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A STUDY OF THE EFFECTS OF A
PRE-SEASON ANKLE EXERCISE PROGRAM
ON THE PREVENTION OF ANKLE INJURIES
IN MICHIGAN HIGH SCHOOL BASKETBALL

Thesis for the Degree of M. A.
MICHIGAN STATE UNIVERSITY

Eugene N. Rhodes

1956

A STUDY OF THE EFFECTS OF A PRE-SEASON ANKLE EXERCISE
PROGRAM ON THE PREVENTION OF ANKLE INJURIES
IN MICHIGAN HIGH SCHOOL BASKETBALL

by

EUGENE N. RHODES

AN ABSTRACT OF A THESIS

Submitted to the College of Education of Michigan
State University of Agriculture and Applied
Science in partial fulfillment of the
requirements for the degree of

MASTER OF ARTS

Department of Health, Physical Education and Recreation

1956

Approved

Wayne D. Van Dine

ABSTRACT

TITLE A Study of the Effects of a Pre-Season Ankle Exercise Program on the Prevention of Ankle Injuries in Michigan High School Basketball.

STATEMENT OF THE PROBLEM To determine the effect of a pre-season ankle exercise program upon the incidence of ankle injuries among Michigan high school basketball players.

METHODOLOGY Twenty high school basketball teams of central Michigan, acting as an experimental group, were given an ankle exercise program to be incorporated within their pre-season practice itineraries. Twenty other schools, comparable to those of the experimental group in size and locality, composed a control group. Records of all ankle injuries, games missed due to ankle injuries, and practices missed due to ankle injuries were kept by each of the forty coaches. At the end of the season, these results were compared statistically by use of a "t" test.

CONCLUSIONS The utilization of an ankle exercise program by the experimental group significantly decreased the number of ankle injuries, number of games missed due to ankle injuries, and number of practices missed due to ankle injuries.

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PREFACE

This study is an investigation of the effects of a pre-season ankle exercise program on the incidence of ankle injuries in Michigan high school basketball. The data were collected from forty central Michigan high school varsity basketball teams during the 1955-56 season.

Although the ankle injury is generally conceded the most frequent injury in basketball, little has been done in search for a definite means of prevention. Authors, trainers, and coaches alike have all voiced their opinions; these theories, however, tend to contradict one another. The writer believes this study will help the high school coach in his attempt to prevent ankle injuries among his basketball players.

Grateful acknowledgment is extended to my advisor, Dr. Wayne D. Van Huss, Associate Professor of Health, Physical Education and Recreation, for the professional guidance and patient counsel rendered in this study.

The writer extends gratitude to the twenty coaches who altered practice itineraries in order to take part in this study. Special thanks is likewise given to the twenty other coaches who recorded essential data.

The author is deeply indebted to his wife, Ginger, for her valuable assistance in the final preparation of this study.

Eugene N. Rhodes

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CHAPTER I

INTRODUCTION OF THE PROBLEM

Attendance figures exceeding those of any other sport attest to the fact that basketball is one of the most popular sports in our country today. In nearly every high school in Michigan, this game is played on the varsity and/or intramural level. Participation being so great, the incidence of injury, especially those classified as "minor," is high. The most prevalent of all minor injuries is the ankle injury;¹ therefore, some method of preventing or minimizing ankle injuries is needed.

I. THE PROBLEM

Statement of the problem. To determine the effect of a pre-season ankle exercise program on the incidence of ankle injuries among high school basketball players.

The need for this study. To maintain the high level of participation that is enjoyed by basketball today, it is becoming necessary to decrease the number of injuries incurred. Regarding prevention of ankle injuries, several theories, many

¹J. Gallagher, "Athletic Injuries Among Adolescents," Research Quarterly, 19:198-214, 1948.

conflicting in nature, have been presented in literature throughout the years. The most popular argument is whether or not the wearing of ankle wraps and/or tape decreases the number of ankle injuries. Ochsenhirt² has found that adolescents in basketball, baseball, and football have shown a reduction in ankle injuries by use of pre-season progressive resistance exercises. Equipment essential to the propagation of a progressive resistance exercise program, however, is foreign to most high school coaches due to the initial expense involved. Few athletic budgets are elastic enough to permit the coach to buy the material needed. For this reason, the author is attempting to evaluate the effects of an ankle exercise program given as part of the pre-season physical conditioning program utilized by the coach.

