes in cold weather, and the researcher had to know if the temperature would affect the readings.

After the instrument was chosen and the investigator knew it could be objectively applied, a specific group had to be chosen for the study. An interview was arranged with the proprietor of the Hub City Lanes in Marshfield. After studying all the available groups, a Wednesday night adult men's group was chosen. In addition, a group of junior high girls was used since the researcher was the advisor of this bowling group.

In attempting to take hand grip readings the first evening, it was discovered that time would not allow using the instrument on sixty of the bowlers. After checking the attendance records of this league, it was decided to concentrate the study on the six teams whose members were present most often. The readings were taken immediately before and after bowling three games. The readings were taken to the nearest five pound calibration. The subject's bowling scores were obtained from the league secretary. This data was recorded for six weeks. During the time the subjects were bowling, other personal statistics and measurements were recorded. These statistics and measurements are shown in this report in the Appendix.

The bowling grip strength of a randomly selected group of twenty male adults of varying vocations was taken to determine if the study group used was average for a normal adult population.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

The analysis of the raw data was concerned with two variables, bowling grip strength and bowling skill. In treating this data, the scores for each subject were arranged in rank order, high to low. The mean for total pins and the mean for grip strength before bowling and total grip strength were determined. These are shown in Table I. The mean pinfall of the total group was one hundred-eighty-three pins per game per subject. This indicated the high proficiency of skill in the group. The mean of the bowling grip strength per subject was one hundred-nine pounds of pressure. In comparing the mean of the bowling grip strength of the study group and the mean of the bowling grip strength of the randomly selected group, it was indicated that the study group was average.

The standard deviations for grip strength before, total grip strength, and total pins are presented in Table I. Setting up a curve using the standard deviations showed the participants to be a very homogeneous group.

Total bowling grip strength and total pinfall was correlated by the Pearson product-moment correlation coefficient formula. A .20 correlation coefficient was determined, which is shown on Table I. The total bowling grip strength and total pinfall were correlated by the Spearman rank-order correlation coefficient formula. A .21 correlation coefficient was determined which is presented on Table I. Both correlation

TABLE I

ANALYSIS OF THE STUDY GROUP

Variables	Means	Standard Deviation	Pearson Product Moment*	Spearman Rank-Order**	"t" Scores***
Total Pins	3,294	187	.2		7.58
Total Bowling Grip Strength	1,300	228	.20	.21	.5270
Total Pins	3,294	187			7.58
Bowling Grip Strength Before	678	106	.21	.25	.7366

* Pearson Product-Moment Formula

$$r = \frac{N\sum XY - \sum X \cdot \sum Y}{\sqrt{\left[N\sum X^2 - (\sum X)^2\right]\left[N\sum Y^2 - (\sum Y)^2\right]}}$$

** Spearman Rank-Order Formula

$$= 1 - \frac{6 \cdot D^2}{N(N^2-1)}$$

*** "t" test formula

$$\text{"t"} = \frac{M_1 - M_2}{\sqrt{\frac{\sum x^2 + \sum x_1^2}{(N_1+N_2)-2} \left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$$

methods indicated a positive, but low relationship between total bowling grip strength and total pinfall. Therefore, the null hypothesis is accepted that bowling grip strength has no effect on bowling skill within the limits of this study.

In correlating the grip strength total before bowling and total pinfall, the Pearson product-moment correlation coefficient formula indicated a .21 correlation coefficient shown by Table I. In correlating these same variables by the Spearman rank-order correlation coefficient formula, a .25 correlation coefficient was indicated as shown in Table I. Both correlation methods indicate positive, but low relationship between grip strength before bowling and total pins.

Since the study in its entirety showed positive, but low relationships between variables, the researcher used a "t" test to determine if there was any difference in the means of the extremes of the study. The top twenty-seven percent was compared to the lowest twenty-seven percent, and "t" scores of grip strength between extremes were not significant, as shown by Table I. The "t" score determined between upper and lower extremes of the total pinfall was significant as shown by Table I.

CHAPTER V

CONCLUSIONS AND SUGGESTIONS FOR FURTHER STUDY

1. The degree of relationship between bowling grip strength and bowling skill is positive but low as determined within the limits of this study.

2. The group used for study was too homogeneous in all variables to show any difference in means.

Any additional studies of the relationship of bowling grip strength and bowling skill should use a group of subjects with more variance in bowling skill. The high proficiency of the study group in bowling skill showed they were advanced bowlers, and different results may be obtained if a group with lower ability and more variance of skill were used.

Other studies could be done determining the relationship of bowling skill and leg strength, amount of practice, or other anthropometric measurements.

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D. EQUIPMENT

J.A. Preston Corporation. Equipment For Physical Medicine and Rehabilitation. 71 Fifth Avenue, New York 3, New York.

APPENDIX

PERSONAL DATA ON THE SUBJECTS OF THE STUDY

SUBJECTS	AGE	WEIGHT	HEIGHT IN FEET & IN.	SEASON AVERAGE	OCCUPATION
1.	35	170	5-8	180	cheesemaker
2.	59	184	5-10½	180	factory superintendent
3.	36	160	5-8½	190	credit manager
4.	41	155	5-8	177	factory superintendent
5.	30	192	6-1	178	cheesemaker
6.	32	175	6-1	182	production planner
7.	33	180	5-10½	202	bowling instructor golf pro
8.	52	200	6-1	184	bricklayer farmer
9.	42	170	5-10	183	contractor
10.	50	225	6-2	177	country club owner
11.	39	165	5-9	186	expeditor at factory
12.	29	210	6-3	176	engineer
13.	28	175	6-4	188	shoe factory worker
14.	35	174	6-2	187	dispatcher at train depot
15.	37	190	6-2	174	assistant foreman

SUBJECTS	AGE	WEIGHT	HEIGHT IN FEET & IN.	SEASON AVERAGE	OCCUPATION
16.	37	132	5-8	178	Restaurant Owner
17.	49	200	6-0	171	switchman for railroad
18.	37	160	5-11	164	maintenance
19.	50	183	5-9	165	radio and T.V. service
20.	26	195	6-1	166	factory worker
21.	43	182	5-11	180	factory foreman