



The relationship of selected physical factors to football ability
by Jeffry Daniel Felton

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE
in Physical Education

Montana State University

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Abstract:

The purpose of this study was to determine: (1) if a single variable of strength, speed, or agility is related to football ability as perceived by coaches and players; (2) if any relationships exist between the variables of strength, speed, and agility; and (3) if there is any relationship between football ability as perceived by coaches and football ability as perceived by players.

It was hypothesized that there would be no significant relationships between the variables of strength, speed, or agility, or between any of these variables and football ability as perceived by coaches or players. Twenty-two members of the 1975 Montana State University varsity football team were utilized as subjects.

To measure the strength factor, maximum efforts for each subject were collected in the bench press, leg press, and a modified Roger's Short Strength Index. Speed was measured by timing each subject in the 40 yard dash. Agility was measured by timing each subject on two different drills. Each subject was asked to evaluate the football playing ability of each of the other subjects by ranking them from one to 22. Members of the coaching staff were asked to rank the 22 subjects in the same manner.

Performance on each of the strength variables was found to be significantly related to performance in the same variable during different data collection periods. Performance in the bench press was significantly related to performance in a modified Roger's Short Strength Index during each of the data collection periods. Significant relationships were found to exist between performance in the speed variable during each of the data collection periods. Speed was not significantly related to strength. Speed was significantly related to agility during the off-season data collection period. Significant relationships were found to exist between performance on the two agility drills during the off-season data collection period. Coaches ratings were significantly related to speed during each data collection period, and to agility drill #1 during the post-season, and to agility drill #2 during the off-season data collection period. Players ratings were significantly related to speed during the pre-season, and to agility drill #1 during the post-season data collection period. Significant relationships were found to exist between football ability as perceived by coaches and football ability as perceived by players.

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Name

Jeff Feltm

Date

May 17, 1976

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THE RELATIONSHIP OF SELECTED PHYSICAL
FACTORS TO FOOTBALL ABILITY

by

JEFFRY DANIEL FELTON

A thesis submitted in partial fulfillment
of the requirements for the degree

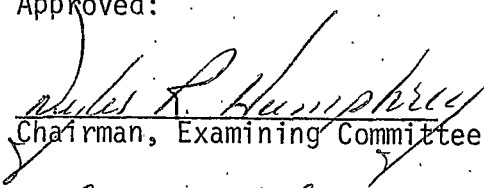
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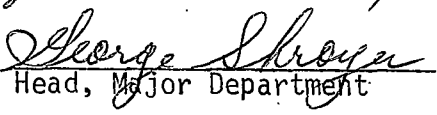
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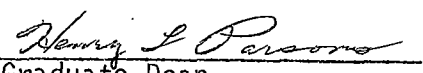
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Approved:


Chairman, Examining Committee


Head, Major Department


Graduate Dean

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ABSTRACT

The purpose of this study was to determine: (1) if a single variable of strength, speed, or agility is related to football ability as perceived by coaches and players; (2) if any relationships exist between the variables of strength, speed, and agility; and (3) if there is any relationship between football ability as perceived by coaches and football ability as perceived by players.

It was hypothesized that there would be no significant relationships between the variables of strength, speed, or agility, or between any of these variables and football ability as perceived by coaches or players. Twenty-two members of the 1975 Montana State University varsity football team were utilized as subjects.

To measure the strength factor, maximum efforts for each subject were collected in the bench press, leg press, and a modified Roger's Short Strength Index. Speed was measured by timing each subject in the 40 yard dash. Agility was measured by timing each subject on two different drills. Each subject was asked to evaluate the football playing ability of each of the other subjects by ranking them from one to 22. Members of the coaching staff were asked to rank the 22 subjects in the same manner.

Performance on each of the strength variables was found to be significantly related to performance in the same variable during different data collection periods. Performance in the bench press was significantly related to performance in a modified Roger's Short Strength Index during each of the data collection periods. Significant relationships were found to exist between performance in the speed variable during each of the data collection periods. Speed was not significantly related to strength. Speed was significantly related to agility during the off-season data collection period. Significant relationships were found to exist between performance on the two agility drills during the off-season data collection period. Coaches ratings were significantly related to speed during each data collection period, and to agility drill #1 during the post-season, and to agility drill #2 during the off-season data collection period. Players ratings were significantly related to speed during the pre-season, and to agility drill #1 during the post-season data collection period. Significant relationships were found to exist between football ability as perceived by coaches and football ability as perceived by players.

Chapter 1

INTRODUCTION

Numerous attempts have been made to identify the characteristics of outstanding football players. Football coaches have traditionally been concerned with size, strength, speed, and agility to assess potential football playing ability (Evans, 1972; Cegelski, 1975). This study was a further attempt to examine relationships between these factors and football ability.

Statement of the Problem

The purpose of this study was to investigate the relationships between the selected physical factors of strength, speed, and agility and their relationship to football ability as perceived by coaches and players. Specifically, an attempt was made to determine:

1. if a single variable of strength, speed, or agility is related to football ability as perceived by coaches and players,
2. if any relationships exist between the variables of strength, speed, and agility,
3. if there is any relationship between football ability as perceived by coaches and football ability as perceived by players.

Delimitations

Twenty-two members of the 1975 Montana State University varsity football team were utilized as subjects in this study. Five experimental variables included measurements of: (1) strength, (2) speed, (3) agility, and football ability as perceived by (4) coaches, and (5) players.

