ATHLETIC TRAINING

THE JOURNAL OF THE NATIONAL ATHLETIC TRAINERS ASSOCIATION

VOLUME 7
NUMBER 6
DECEMBER 1972

IN THIS ISSUE:

Microbicidal power

Microbicidal power of a BETADINE antiseptic was used in Apollo 11/12 Splashdowns

For effective decontamination of water in whirlpool baths

The same broad-spectrum microbicidal power which was used in decontamination procedures after Apollo 11/12 Splashdowns is available in BETADINE Whirlpool Concentrate.

BETADINE Whirlpool Concentrate promptly reduces bacterial contamination of water in whirlpool baths and tanks before and during physical therapy procedures... kills microorganisms in the bath, including *Pseudomonas* strains, *E. coli* and staphylococci.

Virtually nonstinging, nonirritating and nonstaining to skin, mucous membranes, and to natural fabrics, BETADINE Whirlpool Concentrate substantially provides the efficacy of iodine without its drawbacks. It is also economical to use. As a rule, one fluid ounce of BETADINE Whirlpool Concentrate disinfects about 20 gallons of water.

Supplied: One (1) gallon. Also available: Dilution chart giving specific amounts for various tank sizes.

Purdue Frederick
The Purdue Frederick Company, Yonkers, New York 10701

The score is 9 to 1 in favor of Tinactin® when doctors prescribe for athlete's foot.

Until recently Tinactin was available on prescription only.

Now you can use and recommend the athlete's foot product that has both proven efficacy and proven safety.

Here's why doctors prefer TINACTIN:

TINACTIN Cream—actually kills most athlete's foot fungi, is also effective against jock itch and ringworm of the body.

- Begins to relieve itching, burning, and soreness in 24 hours
- Clears lesions, usually in 2 or 3 weeks
- Does not usually sting or irritate
- Odorless and nonstaining

TINACTIN Powder Aerosol—helps prevent athlete's foot reinfection.

- Cooling and soothing
- Aids drying of naturally moist areas

The TINACTIN team offers almost complete protection against athlete's foot—TINACTIN Cream clears the infection...TINACTIN Powder Aerosol helps prevent reinfection.

Schering

Tinactin®

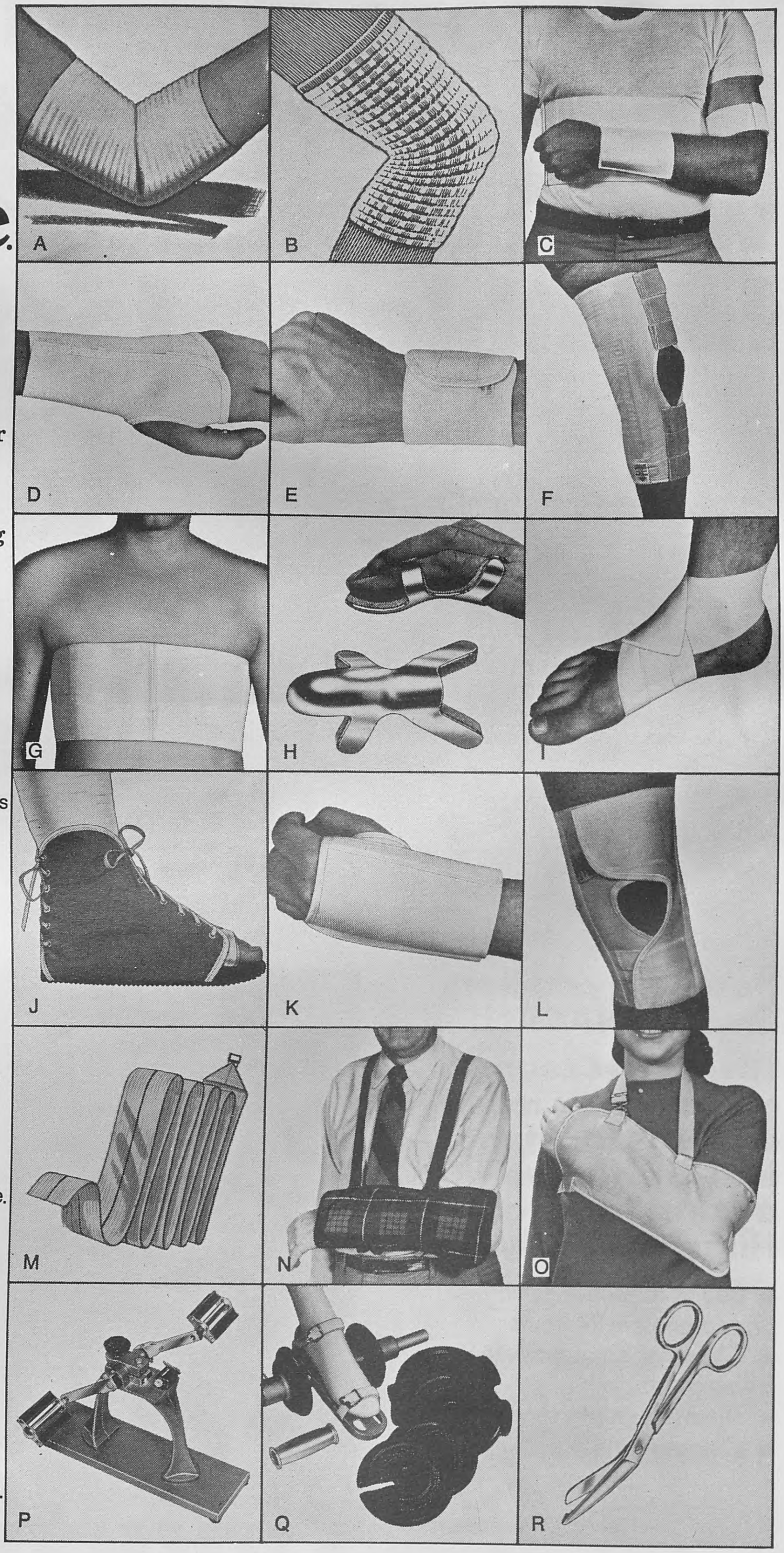
brand of tolnaftate, U.S.P., 1%

Now available without prescription for your use and recommendation.

Schering Laboratories, Kenilworth, New Jersey 07033.

SLR-009

You care. And so do we.



Orthopedic Equipment Company has been making equipment and supplies for the prevention and correction of orthopedic damage for many years. Our skills and experience have enabled us to develop a wide range of items which can be of significant help in preventing, minimizing, and correcting damage to the athletes in your care. Write us today for price and delivery information about the OEC items shown here.

A. **Tubigrip**—The elasticized tubular bandage. Strong latex yarns, doubly covered with cotton. Ideal for joint protection.

B. **Arthro-Pad**—Joint support with double thickness of Tubigrip and foam lining.

C. **Raymond Shoulder Immobilizer**—8″; made of highest-quality elastic with Velcro closure.

D. **Elastic Wrist Support**—Universal size. 2½″ adjustment, with Velcro closure. Right or left.

E. **Elastic Wristlet**—Universal size, 2½″ adjustment. Velcro closure.

F. **Knee Support**—With posterior stays. Velcro closure.

G. **Deluxe Rib Belt**—Flexible stays, darted for anatomical form fitting; 6″; highest-quality elastic. Velcro closure.

H. **Redi-Around**—The handy finger splint. Malleable extenders eliminate adhesives. Aluminum and foam padded.

I. **Ankle Support**—Heavy elastic with Velcro closure. 3″; unstretched lengths 20″, 19″, 18″, and 16″.

J. **Orthopedic Fracture Walker**—For cast applications or post-operative surgery. One of many advantages is no trouser slitting necessary for use.

K. **Elastic Wrist Band Support**—With malleable aluminum stays, and Velcro closure. Right or left.

L. **Elastic Knee Support**—With flexible medial/lateral stays. Velcro closure.

M. **Blue Line Bandages**—Elastic webbing. Unique blue guide line for self-bandaging.

N. **Arm Slings**—Popular standard and plaid models. Also available in cradle, single-strap plaid, and disposable models.

O. **Velpeau Shoulder Dressing**—Slide buckle adjustment provides for positioning various degrees of adduction to horizontal.

P. **Ped-L-Exerciser**—Portable with resistance adjuster and counter.

Q. **Rx-Dumbbell**—Combinations for exercising muscles and joints.

R. **Medl Bandage Scissor**—5½″ size cuts six layers of stockinette, 7¼″ cuts eight layers. Stainless steel.

OEC

Orthopedic Equipment Company, Inc.
Bourbon, Indiana 46504

ATHLETIC TRAINING

THE JOURNAL OF THE NATIONAL ATHLETIC TRAINERS ASSOCIATION

VOLUME 7 NUMBER 6 DECEMBER 1972

Athletic Training is published in the months of March, April, June, September, October, December by the National Athletic Trainers Association, a non-profit organization.