The source of data. The first twelve members of forty central Michigan high school basketball teams in the general area of Grand Rapids to Flint and Leslie to Alma served as subjects.

Limitations of the study. Although the results of this study are conclusive in nature, there are some limitations.

²N. C. Ochsenhirt and others, "Prevention and Management of Athletic Disabilities," Archives of Physical Medicine, 34:158, March, 1953.

In establishing the program with the experimental group, it was necessary for the author to accept the word of the coaches that they followed the program as outlined and that their injury reports were accurate. Any deviations by these coaches after the practice sessions were underway could not be controlled by the author.

Drills utilized by coaches of the control group for other purposes could have overlapped on the experimental group's exercises and biased the data.

II. DEFINITIONS OF TERMS USED

Ankle injury. Any injury to the ankle, with the exception of fracture, that is temporarily disabling, e.g., sprains, strains, torn ligaments and dislocations.

Game missed. Any game in which the boy was unable to manipulate at top speed due to an ankle injury.

Practice missed. Any practice in which the boy was unable to manipulate at top speed due to an ankle injury.

CHAPTER II

REVIEW OF LITERATURE

Basketball, whether played on the varsity or intramural level, serves as an excellent avenue of escape for excessive physical energy stored up by high school children. Unfortunately, however, a marked increase in participation usually means an increase in the number of injuries. Regarding the susceptibility of the adolescent to injury, Stevens states:

The adolescent years are fruitful yet dangerous for the athlete. The structure of his body is developing, but has not reached physical maturity. For example, long bones are more susceptible to fractures, epiphyseal separations, dislocations, etc. The judgment of a qualified roentgenologist is necessary to discover defects not seen by those inexperienced in x-ray evaluation. Frequently, young tissues, although fresh, virile, and flexible, have neither matured nor been trained sufficiently to develop tensile strength so necessary for the stresses they must withstand.¹

Gallagher,² in a seven year study of athletic injuries among adolescents, found the ankle sprain to be the most common basketball injury. Of 28 basketball injuries, 3 were classified as major and 25 as minor, major injuries being

¹Marvin Alan Stevens and Winthrop Morgan Phelps, The Control of Football Injuries (New York: A. S. Barnes and Company, 1933), p. 10.

²J. Gallagher and Thomas L. Delorme, "The Use and Techniques of Progressive Resistance Exercises in Adolescence," Journal of Bone and Joint Surgery, 31-A:847, 1949.

defined as those causing an absence of ten or more days from participation in athletics. Of the total 28 injuries, ankle sprains constituted 15.

Many a coach has had the illusion of an undefeated season shattered when two nights before the first game, his star forward suffers a severely twisted ankle in practice. Thorndike³ believes that once an ankle is sprained it never fully regains its previous strength. The occurrence of every ankle injury in basketball is therefore accompanied by the fact that the recipient possibly will not be able to play at "full speed" for the remainder of the season. Consequently, it is necessary that some means of decreasing the number of ankle injuries in high school basketball be found.

Literature on prevention of ankle injuries. Several contradictory theories regarding the prevention of ankle injuries have been presented, the most common of these concerning the use of ankle wraps and tape. Meanwell⁴ feels that ankle wraps should be worn both during practice and during games. Heppinstall⁵ and other trainers and coaches seem to

³Augustus Thorndike, Athletic Injuries (second edition; Philadelphia: Lea and Febiger, 1942), p. 132.

⁴Walter E. Meanwell and Knute K. Rockne, Training, Conditioning and the Care of Injuries (New York: Copyright by Walter Meanwell, 1931), p. 121.