Limitations

The tests used to measure strength, speed, and agility were assumed to be valid and appropriate indicators of these factors (Holland, 1975). It was recognized that each coach's judgement regarding the football playing ability of individual players may have been influenced by preconceived ideas that the coach had about an individual's ability (Cronbach, 1960). No attempt was made to determine the degree of motivation or the level of fatigue affecting the subjects performance on tests of strength, speed, or agility. No consideration was given to the effect of somatotype on performance in the selected physical factors.

Definitions

Football playing ability. The ability to play football as perceived by coaches and players.

Strength. Overall body strength as measured by each subjects performance on the following physical tasks: (1) bench press, (2) leg

press, and (3) a modified Roger's Short Strength Index.

Speed. Timed running speed for 40 yards.

Agility. Ease and speed of movement in changing directions and positions of the body (Clarke, 1967).

Hypothesis

It was hypothesized that there would be no significant relationships between the variables of strength, speed, or agility, or between any of these variables and football ability as perceived by coaches or players.

Research Design

A quasi-experimental design was used for the collection of data. Generalizations based upon the results of this study can be applied only to the population involved. Internal validity was controlled by the investigator through consistency in the administration of testing procedures. External validity was questionable.

Statistical Analysis

Correlation coefficients were used to determine the degree of relationship between each of the variables studied. The probability of committing a Type 1 error was set at .05.

Justification of the Thesis

Of primary concern to football coaches today is the identification of factors which may be indicative of potential football playing ability. If the variables of strength, speed, and agility can be measured and used to enhance the prediction of performance in football, then the task of recruiting and selecting team personnel will be facilitated.

Chapter 2

REVIEW OF LITERATURE

Investigators in a number of studies of football ability have recognized that there are factors other than physical ability which are related to performance (Evans, 1972). These factors will not be discussed in this review of literature. The studies reviewed in this chapter have been included because of their relevance to this investigation. Most ability prediction studies have utilized white athletes as subjects (Evans, 1972). Several investigations have attempted to relate success in football to growth and development factors. A number of research findings have attempted to support the contention that football playing ability is related to performance on tests of motor fitness. Other studies have concerned themselves with the relationship of psychological or social factors to success in football. Therefore, this review of literature has been divided into the following categories:

1. Growth and Development Factors.
2. Motor Fitness Tests.
3. Sociometric Studies.

Growth and Development Factors

In separate investigations utilizing the Medford Boy's Growth Study, Shelly (1960), Wiley (1963), and Kelly (1969) made comparisons

of maturity, structure, physique, strength, intelligence, and motor characteristics among elementary, junior high, and high school athletes. The subjects were given a battery of tests to measure speed, strength, agility, and reaction time. Anthropometric measurements were taken, and a roentgenologic study was used to determine skeletal age. Shelly (1960) reported that outstanding young football players were found to be superior to others their own age in strength, maturity, and motor ability which contributed to their successful athletic performance. Outstanding young football players also tended to be taller and heavier than other athletes and non-participants their own age (Shelly, 1960; Wiley, 1963).

In a study which attempted to describe somatotypes of outstanding college football players, Carter (1968) found that these athletes were characterized by their height and weight, by high degrees of endomorphy and mesomorphy, and by a low degree of ectomorphy. He found significant size and somatotype differences among college football players at different levels of competition, and between backs and lineman. His findings appear to support those of earlier studies by Sheldon (1940), and DiGiovanna (1943), and suggests that certain somatotypes are well suited to achieve success in football.

Motor Fitness Tests

Clarke (1967) identified seven elements of motor fitness: (1) muscular strength, (2) muscular endurance, (3) cardiovascular endurance, (4) muscular power, (5) speed, (6) agility, and (7) balance. Investigators have attempted to relate performance on tests of motor fitness to football playing ability.

In an early study at Iowa State University, Miller (1936) attempted to determine the relationship of nineteen variables to football ability as determined by a subjective rating scale. Significant correlations were found between the subjective ratings of the players and player performance on several of the test variables.

In separate studies at Iowa State University, Brechler (1940) and Cormack (1940) compared the subjective ratings of high school football players and coaches with the results of a battery of tests designed to measure desirable attributes of high school football players. Significant correlations were found between the subjective ratings of players and coaches and player performance on several of the test items.

Brace (1943) investigated the validity of performance on football achievement tests as a partial basis for the selection of players at the University of Texas. He concluded that a battery of tests could be devised to assist the coach in the identification and selection of football players.

Wilhelm (1951) examined the relationship of certain measurable traits to success in football. He administered 44 tests to measure physical, mental, and visual traits of 65 college freshman football players and 65 non-football players. He identified 25 traits which distinguished the football players from the non-football players.

Among these traits were: (1) arm girth, (2) total body strength, (3) arm push, (4) calf girth, (5) weight, (6) power, (7) speed, and (8) agility. He concluded that successful football players were stronger and possessed greater speed and agility than non-successful football players.

Some investigators have attempted to relate football playing ability to the amount of time played in football games. Ellena (1959) studied the relationship of selected physiological factors to football performance at the University of California at Los Angeles. He concluded that speed and strength were significantly related to the time played in football games, and that the total number of minutes played was the best indicator of an individual's football playing ability. In another study at the University of Utah, Birch (1963) used nine motor performance tests to compare motor performance to the time played in intercollegiate football games. However, none of the test items were found to be significantly related to the time played in football games.