Second class postage paid at Lafayette, Indiana 47904, and additional mailing offices. Address correction requested: Send Form 3579 to 3315 South Street, Lafayette, Indiana 47904.

The views and opinions expressed in *Athletic Training* are those of the author and not necessarily those of the National Athletic Trainers Association.

Nonmember subscriptions are available at $6.00 per year and may be obtained by writing to 3315 South Street, Lafayette, Indiana 47904.

CHANGE OF ADDRESS may be made by sending old address and new address with zip code number. Instructions should state whether change is temporary or permanent. Allow thirty days for changeover. Address changes should be sent to 3315 South Street, Lafayette, Indiana 47904.

SUBMITTING MANUSCRIPTS—Information concerning manuscripts for publication in the Journal appears under "Guide for Contributors," page 104 of the June issue.

ADVERTISING—Although advertising is screened, acceptance of the advertisement does not necessarily imply NATA endorsement of the product or the views expressed. Advertising rates available on request, 3315 South Street, Lafayette, Indiana 47904.

THE NATIONAL ATHLETIC TRAINERS ASSOCIATION

President
Robert Gunn
Houston Oilers
P.O. Box 1516
Houston, Texas 77001

Executive Director
Otho Davis
Baltimore Colts
600 North Howard Street
Baltimore, Maryland 21201

BOARD OF DIRECTORS

Dist. 1 Frank George
Brown University
Providence, Rhode Island 02912

Dist. 2 Francis J. Sheridan (*Vice President*)
Lafayette College
Easton, Pa. 18042

Dist. 3 Joseph Gieck
University of Virginia
Charlottesville, Va. 22903

Dist. 4 Roland E. "Duke" La Rue
Western Illinois University
Macomb, Illinois, 61455

Dist. 5 Byron J. Bird
Oklahoma State University
Stillwater, Oklahoma 74074

Dist. 6 Eddie Lane
Southern Methodist University
Dallas, Texas 75222

Dist. 7 Rodney Kimball
Brigham Young University
Provo, Utah 84601

Dist. 8 Lewis C. Crowl
5207 J Street
Sacramento, California 95827

Dist. 9 Warren Morris
University of Georgia
Athens, Georgia 30601

Dist. 10 Sayers "Bud" Miller
University of Washington
Seattle, Washington 98105

DISTRICT SECRETARIES

Dist. 1 Joseph Abraham
Hobart College
Geneva, New York 14456

Dist. 2 Joseph Abraham
Hobart College
Geneva, New York 14456

Dist. 3 Craig Lewellyn
The Citadel
Charleston, South Carolina 29409

Dist. 4 Charles "Skip" Vosler
Ohio University
Athens, Ohio 45701

Dist. 5 Bill Flentje
University of Missouri at Rolla
Rolla, Missouri

Dist. 6 James Dodson
Midland High School
Midland, Texas 79701

Dist. 7 Warren H. Lee
University of Arizona
Tucson, Arizona 85721

Dist. 8 Tom Little
Chico State College
Chico, California 95926

Dist. 9 Steve Moore
Tennessee Technological University
Cookeville, Tennessee 38501

Dist. 10 John Andersen
University of Washington
Seattle, Wash. 98195

COMMITTEE CHAIRMEN

Audio-Visual Aids—Dick Hoover
Certification—Lindsy McLean
Drug Education—Al Hart
Ethics—L. F. "Tow" Diehm
Grants and Scholarships—W. E. "Pinky" Newell
Honor Awards—George Sullivan
Journal—Clyde Stretch
Membership—Bruce Melin
National Convention—Fred Hoover
Placement—A. G. Edwards
Professional Education—Sayers "Bud" Miller
Sub-Committee for Graduate and Continuing Education—Gary Delforge
Public Relations—Dick Malacrea
Recruitment—Mel Blickenstaff
Research and Injury—Gordon Graham

The Physiology of Ice Hockey[1]

H. L. GREEN
Assistant Professor
Department of Kinesiology
University of Waterloo

INTRODUCTION

For many of us, ice hockey has some very special appeal. For some, the appeal may be in simply observing the coordinated interactions of twelve players, each with a specific responsibility, expertly carrying out the complex skills of the game. This appreciation may be further heightened when it is realized that this seemingly disorganized behavior is being conducted at speeds approaching 30 miles per hour in a space barely one-quarter the size of a football field. Others may find special excitement in admiring the agile, precise coordinations of a player; stopping almost instantaneously, turning and quickly accelerating to top speed, with barely a hint of unbalance or instability. For others, special magnetism may eminate from the collisions that occur; with the boards, the nets and other players, producing the constant threat of serious injury. For still others, the beauty of a favorite team completing a series of well conducted plays, climaxed by the scoring of a goal, may be the stimulus triggering wild enthusiasm.

For the person consumed with a passion for exercise physiology, however, the excitement comes not only from the observation of these events but from understanding the processes and internal mechanisms whereby these events are made possible. The examples cited bear testimony to the unparalleled capacity of the human to perform complex skills. And since it is the muscles of our body that permit this physical behavior to occur, we must look at what powers the muscle if we are to understand function. The focus of this presentation is to look at the energy delivery systems of the body and to relate the particular stress that is placed on them to the type of activity that occurs in ice hockey. Elucidation of these stresses is an essential prerequisite to the planning of conditioning programs that are specifically designed to promote the type of adaptations needed for optimal performance.

One cannot help but to be impressed by the vigor of activity that occurs during the course of a game. In many contests, players are required to skate at near maximum intensity for periods of up to two minutes and to repeat this ten to twelve times over the course of a game. In many leagues, this performance must be repeated 3 to 4 times per week, with practices thrown in during the off days for good measure.

The central question is, "How is the system able to function under such conditions so that the proper amount of energy can be supplied as the situation demands."

MECHANISMS OF ENERGY DELIVERY

As previously indicated, when physical movement takes place, energy is needed to power the contraction of the muscle. This energy is supplied by high energy *chemical compounds* located in the muscle very close to the site at which contraction is taking place. You have had some previous introductions to this, so I will only briefly review the mechanisms whereby these high energy compounds are regenerated.

Three different energy supply capacities have been defined and the importance of each of these relate to the *intensity* and *duration* of the activity.

Figure 1 attempts to illustrate the basic nature of each of these capacities. The chemical compounds in question are ATP and CP and these have been represented by boxes drawn out from the muscle.

1. The *Anaerobic Alactic Capacity* refers to the existing supply or surplus of these compounds that are used at the outset of work. In very intense work, there may be a sufficient supply to last anywhere from *5 to 10 seconds*. As Fig. 2 illustrates this capacity, it is important in wrestling, pentathlon, and sprinting where maximal amounts of energy must be mobilized in short periods of time.

If activity is to continue, these high energy compounds must be continually regenerated and two mechanisms are available for doing this.

2. *Anaerobic Lactate Capacity*. If oxygen cannot be supplied in sufficient quantity, energy is supplied from the breakdown of carbohydrate. However, the breakdown is not complete and an acid called *lactic acid* is formed. This mechanism becomes very significant in situations where intense activity is carried on for one or two minutes. This capacity has been measured by the concentration of lactate in the blood and by the amount of oxygen that is consumed to repay the debt after activity has stopped. Figures 3 and 4 provide some indication of the sensitivity of these capacities to training. In Fig. 3, there is greater than a two-fold

[1] Paper presented to the Canadian Athletic Trainers Association, Guelph, May, 1972.