⁵John G. Heppinstall, Athletic Trainer, Michigan State University.

concur; however, many of their counterparts are of the opinion that continual use of wraps tends to weaken the ankle.

Other writers believe that the use of tape is better than wraps. Hanson⁶ states that taping the ankle will decrease the incidence of sprain; whereas Thorndike,⁷ one of those who does not agree, says that taping of normal joints is not desirable, provided certain definite joint tone exercises are carried out in the early training season.

Whether or not to wrap the ankle remains largely a matter of individual choice, with the concensus of opinion being split fairly evenly in both directions.

Literature on strengthening the ankle. Most authors believe the strength of the ankle can be increased by following a program of stretching exercises. Ochsenhirt⁸ has found that adolescents in basketball, baseball, and football have shown a reduction in ankle injuries by use of pre-season progressive resistance exercises. Regarding stretching muscles in a strengthening program, Delorme, outstanding in the study

⁶W. A. Hanson and G. W. Hauser, "Common Injuries Associated with Football at the University of Minnesota," Minnesota Medicine, 28:755, September, 1945.

⁷Thorndike, loc. cit.

⁸N. C. Ochsenhirt and others, "Prevention and Management of Athletic Disabilities," Archives of Physical Medicine, 34:158, March, 1953.

of progressive resistance exercises, states:

The loads to be overcome when performing progressive resistance exercises may stretch the muscles concerned beyond their normal resting length. This is advantageous. It has long been known that skeletal muscles develop greater force after being previously stretched. Their elasticity appears to be sufficiently high to resist tearing by loads capable of being lifted under the conditions specified in the technique of application. Trauma of this type is never observed in properly administered progressive resistance exercises.⁹

Delorme also lists four ankle-strengthening exercises in a progressive resistance exercise program. These are:

1. Load resisting dorsiflexor exercise.
2. Load resisting plantar flexor exercise.
3. Load resisting evertor exercise.
4. Load resisting invertor exercise.¹⁰

⁹Thomas L. Delorme and Arthur L. Watkins, Progressive Resistance Exercise (New York: Appleton-Century-Crofts, Inc., 1951), p. 6.

¹⁰Delorme, op. cit., p. 10.

CHAPTER III

METHODOLOGY

The relative merits of a pre-season ankle exercise program in the prevention of ankle injuries in Michigan high school basketball is being determined in this study. An experimental group and a control group of twenty teams each have been established, the former being given an ankle exercise program¹ to be incorporated within their respective daily practice itineraries. Records of all ankle injuries, number of games missed, and number of practices missed were kept by the coaches of all forty teams. A "t" test correlating the tabulated data of both groups was run to check the validity of the program.

The sample. The first twelve members of forty central Michigan high school varsity basketball teams constituted the source of data. These teams, twenty of which composed an experimental group, were picked from an area of Michigan from Grand Rapids to Flint and Leslie to Alma.

The teams of the groups were matched as nearly as possible as to school enrollments. For every school with an enrollment of 325 students or over placed in one group, a

¹Ankle Exercise Program, Appendix A.

similar school was placed in the other. The same held true for schools with enrollments of fewer than 325 students.

The teams were also matched as to locale. A school, for example, from the Flint area placed in the experimental group was matched by a Flint area school placed in the control group.

Orientation of subjects. A personal interview was held with each of the twenty coaches of the experimental group teams five weeks before the first scheduled basketball game. At this time, the program and study was thoroughly explained and any questions were answered. If a coach felt that he could not fully comply with the program, he was not included in the group. However, not one of the coaches refused.

Approximately three weeks after the start of practice, twenty more teams, comparable in size and locality to those of the first group, were chosen as the control group. Letters² were sent to the coaches of these teams asking if they would record the ankle injuries incurred by their respective teams. A stamped self-addressed post card was included for their reply. No refusals were encountered, thereby eliminating the necessity of a substitute.

²Letter 1, Appendix B.

Recording of data. Record sheets³ on which to record the injured boy's name, number of practices missed, number of games missed, and type of injury were issued to the forty coaches. These sheets were of such a nature that they could easily be posted and kept up-to-date. As each injury occurred it was immediately recorded so as to eliminate forgetting any injury.