Thompson (1959) investigated the relationship of pre-season physical testing to post-season rank of selected high school football players. He administered the Roger's Strength Index, Cozens Agility Run, the 20 yard dash, and the California Mental Maturity Test to 24 high school football players. He reported a high correlation between the strength index and the coaches subjective evaluation of players. He concluded that the strength index was the best means for identifying potential football players as compared to the other test items.

Allen (1965) used the Cowell and Ismail Football Rating Scale to measure football ability and attempted to identify a common factor which contributed to football playing ability. His study is one of the few extensive studies on college football players which includes somatotype assessment (Carter, 1968). He analyzed test scores of 82 subjects on 44 experimental variables which included measures of: (1) physical factors, (2) motor ability factors, (3) strength factors, (4) psychological factors, and (5) body structural factors. He failed to isolate a common contributing factor, but found significant correlations between the factors of strength, speed, agility, and the standing long jump and football ability.

In another study to determine the effects of selected variables on performance in football, Norred (1966) studied the relationship of speed, agility, power, strength, scholastic aptitude and achievement, and personality needs to performance in college football. Thirty-one

members of the 1963 University of Alabama football team served as subjects. Player performance was graded, based upon the analysis of game films. The relationship of the independent variables to individual performance was then determined statistically. He concluded that the number of plays in which each subject participated was significantly related to the quality of his performance. No significant relationship between a single variable and football performance was identified. However, the faster athletes were also more agile and had greater arm strength and strength per pound than did the slower subjects.

Polychronis (1967) examined the relationship between tests of general motor ability and the coaches rankings of football ability at the University of Utah. Thirty-one freshman football players who were candidates for the varsity football team were tested in the 40 yard dash, the Sargent Jump Test, and the Illinois Agility Run prior to the start of spring practice. Coaches rankings of football ability were based upon the analysis of films of intrasquad games during the spring practice. Polychronis concluded that there were significant relationships between each of the test items and the coaches rankings of football ability, and stated that speed and agility were related to successful performance in football.

Price (1967) attempted to determine the relationship between the coaches subjective rankings of ability and scores achieved in

selected tests of strength, speed, and agility. One hundred and nine University of Washington football players were tested for arm strength, leg strength, speed, and agility. Total strength was determined by the composite of arm and leg strength. Players were evaluated only by the coach or coaches responsible for their specific position. Subjective evaluations made by the coaches indicated the rank order of players according to their offensive or defensive positions prior to the completion of spring practice. For purposes of comparison the players were divided into two groups. Group I consisted primarily of members of the first and second teams who would engage in the majority of playing time during the regular football season. Group II was comprised of the remaining players. Comparisons were also made between members of the following groups: (1) offensive backs, (2) offensive lineman, (3) defensive backs, (4) defensive lineman, and (5) combined groups. Price concluded that arm strength and agility were not significantly related to the coaches rankings of ability, and that overall body strength as indicated by total strength was essential to performance in football. Speed and leg strength were not found to be valid indicators for placing individual players by position in rank order. When positions were not involved and the requirement was only to assign players to Group I or Group II, speed and leg strength were significant factors.

A method for selecting players for positions was studied by Cooper (1967). Cooper listed 25 traits on a questionnaire that was sent to high school and college football coaches throughout the state of Oregon. A battery of tests was designed to measure each of the 14 traits rated most highly by coaches. These tests were administered to members of the Willamette Valley Conference high school all-star football team, and to members of a varsity football team from the same league. The test results of the all-stars and the varsity football players were compared by position. Strength, speed, and agility were three of the nine traits in which the performance of the all-star football players was found to be superior to that of the varsity football players.

Jordan (1970) investigated the influence of selected physical variables on the performance of quarterbacks in the Southern Conference during the 1969 football season. Seven quarterbacks were tested to determine their level of proficiency in regard to the following variables selected by major college coaches: (1) agility, (2) 40 yard dash, (3) vision, (4) quickness in running and throwing, (5) grip strength, and (6) the football throw for distance. The physical test measures were then correlated with the cumulative statistics compiled by each quarterback during that season. He concluded that the agility test, the 40 yard dash, and the football throw for distance were the best indicators of a quarterbacks potential for success in the Southern

Conference.

Sociometric Studies

Rhodes (1950) constructed a football classification index which consisted of a player's personal history index and a physical test index. The football classification index was administered to 685 high school football players. The results indicated that the subjective evaluation of players by their coaches was significantly related to player evaluation based upon the football classification index. He concluded that the traits necessary to be a successful high school football player were measurable to some degree.

Cowell and Ismail (1961) investigated the validity of a football ability rating scale in relation to social integration and academic ability at Purdue University. Forty-five freshman football players were utilized as subjects for this study. Each subject was rated by his teammates and coaches on the following characteristics: (1) condition, (2) aggressiveness, (3) team play, (4) attitude toward coaching, (5) ability at playing their position, (6) perseverance, (7) blocking, (8) tackling, and (9) football knowledge. Cowell and Ismail found that the social integration of the team increased according to the length of time the players played together, and was affected by the intense competition for places on the team. Football ability and academic ability were not found to be significantly related

to each other, but football ability was significantly related to social acceptance. A player's attitude toward coaching and his ability to play his position were recommended as criteria for the selection of football players. They concluded that there are significant relationships between the ratings of players by coaches and ratings by fellow players.

Salato (1961) examined the relationship between physical and social factors, athletic participation, and the selection of football players. He utilized the Cowell and Ismail Football Rating Scale and collected data on the personal distance and social behavior of 200 successful varsity football players from five Chicago Catholic high schools. He concluded that personal distance and social behavior were related to the selection of high school football players.