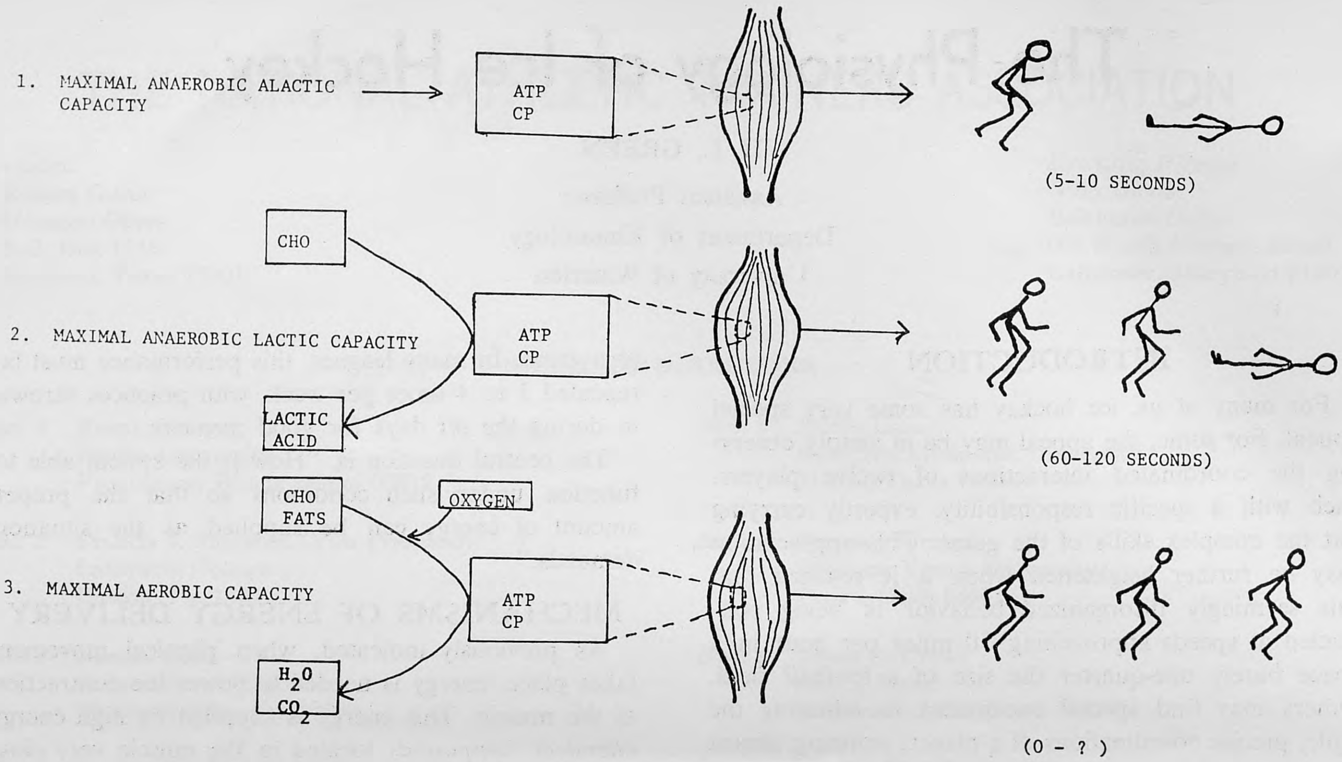


FIG. 1 Sources of energy and capacities involved in muscular work.

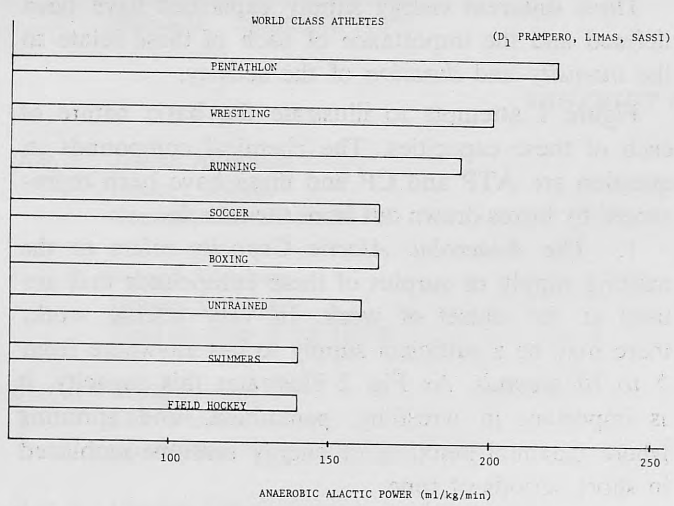


FIG. 2 Maximal anaerobic alactic power in world class athletes (D_1 Prampero, Limas, Sassi)

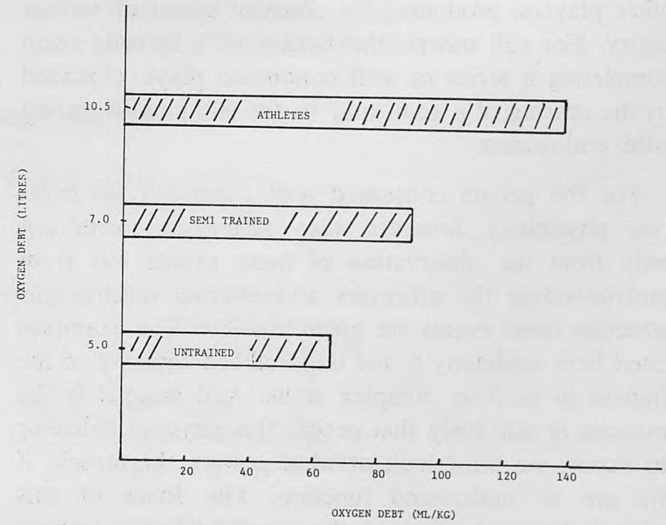


FIG. 3 Oxygen debt in trained and untrained subjects (Hermansen)

difference in the oxygen debt that can be tolerated between the trained and untrained. Figure 4 depicts the influence of training over a season on these capacities. Of particular significance is the increase in blood lactate concentration during training and the dramatic decrease following the training period.

3. *Aerobic Capacity.* In situations where the activity is carried on for longer periods of time, the circulatory system has an opportunity to adjust and oxygen can be delivered and used to combust with carbohydrates or fats for the supply of energy. In such conditions the substrate is broken down into carbon dioxide and water, both of which are easily eliminated and enable work to continue. The extent to which oxygen can be supplied to the muscle from the atmospheric air determines the amount of energy realized and therefore the intensity at which such work can be continued. This delivery of oxygen is connected with the lungs and heart and as indicated for the other capacities, is also sensitive to training. Figures 5 and 6 indicate the difference between different sports participants in this capacity and the sensitivity of this system to training.

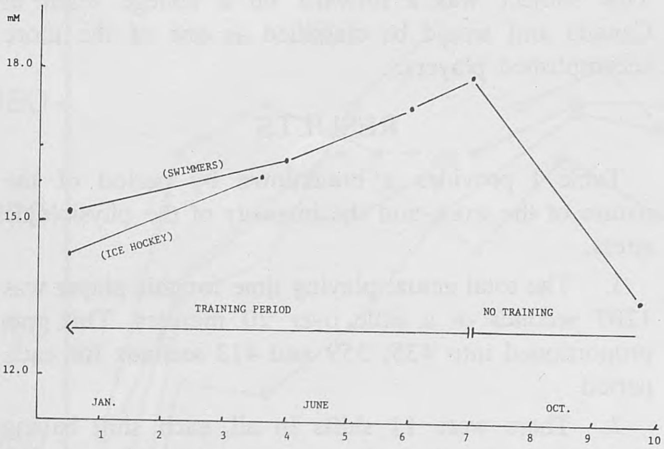


FIG. 4 Blood lactate concentration before training, after training and after detraining (Hermansen)

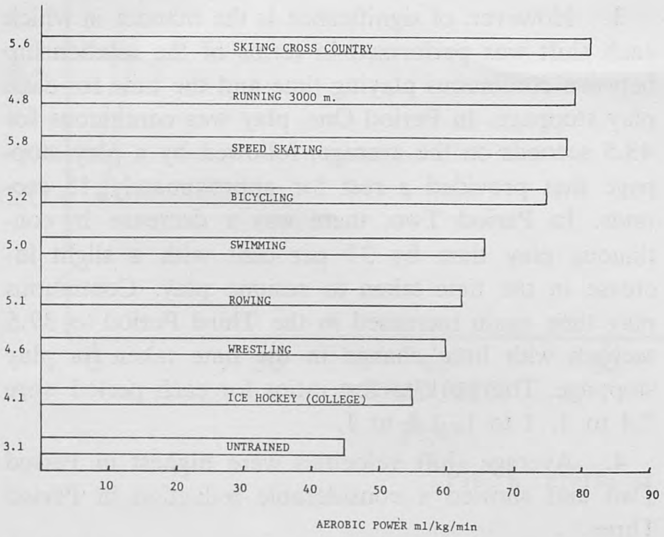


FIG. 5 Maximal aerobic power for males on Swedish national team in different sports (Saltin and Astrand)

It was mentioned earlier that the high energy chemical can be derived either from carbohydrates or fats. As Doctor Houston emphasized earlier, is the case of work of high intensity, the muscle carbohydrate or muscle *glycogen* is the *only substrate* of any consequence. If work is prolonged, the substrate may be depleted and work intensity would show a dramatic reduction. In continuous work of moderate intensity, it is felt that there is enough muscle glycogen to last for at least 60 minutes.