At the end of the season, a letter⁴ was sent to each of the forty coaches, requesting them to submit their report sheets and any questions regarding the data. Only one coach wrote that he had questionable information; he was visited by the author and the proper data was subsequently derived.

After all data was collected, the author had a personal interview with ten coaches from each group. The information obtained from each of these interviews substantiated the data recorded on the report sheets.

Statistical procedure. After the record sheets were obtained, the number of injuries, practices missed, and games missed were tabulated for each group.⁵ The results of these two groups were then correlated by means of a "t" test.

³Record Sheet, Appendix C.

⁴Letter 2, Appendix B.

⁵Tabulation Sheet, Appendix D.

CHAPTER IV

ANALYSIS OF THE DATA

The preceding chapters have dealt with the statement and purpose of the problem, the need for the study, related literature, and the methods used in accumulating the data.

This chapter will reveal the results of the study as indicated by the procedure described in Chapter III.

Table and chart contents. The tabulation of all data of each team in the study is shown in the Tabulation Sheet, Appendix D. A final compilation of the number of ankle injuries, number of games missed due to ankle injuries, and number of practices missed due to ankle injuries for each group is indicated in the table. In Chart I,¹ the significance of all three variables is demonstrated.

Number of ankle injuries. The number of ankle injuries suffered by the control group exceeded those of the experimental group by 52 to 40. The "t" of 2.160 indicates this to be significant at the five per cent level.

Number of games missed due to ankle injuries. The number of games missed by the control group exceeded those

¹Chart I, page 13.

missed by the experimental group by 35 to 15. The "t" of 2.292 indicates significance at the five per cent level.

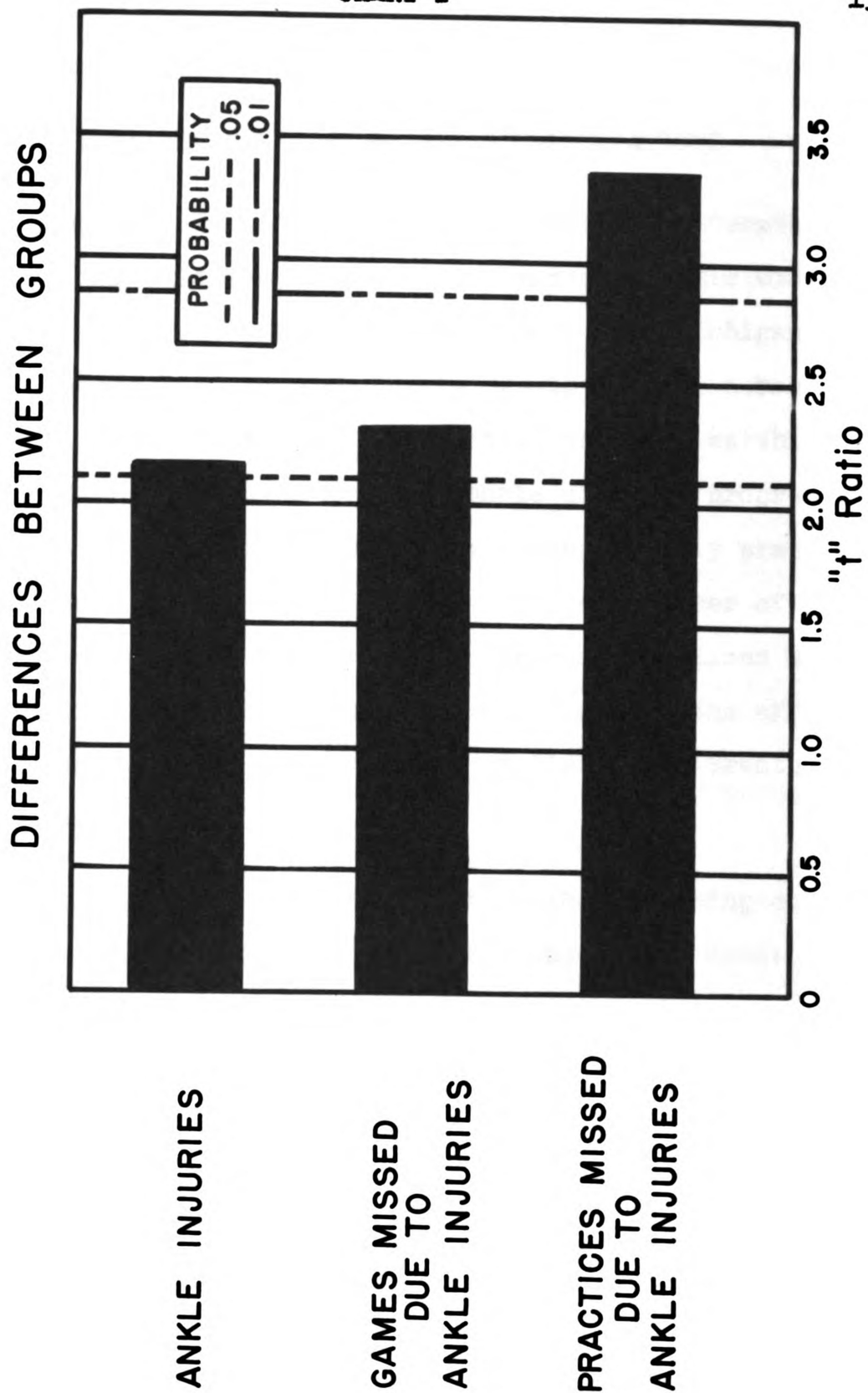
Number of practices missed due to ankle injuries.