Schendel (1963) attempted to compare personality characteristics of athletes to those of non-athletes in the ninth grade, twelfth grade, and at the college level. Football was one of several team sports in which an attempt was made to identify differences. He concluded that specific differences do exist between the psychological characteristics of athletes and those of non-athletes. Little similarity was found between the differences which distinguished athletes from non-athletes at the different levels. Few differences in personality were found to exist between athletes who were rated as regulars, substitutes, or outstanding.

Berger and Littlefield (1969) compared the personalities of outstanding football players with those of non-athletes. Thirty subjects in each group were given the California Psychological Inventory. This study failed to identify any significant differences between the personality characteristics of outstanding football players and non-athletes.

Summary

The review of literature suggests that previous studies have failed to isolate a common physical factor related to football playing ability. Growth and development factors may be related to success in football at the elementary, junior high, and high school level. Certain somatotypes appear to be well suited to achieve success in football. Other studies support the contention that football playing ability is related to the time played in football games. Cumulative records and the analysis of game films have also been used to evaluate football playing ability. Several studies have been concerned with psychological and social factors as related to success in football. Cowell (1961) and others have found significant correlations between the ratings of players by coaches and ratings by fellow players. The review of literature appeared to support the contention that football playing ability is related to certain elements of motor fitness. In numerous studies, the tests used to enhance the prediction,

identification, and selection of potential football players have been based in part on various measurements of strength, speed, and agility. However, "the accurate prediction of successful football ability remains an unsolved problem in athletics today (Evans, 1972)."

Chapter 3

PROCEDURES

Twenty-two members of the 1975 Montana State University varsity football team were utilized in this study. Prior to the start of pre-season practice, each member of the coaching staff was asked to designate the 22 best football players on the team. These players were listed by each coach in rank order from one to 22 on the basis of football playing ability, and regardless of position. Based upon the composite score of the coaches evaluations, those 22 players with the lowest total score were designated as subjects.

Data Collection

Data was collected during each of three established data collection periods. The three data collection periods were designated as the post-season (November 5 to December 12, 1974), the off-season (January 15 to April 5, 1975), and the pre-season (August 18 to September 6, 1975). Subjects were required to perform the same tasks in an identical manner during each of the established collection periods. Subjects were clothed in gym shorts and T-shirts for all testing procedures. Football cleats were worn while testing speed and agility on a clay surface.

Each of the 22 subjects was asked to evaluate the football playing ability of each of the other subjects by ranking them from one

to 22. Members of the coaching staff were asked to rank the 22 subjects in the same manner. Previous studies by Cowell (1961) and others suggest that there are significant correlations between the ratings of players by coaches and ratings by fellow players. It should be noted that the personal distance of the subjects involved in this study was not examined. Personal distance refers to the degree of social acceptance or rejection within ones own group (Cowell, 1964). The personal distance of the subjects involved in this study may have influenced their ratings of one another.

To measure the strength factor, each subject was required to perform one maximum repetition of the bench press using a Universal Weight Machine during each collection period. Maximum efforts for each subject in the leg press were collected in the same manner during the post-season and off-season data collection periods. Testing in the leg press was limited to these collection periods due to the possibility of injury to the subjects near the start of the competitive season. A modified Roger's Short Strength Index was also administered during each collection period. Each subject was required to perform a maximum number of repetitions of pull-ups and a maximum number of bar dips. The strength index was then computed using the following formula:

$$P = \text{pull-ups}, D = \text{bar dips}, BW = \text{body weight}, H = \text{height}, \text{ and } SI = \text{strength index};$$

$$(P + D) \times \left(\frac{BW}{10} + (H - 60) \right) = SI.$$

The speed factor was measured by timing each subject in the 40 yard dash with the use of a hand held stopwatch. Subjects were started from a three point stance. Timing began with the subject's initial movement and ended when the subject's torso broke an imaginary plane at the finish. Each subject completed three tests during each data collection period. Means were computed for the three trials during each data collection period.

Agility was measured by timing each subject on two different agility drills with the use of a hand held stopwatch. Subjects were started from a three point stance. Timing began with the subject's initial movement and ended when the subject's torso broke an imaginary plane at the finish. Each subject completed two trials on each of the agility drills during the post-season and off-season data collection periods. Means were computed for the two trials on each agility drill during each collection period. Descriptions of the two agility drills used in this study will follow on pages 21 and 22.

Statistical Analysis

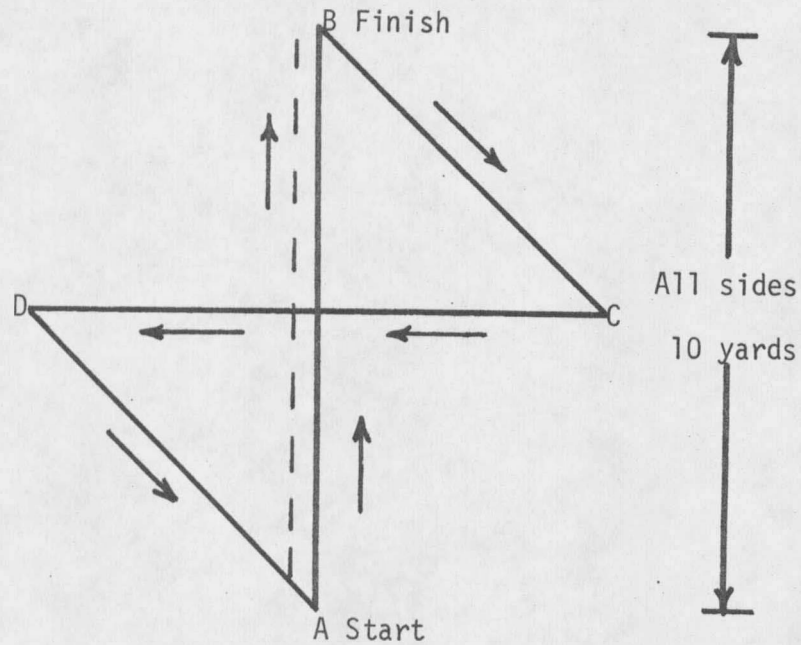
Correlation coefficients were used to make the following comparisons:

1. comparisons between the strength variables,
2. comparisons between the speed variables,
3. comparisons between the agility variables,

4. strength to the speed and agility variables,
5. speed to the strength and agility variables,
6. agility to the strength and speed variables,
7. coaches ratings to the strength, speed, and agility variables,
8. players ratings to the strength, speed, and agility variables,
9. coaches ratings to the players ratings.

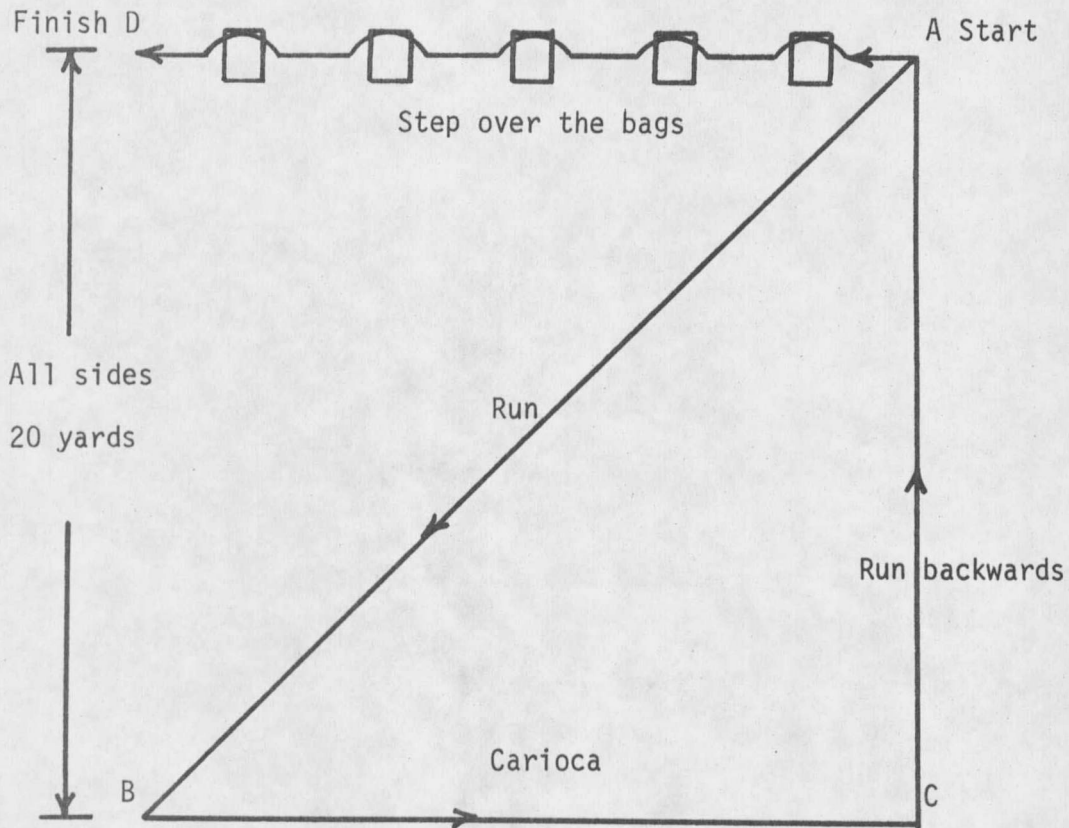
The results of these comparisons will be presented in Chapter 4.

Agility Drill #1



Subjects were instructed to run to each point as quickly as possible. Each subject started at point A and proceeded to points B, C, D, A, and back to point B to complete the test.

Agility Drill #2



Subjects were instructed to move to each point as quickly as possible. Each subject started at point A and ran to point B where he picked up a roll of tape. From point B to point C the subject moved laterally by doing the carioca, which involves a series of alternating front and rear lateral cross steps. At point C the subject picked up another roll of tape and ran backwards to point A. From point A the subject moved laterally to point D, stepping over the blocking dummies which lay in his path.

Chapter 4

ANALYSIS OF DATA

The purpose of this study was to investigate the relationships between the selected physical factors of strength, speed, and agility and their relationship to football ability as perceived by coaches and players. Correlation coefficients were used to make comparisons between the experimental variables utilizing data collected during three established data collection periods. The results of these comparisons are presented in tables and figures in this chapter. The N for each table is 22. Any correlation of .404 or greater indicates significance beyond the .05 level of confidence. For the purpose of constructing tables for this chapter, the following abbreviations were used. The post-season, off-season, and pre-season data collection periods will be designated by the words Post, Off, and Pre. BP refers to the bench press, LP refers to the leg press, and RSI refers to a modified Roger's Short Strength Index. A₁ refers to agility drill #1, and A₂ refers to agility drill #2.