This brief review gives you some indication of how each capacity may be challenged in work of different durations. i.e., Fig. 7. However of *central importance to ice hockey is the significance of these various capacities in situations where the effort must be repeated many times.* From what has been indicated, it is possible to manipulate the rest and work ratios in such a manner that a challenge can be imposed on a *preferred capacity.*

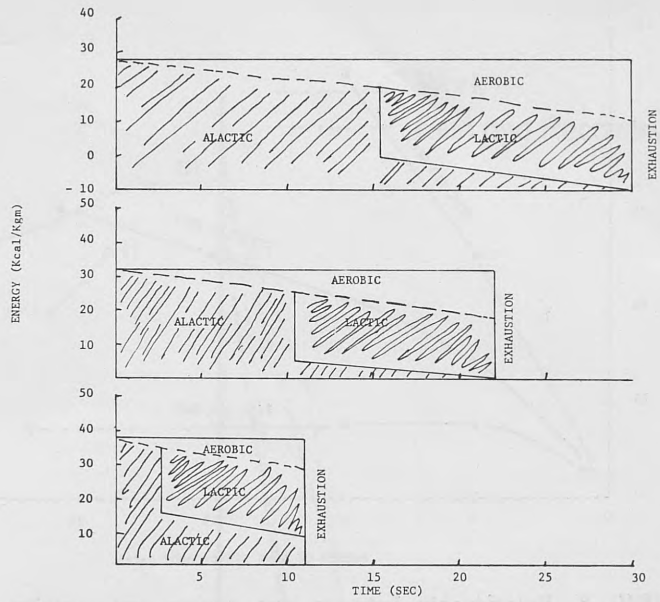


FIG. 6 Contributions of the three energy sources during running of different durations (Margaria)

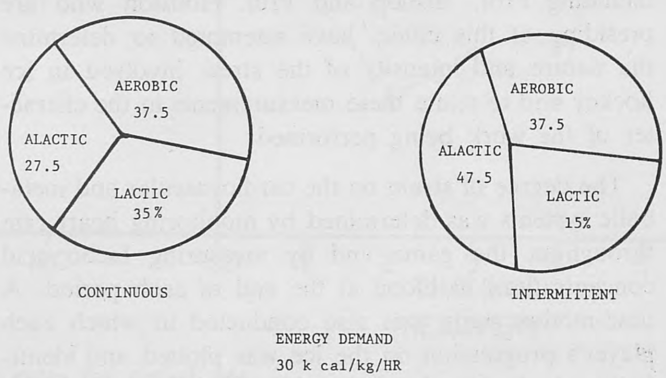


FIG. 7 Percentage of total energy delivered by the different sources during continuous and interval running (Fox, Robinson, Wigman)

As an example, if work is continued for 10 to 15 seconds and stopped, the high energy phosphates are used and then quickly replaced in the ensuing rest period. In fact, if this rest period is about 25 seconds long, these supplies are completely recharged and work can continue for a considerable period of time. Figure 8 illustrates the relationship between working for ten seconds and resting for either 10, 20 or 30 seconds. If the rest period is insufficient, lactic acid accumulates and will eventually terminate work.

If the work is prolonged for one to two minutes, a considerable proportion of the energy comes from *anaerobic sources*. As such, high concentrations of lactate occur and since this acid is cleared very slowly from the body, progressive fatigue will occur unless the recovery period is of considerable duration.

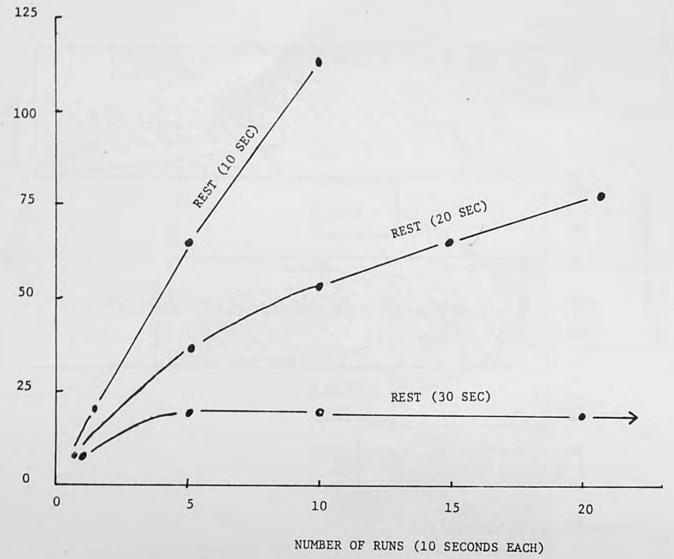


FIG. 8 Relationship between rest pauses and contributions of different energy sources (Margaria)

NATURE OF STRESS IN ICE HOCKEY

For the past two years at Waterloo, a number of us including Prof. Bishop and Prof. Houston who are presiding at this clinic, have attempted to determine the nature and intensity of the stress involved in ice hockey and to relate these measurements to the character of the work being performed.

The degree of strain on the cardiovascular and metabolic systems was determined by monitoring heart rate throughout the game and by measuring lactic acid concentrations in blood at the end of each period. A time-motion study was also conducted in which each player's progression on the ice was plotted and identified with the length of the shift subdivided into both rest and work phases.

The results that will be presented today represent *the most complete* profile of three players monitored. This subject was a forward on a college team in Canada and would be classified as one of the more accomplished players.

RESULTS

Table 1 provides a breakdown by period of the nature of the work and the intensity of the physiologic stress.

1. The total actual playing time for this player was 1207 seconds or a little over 20 minutes. This was proportioned into 435, 359 and 413 seconds for each period.

2. There were 11 shifts in all, each shift having an average duration of approximately 115 seconds. By period, the average playing time per shift increased progressively over the three periods, ranging from 87 seconds to 138 seconds.

3. However, of significance is the manner in which each shift was performed in terms of the relationship between continuous playing time and the time for each play stoppage. In Period One, play was continuous for 43.5 seconds on the average, followed by a play stoppage that provided a rest for approximately 18 seconds. In Period Two, there was a decrease in continuous play time by 37 per cent with a slight increase in the time taken to resume play. Continuous play time again increased in the Third Period to 37.5 seconds with little change in the time taken for play stoppage. The work to rest ratios for each period were 2.4 to 1, 1 to 1, 1.5 to 1.

4. Average shift velocities were highest in Period Two and showed a considerable reduction in Period Three.

TABLE 1 Characteristics of Work, Heart Rate and Lactic Acid Response Recorded by Period for a Forward During an Ice Hockey Performance.

Variables	One Period	Two Period	Three Period	Periods Combined
Actual Playing Time (Sec.)	435	359	413	1207
No. of Shifts	5	3	3	11
Av. Playing Time Per Shift (Sec.)	87.0	119.7	137.7	114.8
Av. No. of Play Stoppages per Shift	2	4.3	3.7	3.3
Av. Playing Time Between Play Stoppage	43.5	27.6	37.5	36.2
Av. Time for Play Stoppage (Sec.)	18.4	24.2	25.8	22.8
Av. Heart Rate Per Shift	170	171	170	170.3
Av. Velocity Per Shift (M/min)	231.6	241.9	205.0	226.2
Lactic Acid Conc. (mg%)	134.0	108.9	54.1	
Hematocrit	45	43	42	