Chart I² indicates the control group missed 154 practices due to ankle injuries whereas the experimental group missed only 76. This is shown to be significant at the one per cent level by a "t" of 3.356.

General discussion. The above data indicate that by deviating only slightly from his original practice itinerary, a basketball coach may utilize a pre-season ankle exercise program that will significantly decrease the number of ankle injuries suffered by his teams throughout the season. It is also demonstrated that a team using this prescribed program will miss significantly fewer games and practices than the team without the program. In essence, the utilization of this ankle exercise program indicates the coach will have more boys available for full-time duty.

²Ibid.

CHART I



CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary. In this study, the author has attempted to determine the relative merits of a pre-season ankle exercise program in the prevention of ankle injuries in Michigan high school basketball. An experimental group and a control group of twenty high school basketball teams each were established. The experimental variable was the ankle exercise program incorporated within the experimental group's daily practice itineraries. Records of all ankle injuries, number of games missed due to ankle injuries, and number of practices missed due to ankle injuries were maintained. To test the effectiveness of the program, the data were statistically treated using the "t" test.

Conclusions. From the results, the following conclusions may be drawn within the limitations of the data:

1. The use of a pre-season ankle exercise program decreased the number of ankle injuries. The subjects of the control group suffered 52 ankle injuries whereas those of the experimental group had 40. ("t" = 2.160; significant at the five per cent level with 19 df)
2. The use of a pre-season ankle exercise program decreased the number of games missed due to ankle injuries.

35 games were missed by the control group; 15 were missed by the experimental group. ($t = 2.292$; significant at the five per cent level with 19 df)

3. The use of a pre-season ankle exercise program decreased the number of practices missed due to ankle injuries. The control subjects missed 148 practices; the experimental subjects missed 76. ($t = 3.356$; significant at the one per cent level with 19 df)

Recommendations.

1. It is recommended that this study be repeated for a period of three years.

2. It is recommended that the study be repeated on a larger number of subjects.

3. It is recommended that this study be repeated on subjects from a different, more diversified area.

4. It is recommended that a study on the correlation of ankle strength and ankle injury incidence be run.

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APPENDIXES

APPENDIX A, ANKLE EXERCISE PROGRAM

In the construction of an ankle exercise program, the following two questions must be answered:

1. Do the exercises sufficiently stretch the ankles in the manner intended?
2. Are the exercises of such a nature that they can be incorporated within each coach's pre-season physical conditioning itinerary without requiring additional time for administration?