Relationships Between Strength Variables

Strength was measured by testing each subject in the bench press, the leg press, and a modified Roger's Short Strength Index. Significant relationships were found to exist between performance in the bench press during each of the data collection periods.

Significant relationships were found to exist between performance in the leg press during the post-season and off-season data collection periods. Significant relationships were also found to exist between performance in a modified Roger's Short Strength Index during each of the data collection periods. Performance in the bench press was found to be significantly related to performance in the strength index during each of the data collection periods. Performance in the leg press was not significantly related to performance in the bench press or the strength index during any of the data collection periods. The results of these comparisons are presented in Table 1 on page 25.

Relationships Between Speed Variables

Speed was measured by timing each subject in the 40 yard dash. Significant relationships were found to exist between the results collected during each of the data collection periods. The results of these comparisons are presented in Table 2 on page 26.

Relationships Between Agility Variables

Agility was measured by timing each subject on two different agility drills. Performance on agility drill #1 during the post-season data collection period was not found to be significantly related to performance on the same drill during the off-season. Performance on agility drill #2 during the post-season data collection period was not found to be significantly related to performance on the same drill

Table 1

Relationships Between Strength Variables

		BP			LP		RSI		
Strength		Post	Off	Pre	Post	Off	Post	Off	Pre
BP	Post	X	.88*	.90*	.10	.18	.73*	.68*	.67*
	Off	.88*	X	.93*	.12	.16	.80*	.78*	.68*
	Pre	.90*	.93*	X	.12	.14	.84*	.81*	.69*
LP	Post	.10	.12	.12	X	.96*	.13	.04	.01
	Off	.18	.16	.14	.96*	X	.14	.02	.11
RSI	Post	.73*	.80*	.84*	.13	.14	X	.84*	.79*
	Off	.68*	.78*	.81*	.04	.02	.84*	X	.83*
	Pre	.67*	.68*	.69*	.01	.11	.79*	.83*	X

*Indicates significance beyond the .05 level of confidence.

Table 2
Relationships Between Speed Variables

Speed	Post	Off	Pre
40 yard dash			
Post	X	.90*	.84*
Off	.90*	X	.87*
Pre	.84*	.87*	X

*Indicates significance beyond the .05 level of confidence.

during the off-season. Performance on agility drill #1 during the post-season and the off-season data collection periods was found to be significantly related to performance on agility drill #2 during the off-season, but was not significantly related to performance on agility drill #2 during the post-season data collection period. The results of these comparisons are presented in Table 3.

Table 3
Relationships Between Agility Variables

		A ₁		A ₂	
Agility		Post	Off	Post	Off
A ₁	Post	X	.36	.37	.63*
	Off	.36	X	.40	.68*
A ₂	Post	.37	.40	X	.38
	Off	.63*	.68*	.38	X

*Indicates significance beyond the .05 level of confidence.

Relationship of Strength to Speed and Agility

Performance in the bench press, leg press, and a modified Roger's Short Strength Index was not significantly related to performance in the 40 yard dash during any of the data collection periods. Performance in the bench press during the post-season and off-season data collection periods was not significantly related to

performance on agility drill #1 or agility drill #2 during these same data collection periods. Performance in the bench press during the pre-season data collection period was significantly related to performance on agility drill #1 during the off-season, but was not significantly related to performance on this same agility drill during the post-season data collection period. Performance in the bench press during the pre-season data collection period was not significantly related to performance on agility drill #2 during the post-season or off-season data collection periods. Performance in the leg press was not significantly related to performance on agility drill #1 or agility drill #2 during any of the data collection periods. Performance in a modified Roger's Short Strength Index during the post-season and off-season data collection periods was not significantly related to performance on agility drill #1 during the post-season, or to agility drill #2 during the post-season or off-season data collection periods. Performance in the strength index during the post-season and off-season data collection periods was significantly related to performance on agility drill #1 during the off-season data collection period. Performance in the strength index during the pre-season data collection period was not significantly related to performance on agility drill #1 or agility drill #2 during the post-season or off-season data collection periods. The results of these comparisons are presented in Table 4 on page 29.

Table 4.

Relationship of Strength to Speed and Agility Variables

		40 yard dash			A ₁		A ₂	
Strength		Post	Off	Pre	Post	Off	Post	Off
BP	Post	.25	.09	.23	.25	.33	.27	.28
	Off	.27	.08	.22	.24	.31	.32	.22
	Pre	.30	.13	.25	.31	.44*	.36	.33
LP	Post	.26	.19	.18	.04	.00	.06	.14
	Off	.30	.26	.22	.00	.04	.04	.20
RSI	Post	.29	.01	.12	.21	.42*	.29	.23
	Off	.17	.04	.06	.14	.46*	.27	.14
	Pre	.04	.21	.01	.08	.26	.13	.06

*Indicates significance beyond the .05 level of confidence.

Relationship of Speed to Strength and Agility

Performance in the 40 yard dash was not found to be significantly related to performance in the bench press, leg press, or a modified Roger's Short Strength Index during any of the data collection periods. Performance in the 40 yard dash during the post-season and off-season data collection periods was found to be significantly related to performance on agility drill #1 and agility drill #2 during the off-season data collection period. However, it was not significantly related to performance on agility drill #1 or agility drill #2 during the post-season data collection period. Performance in the 40 yard dash during the pre-season data collection period was found to be significantly related to performance on agility drill #1 during both the post-season and off-season, and to agility drill #2 during the off-season data collection period. Performance in the 40 yard dash during the pre-season data collection period was not significantly related to performance on agility drill #2 during the post-season data collection period. The results of these comparisons are presented in Table 5 on page 31.