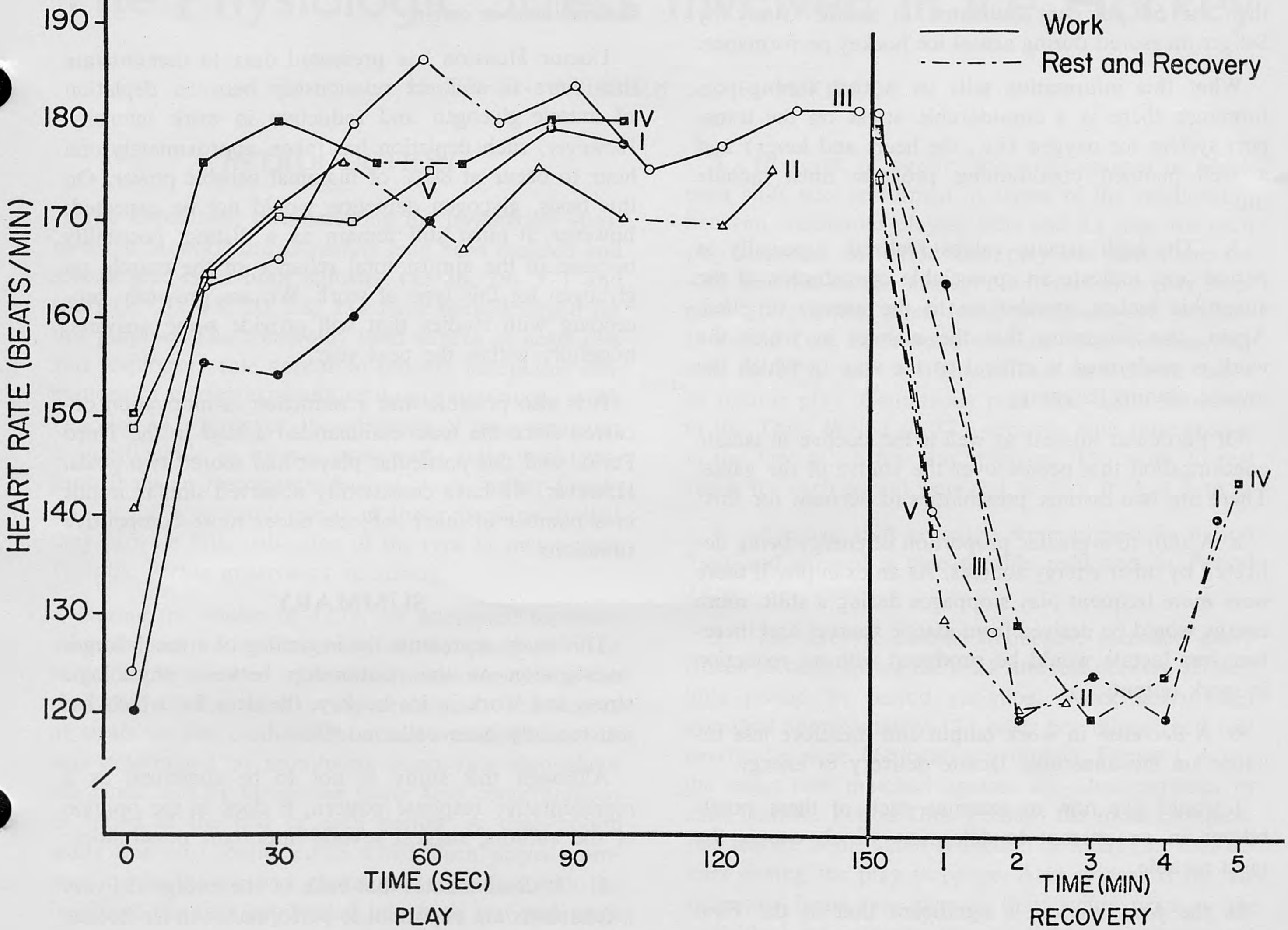


FIG. 9 Profile of heart rates for period one

5. The average cardiac frequency, recorded every fifteen seconds during the work and rest periods, showed little period by period variation. Work heart rates averaged approximately 174 beats per minute and rest heart rates were 166 beats per minute. Figure 9 shows the heart rate matched against the characteristics of each shift for Period One. Perhaps the most conspicuous feature is the small reduction in heart rate that occurs during the play stoppage. Also evident is the anticipatory heart rate increase that occurs prior to the individual returning to the ice following recovery on the bench.

6. Venous blood lactate concentrations showed a decreasing trend over the Three Periods. They were highest in Period One at 134 mg per cent, decreasing to 109 mg per cent and 54 mg per cent at the end of the Second and Third Periods.

7. Hematocrits showed a similar tendency, decreasing from 45 in the First Period to 43 and 42 at the end of the Second and Third Periods. Pre-game 42. This could suggest a fluid shift into the blood system.

DISCUSSION

1. The cardiac frequency values determined during work are marked by a considerable inter-period consistency. Average rates of 174 beats per minute represent approximately 90 per cent of the individual's maximal rate determined during a treadmill aerobic power test. Of significance as well is that during the play stoppages which amounted to an overall average of 23 seconds only a small drop in frequency was witnessed; indicating a maintained high circulatory stress throughout each shift.

2. A crude estimation of energy expenditure can be obtained from determining the relationship between heart rate and oxygen uptake. The treadmill determination of this relationship would suggest that on the

average the subject is working at 75 to 80 per cent of his maximal aerobic power. This is somewhat higher than the 66 per cent estimated in another study by Seliger measured during actual ice hockey performance.

What this information tells us is that during performance there is a considerable stress on the transport system for oxygen (i.e., the heart and lungs) and a well planned conditioning program must include this.

3. The high lactate values realized, especially in period one, indicate an appreciable contribution of the anaerobic lactate metabolism to the energy supplied. Again, this illustrates that the manner in which the work is performed is critical to the way in which the muscle obtains its energy.

Of particular interest as well is the decline in lactate concentration that occurs over the course of the game. There are two distinct possibilities to account for this:

a. A *shift* to a greater proportion of energy being delivered by other energy sources. As an example, if there were more frequent play stoppages during a shift, more energy would be derived from alactic sources and therefore less lactate would be produced with no reduction in work output.

b. A *decrease* in work output and therefore less reliance on the anaerobic lactate delivery of energy.

I would like now to examine each of these possibilities in an attempt to determine which one is the most tenable.

In the *first case,* it is significant that in the *First Period,* where lactate concentration was the highest, the subject had the longest continuous work period, the shortest rest and the second highest velocity. In *Period two,* there is a considerable reduction in the length of the work period, producing a situation in which a greater proportion of the energy can be delivered by the anaerobic alactic sources. In *Period three,* even though there was a prolongation of the work period, there has been a reduction in the work intensity, enabling the aerobic system to assume major emphasis in energy supply.

The *second possibility,* that of a reduced work output, is more evident in *Period three* where a considerably lower velocity is noticed per shift. The question remains as to whether or not this reduced skating intensity observed in the Third Period was caused by a reduced capacity of the system to produce lactate or whether the limitation was simply situational or motivational in origin.

Doctor Houston has presented data to demonstrate that there is a direct relationship between depletion of muscle glycogen and reduction in work intensity. However, such depletion has taken approximately one hour to occur at 80% of maximal aerobic power. On this basis, glycogen depletion would not be expected; however, it must still remain as a distinct possibility because of the almost total reliance of the muscle on glycogen for this type of work. We are presently proceeding with studies that will provide some answers, hopefully within the next year.

It is also possible that a reduction in motivation occurred since the team commanded a lead in the Third Period and this particular player had scored two goals. However, we have consistently observed similar trends in a number of other subjects under more competitive situations.

SUMMARY

This study represents the beginning of a much larger investigation on the relationship between physiologic stress and work in ice hockey, the data for which has just recently been collected.

Although this study is not to be construed as a representative response pattern, it does in the opinion of the authors, suggest several important possibilities:

1. It demonstrates that each of the energy delivery mechanisms are important to performance in ice hockey and suggests the need to impose challenges to each of these systems during conditioning periods. Their sensitivity to adaptation has been indicated.

2. It suggests the distinct possibility that glycogen depletion may lower performance in the latter part of the game. If, in fact, we can demonstrate this, then proper training can enhance this capacity by 200-300 per cent.

3. It illustrates the possible influence of the coach in determining the type of work being done. Wise manipulation of the rest and work ratios by the coach can significantly influence the proportion of energy being derived from each of the courses mentioned. As a result muscle efficiency can be increased, work output can remain high, and fatigue can be delayed.

The Physiologic Stress Involved in Ice Hockey[1]

H. GREEN, P. BISHOP and R. McKILLOP

INTRODUCTION

The importance of monitoring the physiologic stress involved in work situations has long been realized and several studies in both industry (1, 26, 29, 37) and sport (7, 10, 13, 20, 28, 33) have been designed for this purpose. The commonly used indices of heart rate and respiratory rate appear to provide acceptable estimations of energy expenditure during continuous work (24, 28, 34); however, the adequacy of these measures is questionable in intense non-steady state work performed on an intermittent basis (2). A further limitation in the sole employment of these measures is that they provide little indication of the type of metabolism (aerobic versus anaerobic) occurring.

During the winter of 1971, we attempted to determine the nature and intensity of the stress involved in ice hockey and to relate these measurements to the character of the work being performed. The degree of strain on the cardiovascular and metabolic systems was determined by monitoring heart rate throughout the game and by measuring lactic acid concentrations in blood at the end of each period. A time-motion study was also conducted in which each player's progression on the ice was platted and identified with the length of the shift subdivided into both rest and work phases.

The results presented here represent the most complete profile of three players monitored. This subject was a forward on a college team in Canada and would be classified as one of the more accomplished players.