In order to answer "Yes" to these questions the author used the following two exercises as the constituents of his program:

1. Defensive drill exercise. The defensive drill is designed to improve footwork and to condition the arms, feet, forelegs, and ankles. In this drill, a designated person (usually the coach) calls out, "Forward, rear, right, left," in any sequence he desires. The players, alined three deep and ten feet apart, are in a defensive position (hands up, feet spread, knees flexed), sliding in the direction called out by the coach. At the end of five minutes, the drill is momentarily interrupted as the player "changes hands"; for example, if he has used his right hand as the lead hand (up in the air),

he changes to his left for the remaining five minutes. This is done mostly to prevent excessive tiring of the arms.

To make this drill a little more realistic, a boy sometimes dribbles a ball in front of the group. As the boy, facing the group, dribbles to his right, the group slides to its left, much as if they were actually playing defense against the dribbler. (This will also give the coach an added opportunity to correct defensive mistakes, such as crossing the feet.)

2. Ankle exercise. The second part of the program has the group responding to the coach once more as he calls out "Up, back, out, in." This time the group is in a stationary position, going up on its toes on the command of "Up," back on its heels on "Back," bending outward as far as possible on "Out," and bending inward on the command "In."

It was suggested to the experimental group coaches that the above exercises be given out-of-doors the first couple of weeks of the training season, using a cinder track or school-yard on which to run. This is preferred due to the "give" in the surface, permitting a gradual conditioning of the legs. "Shin-splints" result quite often from working on a hard

surface too early in the season.

Administration of the program. One week before the beginning of practice each coach of the experimental group was thoroughly oriented in the administration of the program. In turn, the coaches were entrusted to incorporate the exercises into their daily practice sessions. The duration of the ankle exercise program was daily for the first four weeks of the training season.

APPENDIX B, LETTER 1

Michigan State University
East Lansing, Michigan
November 20, 1955

Mr. Ted Dauer
Everett High School
3426 S. Cedar
Lansing, Michigan

Dear Coach:

This fall I have been doing research work on the occurrence of ankle injuries in Michigan high school basketball. To make this study complete, it is necessary to obtain from several high schools throughout the state a report of the number of injuries, type of injuries, games missed, and practice sessions missed by members of their basketball teams.

I hope you will consent to keep the included reports up to date during the season. At the conclusion of the basketball year, I will send for or pick up these reports personally.

The injury report sheet is self-explanatory with an example given. Any time a member of your varsity squad (first twelve men) cannot go full speed due to some ankle injury, it is to be regarded as time lost and should be recorded.

Enclosed, also, is a post card which I would like to have returned as soon as possible. Please feel free to jot down any questions you may have along with the information already on the card.

Thank you very much for your cooperation and good luck throughout the basketball year.

Sincerely,

Gene Rhodes

2 Encl.

APPENDIX B, LETTER 2

Michigan State University
East Lansing, Michigan
March 15, 1956

Mr. John Richard
Durand High School
Durand, Michigan

Dear Coach:

A few months ago when I first contacted you in regard to recording the ankle injuries of your basketball team, I had anticipated picking up the data personally at the end of the season. However, I find it impossible to do this and consequently must ask you to mail me the information as soon as possible.

Included with this letter will be a stamped self-addressed envelope within which I'd like you to enclose the blue report sheet I sent earlier. Please include any questions you may have regarding the data. A copy of the final tabulation of my results will be forwarded to you in approximately six weeks.

Hoping you had a successful season, I once again want to thank you very much for taking part in this project.

Sincerely,

Gene Rhodes

1 Encl.

APPENDIX C, RECORD SHEET

[illegible]

TABULATION SHEET

DATE OF TABULATION

TOPIC ANILE INJURIES; GAMES & PRACTICES MISSED

TRANSLATED BY
Eugene N. Rhodes[illegible]

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