Relationship of Agility to Strength and Speed

Performance on agility drill #1 during the post-season data collection period was not significantly related to performance in the bench press during any of the data collection periods. Performance on

Table 5

Relationship of Speed to Strength and Agility Variables

	BP			LP		RSI			A ₁		A ₂	
Speed	Post	Off	Pre	Post	Off	Post	Off	Pre	Post	Off	Post	Off
40 yard dash time												
Post	.25	.27	.30	.26	.30	.29	.17	.04	.31	.51*	.10	.63*
Off	.09	.08	.13	.19	.26	.01	.04	.21	.36	.52*	.04	.70*
Pre	.23	.22	.25	.18	.22	.12	.06	.01	.44*	.60*	.14	.76*

*Indicates significance beyond the .05 level of confidence.

agility drill #1 during the off-season data collection period was not significantly related to performance in the bench press during the post-season or off-season, but was significantly related to performance in the bench press during the pre-season data collection period.

Performance on agility drill #2 during the post-season and off-season data collection periods was not significantly related to performance in the bench press during any of the data collection periods. Performance on agility drill #1 and agility drill #2 during the post-season and off-season data collection periods was not significantly related to performance in the leg press during any of the data collection periods. Performance on agility drill #1 during the post-season data collection period was not significantly related to performance in a modified Roger's Short Strength Index during any of the data collection periods. Performance on agility drill #1 during the off-season data collection period was significantly related to the strength index during the post-season and off-season, but was not significantly related during the pre-season data collection period. Performance on agility drill #2 during the post-season and off-season data collection periods was not significantly related to performance in the strength index during any of the data collection periods.

Performance on agility drill #1 and agility drill #2 during the post-season data collection period was not significantly related to performance in the 40 yard dash during the post-season or off-season

data collection periods. Performance on agility drill #1 and agility drill #2 during the off-season data collection period was found to be significantly related to performance in the 40 yard dash during each of the data collection periods. Performance on agility drill #1 during the post-season data collection period was found to be significantly related to performance in the 40 yard dash during the pre-season data collection period. Performance on agility drill #2 during the post-season data collection period was not significantly related to performance in the 40 yard dash during the pre-season. The results of these comparisons are presented in Table 6 on page 34.

Relationship of Coaches Ratings to Strength, Speed, and Agility

Prior to the start of pre-season practice, members of the football coaching staff at Montana State University ranked each of the subjects from one to 22 on the basis of football playing ability, regardless of position. The coaches ratings were not significantly related to performance in the bench press, leg press, or the modified Roger's Short Strength Index during any of the data collection periods. Coaches ratings were significantly related to performance in the 40 yard dash during each of the data collection periods. Coaches ratings were significantly related to performance on agility drill #1 during the post-season data collection period, and to performance on agility drill #2 during the off-season data collection period. Coaches ratings

Table 6

Relationship of Agility to Strength and Speed Variables

		BP			LP		RSI			40 yard dash		
Agility		Post	Off	Pre	Post	Off	Post	Off	Pre	Post	Off	Pre
A ₁	Post	.25	.24	.31	.04	.00	.21	.14	.08	.31	.36	.44*
	Off	.33	.31	.44*	.00	.04	.42*	.46*	.26	.51*	.52*	.60*
A ₂	Post	.27	.32	.36	.06	.04	.29	.27	.13	.10	.04	.14
	Off	.28	.22	.33	.14	.20	.23	.14	.06	.63*	.70*	.76*

*Indicates significance beyond the .05 level of confidence.

were not significantly related to performance on agility drill #1 during the off-season data collection period, or to performance on agility drill #2 during the post-season data collection period. The results of these comparisons are presented in Table 7 on page 36.

Relationship of Players Ratings to Strength, Speed, and Agility

Each of the subjects was asked to evaluate the football playing ability of each of the other subjects as well as themselves, by ranking them from one to 22. The players ratings were not significantly related to performance in the bench press, leg press, or the modified Roger's Short Strength Index during any of the data collection periods. Players ratings were not significantly related to performance in the 40 yard dash during the post-season and off-season data collection periods, but were significantly related to performance in the 40 yard dash during the pre-season data collection period. Players ratings were significantly related to performance on agility drill #1 during the post-season data collection period. Players ratings were not significantly related to performance on agility drill #1 during the off-season data collection period, or to performance on agility drill #2 during the post-season or off-season data collection periods. The results of these comparisons are presented in Table 8 on page 36.

Table 7
Relationship of Coaches Ratings to Strength, Speed, and Agility Variables

	BP			LP			RSI			40 yard dash			A ₁		A ₂	
	Post	Off	Pre	Post	Off	Pre	Post	Off	Pre	Post	Off	Pre	Post	Off	Post	Off
CR	.18	.33	.25	.07	.02	.17	.04	.16	.52*	.47*	.60*	.58*	.30	.28	.54*	

*Indicates significance beyond the .05 level of confidence.

Table 8
Relationship of Players Ratings to Strength, Speed, and Agility Variables

	BP			LP			RSI			40 yard dash			A ₁		A ₂	
	Post	Off	Pre	Post	Off	Pre	Post	Off	Pre	Post	Off	Pre	Post	Off	Post	Off
PR	.17	.17	.17	.08	.07	.15	.01	.01	.31	.17	.42*	.43*	.06	.18	.20	

*Indicates significance beyond the .05 level of confidence.