RESULTS

Table 1 provides a breakdown by period of the nature of the work and the intensity of the physiologic stress.

1. The total actual playing time for this player was 1207 seconds or a little over 20 minutes. This was proportioned into 435, 359 and 413 seconds for each period.

2. There were 11 shifts in all, each shift having an average duration of approximately 115 seconds. By period, the average playing time per shift increased progressively over the three periods, ranging from 87 seconds to 138 seconds.

3. However, of significance is the manner in which each shift was performed in terms of the relationship between continuous playing time and the time for each play stoppage. In Period One, play was continuous for 43.5 seconds on the average, followed by a play stoppage that provided a rest for approximately 18 seconds. In Period Two, there was a decrease in continuous play time by 37% with a slight increase in the time taken to resume play. Continuous play time again increased in the Third Period to 37.5 seconds with little change in the time taken for play stoppage. The work to rest ratios for each period were 2.4 to 1, 1 to 1, 1.5 to 1.

4. Average shift velocities were highest in Period Two and showed a considerable reduction in Period Three.

5. The average cardiac frequency, recorded every fifteen seconds during the work and rest periods, showed little period by period variation. Work heart rates averaged approximately 174 beats per minute and rest heart rates were 166 beats per minute. Figure 1 shows the heart rate matched against the characteristics of each shift for Period One. Perhaps the more conspicuous feature is the small reduction in heart rate that occurs during the play stoppage. Also evident is the anticipatory heart rate increase that occurs prior to the individual returning to the ice following recovery on the bench.

6. Venous blood lactate concentrations showed a decreasing trend over the three periods. They were highest in Period One at 134 mg%, decreasing to 109 mg% and 54 mg% at the end of the second and third periods.

7. Hematocrits showed a similar tendency, decreasing from 45 in the First Period to 43 and 42 at the end of the Second and Third Periods. Pre-game 42.

DISCUSSION

1. The cardiac frequency values determined during work are marked by considerable inter-period consistency. Average rates of 174 beats per minute represent approximately 90% of the individual's maximal rate determined during a treadmill aerobic power test. Of significance as well is that during the play stoppages which amounted to an overall average of 23 seconds only a small drop in frequency was witnessed; indicating a maintained high circulatory stress throughout each shift.

2. An estimation of energy expenditure from the

[1] Paper presented at the Annual Meeting of the American College of Sports Medicine, Philadelphia, May, 1972.

TABLE 1 Characteristics of Work, Heart Rate and Lactic Acid Response Recorded by Period for a Forward During an Ice Hockey Performance

Variables	Period One	Period Two	Period Three	Combined Periods
Actual Playing Time (Sec.)	435	359	413	1207
No. of Shifts	5	3	3	11
Av. Playing Time Per Shift (Sec.)	87.0	119.7	137.7	114.8
Av. No. of Play Stoppages Per Shift	2	4.3	3.7	3.3
Av. Playing Time Between Play Stoppage	43.5	27.6	37.5	36.2
Av. Time for Play Stoppage (Sec.)	18.4	24.2	25.8	22.8
Av. Heart Rate Per Shift	170	171	170	170.3
Av. Velocity Per Shift (M/Min)	231.6	241.9	205.0	226.2
Lactic Acid Conc. (mg%)	134.0	108.9	54.1	
Hematocrit	45	43	42	

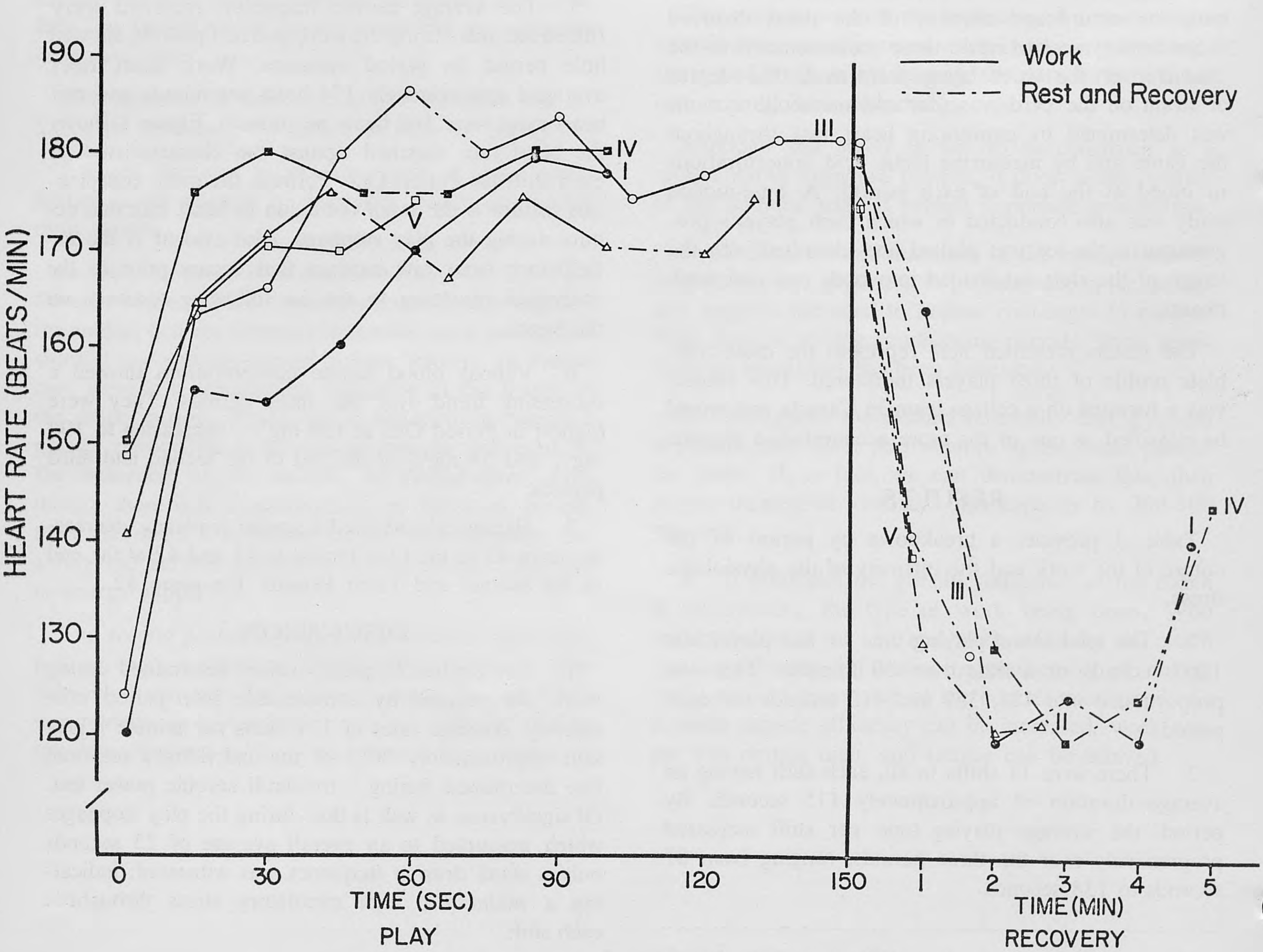


FIG. 1 Profile of heart rates for period One

heart rate/VO_2 relationship is very tenous. The treadmill determination of this relationship for the subject in question would suggest that the subject is working at approximately 75-80% of his maximal aerobic power. This is somewhat higher than the 66% estimated by Seliger (33) measured during actual ice hockey performance. However, as has been suggested (35), erroneous approximations can result when trying to estimate energy expenditure for an activity other than in which the heart rate/VO_2 relationship was established. The estimation is further jeopardized when it is realized that much upper body activity also occurs during ice hockey performance and this could serve to distort the relationship between these two variables (1, 35).

3. Recently Ferguson et al. (11) have produced a velocity/oxygen cost curve for ice skating in which it is possible to approximate the oxygen requirements at certain skating velocities. Extrapolation of these results would suggest that this subject should have an average velocity of approximately 350-375 meters/min. to produce an energy expenditure of 75% of maximal aerobic power. Although the average velocities presented here are slightly conservative as compared to videotape analysis, they are still considerably below the velocity needed for the approximated energy expenditure. Since acutal skating may only occur during a fraction of the continuous play period, this would suggest that the use of average velocity to estimate energy expenditure may lead to a serious under estimation of the work actually performed.

4. The high lactate values realized indicates an appreciable contribution of anaerobic metabolism to the energy supplied (2, 6, 12). The decline in lactate concentration that occurs over the course of the game might be caused by a decrease in work output, and therefore less reliance on the anaerobic lactic delivery of energy (25), a shift to a grater proportion of energy being delivered by oxidative and anaerobic alactic sources (2, 6, 12, 25) or a greater removal of lactate (3, 17).

Several investigators (2, 6, 12, 25) have shown that in intermittent work situations, the blood lactate concentration will relate to the intensity of work, and to the duration of the rest and work components. It is significant that in the First Period, where lactate concentration was the highest, the subject had the longest rest and the second highest velocity. In Period Two, there is a considerable reduction in the length of the work period, producing a situation in which a greater proportion of the energy can be delivered by anaerobic alactic sources (12, 25). In Period Three, even though there was a prolongation of the work period, there has been a reduction in work intensity, enabling the aerobic system to assume the major emphasis in energy supply. It is possible that part of the lowered concentration observed in the later periods may also be due to an enhanced utilization of lactate by the muscles, heart and liver which was promoted by the previous activity (3, 17).

The question remains as to whether or not the reduced skating intensity observed in the Third Period was caused by a reduced glycolytic capability or whether the limitation was simply situational or motivational in origin. Previous investigators (5) have demonstrated a direct relationship between depletion of muscle glycogen and reduction in work intensity. However, such depletion has taken approximately one hour to occur at 80% of maximal aerobic power. In the present study, the upper limit of work intensity would not be expected to exceed 80% on the average and since the total work duration was only 20 minutes, glycogen depletion is highly improbable as a cause of the reduced work intensity and lactate production. Further, the results of previous research (9, 17, 18) have demonstrated decreases in blood lactate concentration in maximal effort after prolonged heavy exercise even though glycogen depletion was eliminated as the cause. Karlsson (18) has suggested that this reduction might be due to the activation of rate limiting site in glycolysis.

As previously mentioned, it is possible that a reduction in motivation occurred since the team commanded a lead in the Third Period. However, similar trends have been shown in a number of other subjects under more competitive situations.

5. Many investigators (31, 32) have found an increase in hematocrit, blood hemoglobin and plasma protein concentrations during heavy exercise which quickly returns to pre-exercise levels during recovery. This increase has been attributed (31) to an increase in interstitial water or a shift of water into the cells due to the increased intra-cellular osmotic pressure which is secondary to the increased muscle lactate concentration. In the present investigation, the opposite trend was observed in that there was an initial hemoconcentration following by a reduction in hematocrit over the remaining periods. This could be a consequence of release of the large amount of water associated with glycogen storage which would lend to an elevated interstitial hydrostatic pressure and the decreased intracellular osmotic pressure associated with reduction in lactate concentration. Both of these factors could promote increases in plasma volume.

SUMMARY

This study represents the beginning of a much larger investigation on the relationship between physiologic stress and work in ice hockey, the data of which has just been collected. Although this study is not to be construed as a representative response pattern, it does in the opinion of the authors reveal certain important

findings. The disruption caused to the subject might be properly indicated by the fact that he scored 2 out of the 6 goals.

REFERENCES

1. Astrand, I. "The Degree of Strain During Building Work as Related to Individual Aerobic Capacity," Ergonomics, 10:3, 293–303, 1967.
2. Astrand, I., Astrand, P. O., Christensen, E. H., and Hedman, R., "Intermittent Muscular Work," *Acta. Physiol. Scand.,* 48: 448–453, 1960.
3. Bang, O., "The Lactate Content of the Blood During and After Muscular Exercise in Man," Skand. Arch. Physiol., 74, 1936, Suppl. 10, 51–82.
4. Barker, S. B., and Summerson, W. H., "The Calorimetric Determination of Lactic Acid in Biological Material," *J. Biol. Chem.,* 138: 535–554, 1941.
5. Bergstrom, J., Hermansson, L., Hultman, E., and Saltin, B., "Diet, Muscle Glycogen and Physical Performance," *Acta. Physiol. Scand.,* 71: 140–150, 1967.
6. Christensen, E. H., Hedman, R., and Saltin, B., "Intermittent and Continuous Running," *Acta Physiol. Scandinavia,* 50: 269–287, 1960.
7. Christensen, E. H., and Hogberg, P., "Physiology of Skiing," *Arbeits. Physiol.,* 14: 292–303, 1950.
8. Costill, D. L., "Metabolic Responses to Distance Running," *JAP* 28:3, 251–255, March, 1970.
9. Costill, D. L., Sparks, K., Gregor, R., and Turner, C., "Muscle Glycogen Utilization During Exhaustive Running," *JAP,* 31:3, 353–356, 1971.
10. Faria, I. E., and Philips, I. E., "A Study of Cardiac Response of Young Boys and Girls During Gymnastics Participation," *J. Sports Med. Physical Fitness,* Vol. 10:3, 145–149, 1970.
11. Ferguson, R. J., Marcotte, G. G., and Montpetit, R. R., "A Maximal Oxygen Uptake Test During Ice Skating," *Medicine and Science in Sports,* Vol. 1:4, 207–211, 1969.
12. Fox, E. L., Robinson, S., and Wiegman, D. L., "Metabolic Energy Sources During Continuous and Interval Running," *Journal of Applied Physiology,* 27:2 174–178, Aug. 1969.
13. Goodwin, A. B., and Cumming, G. R., "Radio Telemetry of the Electrocardiogram, Fitness Tests and Oxygen Uptake of Water Polo Players," *Can. Med. Assoc. Journal,* 95: 402–406, 1966.
14. Hanson, J. S., and Tabakin, B. S., "Electrocardiographic Telemetry in Skiers," *New Engl. J. Med.,* 271: 181–185, 1964.
15. Hermanson, L. E., "Anaerobic Energy Release," *Med. Sci. Sports,* 1: 32–38, 1969.
16. Holmgren, A., "Circulatory Chances During Muscular Work in Man with Special Reference to Arterial and Central Venous Pressures in the Systemic Circulation," *Scand. J. Clin. Lab Invest.,* Suppl 24, 1956.
17. Karlsson, J., "Lactate in Working Muscles After Prolonged Exercise," *Acta Physiol. Scand.,* 82: 123–130, 1971.
18. Karlsson, J., Diamant, B., and Saltin, B., "Lactate Dehydrogenase Activity in Muscle After Prolonged Severe Exercise in Man," *J. Appl. Physiol.,* 25: 88–91, 1968.
19. Karlsson, J., and Saltin, B., "Oxygen Deficit and Muscle Metabolites in Intermittent Exercise,"*Acta. Physiol. Scand.,* 8: 115–122, 1971.
20. Kozar, A. J., and Hunsicker, P. A., "A Study of Telemetered Heart Rate During Sports Participation," *J. Sports Med. and Physical Fitness,* 3: 1–5, 1963.
21. Magel, J. R., McArdle, W. D., and Glaser, R. M., "Telemetered Heart Rate Responses to Selected Competitive Swimming Events," *JAP,* 26: 764–770, 1970.
22. Maksud, M. G., et al., "Maximal VO_2, Ventilation and Heart Rate of Olympic Speed Skating Candidates," *JAP,* 29: 186–190, 1970.
23. Malcyniski, H., "Biotechnological Methods Used to Demonstrate the Physiological Efficiency of the Working Man in Practice," *Ergonomics,* 14: 307–312, 1971.
24. Malhortra, M. S., Sen Gupta, J., and Aai, R. M., "Pulse Count as a Measure of Energy Expenditure," *J. Appl. Physiol.,* 18: 994–996, 1963.
25. Margaria, R., et al., "Energy Utilization in Intermittent Exercise of Supramaximal Intensity," *JAP,* 26:6, 752–756, 1969.
26. Maxfield, M. E., "The Indirect Measurement of Energy Expenditure in Industrial Situations," *Am. J. Clin. Nutrition,* 24: 1126–1138, Sept. 1971.
27. McArdle, W. D., Foglia, G. F., and Patti, A. V., "Telemetered Cardiac Response to Selected Running Events," *J. Appl. Physiol.,* 23: 566–570, 1967.
28. McArdle W. D., Magel, J. R., and Kyvallos, L. C., "Aerobic Capacity, Heart Rate and Estimated Energy Cost During Women's Competitive Basketball," *RQ,* 42:2, 178–186, 1971.
29. Minter, A. L., "A Comment on the Relationship Between Energy Expenditure and Performance Index in the Task of Shovelling Sand," *Ergonomics,* Vol. 11:6, 587–589, 1968.
30. Moores, B., "A Comparison of Workload Using Physiological and Time Study Assessments," *Ergonomics,* Vol. 13:6, 769–776, 1970.
31. Pruett, E. D., "Plasma Insulin Concentration During Prolonged Work at Near Maximal Oxygen Uptake," *JAP,* 29:2, 155–158, Aug. 1970.