Relationship of Coaches Ratings to Players Ratings

Significant relationships were found to exist between football ability as perceived by coaches and football ability as perceived by players.

Discussion

Many investigations have shown a significant relationship between a single variable of strength, speed, or agility or a combination of these variables and football playing ability. The relationships which were found to exist between these variables in this study, and their relationship to football playing ability will be discussed individually.

Several studies have suggested that strength is essential to performance in football. The results of this study indicated that coaches ratings and players ratings were not significantly related to strength. Significant relationships were found to exist between performance in the bench press and performance in a modified Roger's Short Strength Index during each data collection period. However, performance in the leg press was not significantly related to performance in either the bench press or the strength index during any of the data collection periods. This may have been due to the fact that the leg press involved an entirely different muscle group than did the bench press or the strength index. If the bench press or a

modified Roger's Short Strength Index are assumed to be valid indicators of overall body strength, the results of this study show that the leg press was not.

Many coaches have suggested that strength is a prerequisite to speed (Holland, 1975). The results of this study indicated that strength was not significantly related to speed. This is contrary to the findings of several previous studies. If strength can be assumed to be a prerequisite to speed, then the measures of strength utilized in this study were not.

No significant relationships were found to exist between performance on agility drill #1 during different data collection periods. No significant relationships were found to exist between performance on agility drill #2 during different data collection periods. No significant relationships were found to exist between performance on the two agility drills except during the off-season data collection period. Speed was significantly related to agility during the off-season data collection period, but was not significantly related to agility during the post-season. Performance on agility drill #1 was found to be somewhat related to strength during the off-season data collection period. The lack of consistency in performance on the two agility drills suggests that these drills may not have been reliable indicators of agility. Therefore, very little emphasis can be placed on the significant relationships that these

drills had with the other physical parameters.

As indicated in previous studies by Cowell (1961) and others, significant relationships were found to exist between football ability as perceived by coaches and football ability as perceived by players. Coaches appeared to place a greater emphasis on speed in the evaluation of football ability than did the players. It is also interesting to note that the coaches ratings had a higher degree of relationship to each physical parameter than did the players ratings. The results of this study suggest that the determining factors upon which the coaches based their evaluations of football ability were different from those upon which the players based the evaluations of other players and themselves.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to investigate the relationships between the selected physical factors of strength, speed, and agility and their relationship to football ability as perceived by coaches and players. Specifically, an attempt was made to determine:

1. if a single variable of strength, speed, or agility is related to football ability as perceived by coaches and players,
2. if any relationships exist between the variables of strength, speed, and agility,
3. if there is any relationship between football ability as perceived by coaches and football ability as perceived by players.

It was hypothesized that there would be no significant relationships between the variables of strength, speed, or agility, or between any of these variables and football ability as perceived by coaches or players.

Twenty-two members of the 1975 Montana State University varsity football team were utilized as subjects in this study. Correlation coefficients were used to make comparisons between the five experimental variables. Data was collected during each of three established data collection periods which were designated as the

post-season, the off-season, and the pre-season.

To measure the strength factor, each subject was required to perform one maximum repetition in the bench press. Maximum efforts for each subject were also collected in the leg press, and a modified Roger's Short Strength Index was administered. The speed factor was measured by timing each subject in the 40 yard dash with the use of a hand held stopwatch. Agility was measured by timing each subject on two different agility drills with the use of a hand held stopwatch. Each of the 22 subjects was asked to evaluate the football playing ability of each of the other subjects by ranking them from one to 22. Members of the coaching staff were asked to rank the 22 subjects in the same manner.

Performance on each of the strength variables was found to be significantly related to performance in the same variable during different data collection periods. Performance in the bench press was significantly related to performance in a modified Roger's Short Strength Index during each of the data collection periods. Performance in the leg press was not significantly related to performance in the bench press or the strength index during any of the data collection periods. Significant relationships were found to exist between performance in the speed variable during each of the data collection periods. Speed was not significantly related to strength during any of the data collection periods. Speed was significantly related to

agility during the off-season data collection period. No significant relationships were found to exist between performance on the same agility drills during different data collection periods. Significant relationships were found to exist between performance on the two agility drills during the off-season data collection period. Coaches ratings were significantly related to speed during each of the data collection periods, and to agility drill #1 during the post-season, and to agility drill #2 during the off-season data collection period. Players ratings were significantly related to speed during the pre-season, and to agility drill #1 during the post-season data collection period. Significant relationships were found to exist between football ability as perceived by coaches and football ability as perceived by players.

Conclusions

The following conclusions were made based upon the results of this study.

1. Speed and agility were significantly related to the evaluation of football ability by coaches and players.
2. Strength was not significantly related to speed.
3. Agility was significantly related to strength and speed.
4. There were significant relationships between football ability as perceived by coaches and football ability as

perceived by players.

Recommendations

The following recommendations are made concerning further research on this topic.

1. More physical parameters should be included in order to ascertain which parameters if any are significantly related.
2. Different indicators of strength, speed, and agility should be utilized to verify or disprove the reliability of those used in this study.
3. The effect of personal distance on subjective evaluation should be considered by including a sociometric analysis in the comparisons.
4. A larger number of subjects could be utilized.
5. A composite index of physical parameters should be developed which could indicate if a relationship exists between football ability and the index.

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