32. Saltin, B., "Aerobic Work Capacity and Circulation Exercise in Man With Special Reference to the Effect of Prolonged Exercise and/or Heat Exposure," *Acta. Physiol. Scand. Suppl.,* 230, 1964.

33. Seliger, V., "Energy Metabolism in Selected Physical Exercises," *Int. 2 Physiol. Einschl. Arbeits, Physiol.,* 25: 104–120, 1968.

34. Sharkey, B. J., and McDonald, J. F., "Pulse Rate and Pulmonary Ventilation as Predictor of Human Energy Cost," *Ergonomics,* 9: 223–227, 1966.

35. Skubic, V., and Hodgkins, J., "Relative Strenuousness of Selected Sports as Performed by Women," *Res. Quart.,* 38: 305, 313, 1967.

36. Whitt, F. R., "A Note on the Energy Expenditure in Sporting Cyclists," *Ergonomics,* 14: 419–424, May 1971.

37. Wyndham, C. H., Morrison, J. F., Williams, G. G., Heyns, A., Margo, E., Brown, A. N., and Astrup, J., "The Relationship Between Energy Expenditure and Performance Index in the Task of Shovelling Sand," *Ergonomics,* Vol. 9:5, 371–378, 1966.

38. Yellin, N., "The Histochemical Classification of Muscle Fibres," *Exptl. Neurol.,* 26: 424–432, 1970.

The Effect of Anabolic Steroid (Methandrostenolone) Upon Selected Physiological Parameters

GIDEON ARIEL
University of Massachusetts
Department of Exercise Science

Human physical performance is the result of complex interdependent physiological, psychological, and physical processes. The efficiency of human performance depends on great numerical factors. It was shown by Bergstrom, Hultman and Saltin (10), for example, that the muscle glycogen concentration can be varied within a wide range, provided that different diets are administered after exhaustive exercise causing depletion of the local muscle glycogen stores.

The area of ergogenic aid or work-producing aid is extensive in athletics. Special foods, food supplements, and beverages are used by many athletes to increase their performance. The ergogenic benefit from supplemental vitamin feeding has eluded the careful researcher. In a study conducted by Karpovich and Millman, placebos were determined to be as beneficial as vitamin tablets (40). Yakovlev (96) a Soviet nutritionist claimed that rational nutrition is one of the essential means for increasing physical fitness and fighting fatigue.

Aside from regular nutrition, a new factor is facing human performance—Anabolic Steriods. Anabolic steroids may be defined as those steroids whose function is to stimulate the synthesis of protein. The work of Kochakian and Murlin (53) provides the basis for the use of anabolic steroids. The pharmacological properties of these steroids has proved of value clinically in the treatment of conditions where increased protein synthesis and reduced nitrogen loss is desired. Their use has been extended by "power event" athletes who have attempted to develop increased muscular contractile force. The difficulty of detection of these substances in the urine or blood assures their continued use despite criticism and prohibition by official bodies.

The purpose of this study was to investigate the physiological as well as the psychological effects of anabolic steriod (Methandrostenolone) upon the contractile force of skeletal muscles and the effects of anabolic steroid upon the nervous system by measuring the knee jerk reflex components.

Johnson and O'Shea (38) found that strength, body weight, oxygen uptake and blood nitrogen retention were significantly increased when healthy subjects were administered an anabolic steroid. Significant alterations in lactate dehydrogenase, creatine phosphokinase, urea nitrogen, and protein metabolism were reported by O'Shea and Winkler (75) in a study of competitive swimmers and weight trainers. The weight trainers significantly increased their strength performance while the swimmers were unable to improve their competitive speed performance. Fowler (23) reported no effects of steroids on strength. Casner *et al.* (115) reported no significant strength increase due to steroid treatment.

METHODS

Six male University students, aged 18–22 years, served as subjects in this study. Their height averaged 182 cm. with a mean weight of 97 kg. The experiment was conducted during a fifteen-week period. In order to minimize the effect of diurnal variation, testing was conducted between 8 p.m. and 10 p.m.

Testing was conducted weekly on two successive days. All the subjects were varsity athletes who had experienced two years of weight training. For a period of four months prior to the beginning of the test procedures all the subjects lifted for five days and were tested on the sixth and seventh days. This procedure was followed for the 15-weeks study procedure. From the first week to the seventh week data were collected for the seated, military and bench presses, and squat exercises. A standard warm-up procedure was performed and each test was a maximal lift. During this period the Director of the University Health Services explained the possible physiological effects of the anabolic steroids in a positive manner. Research studies reporting the strength gains associated with anabolic

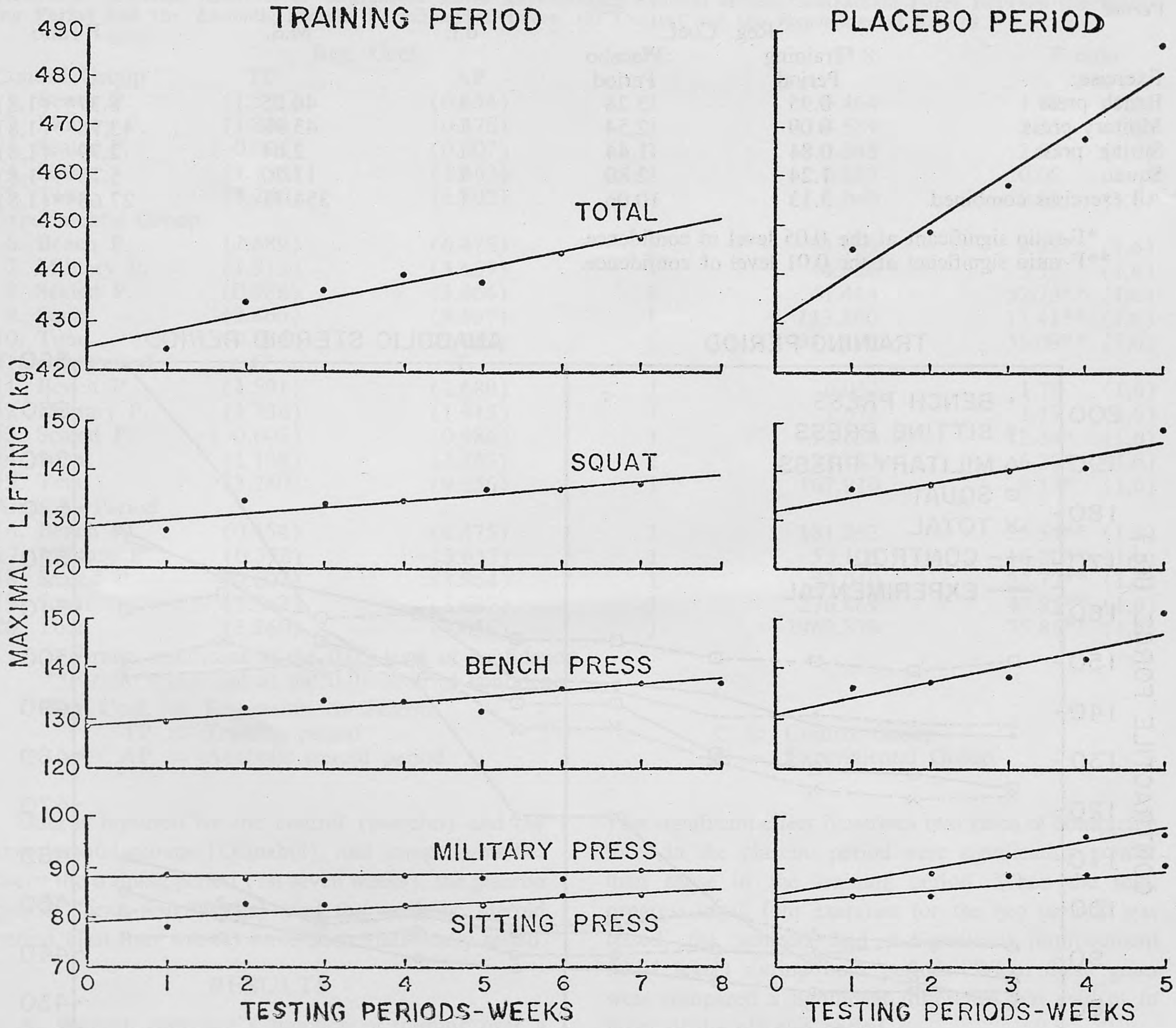


FIG. 1

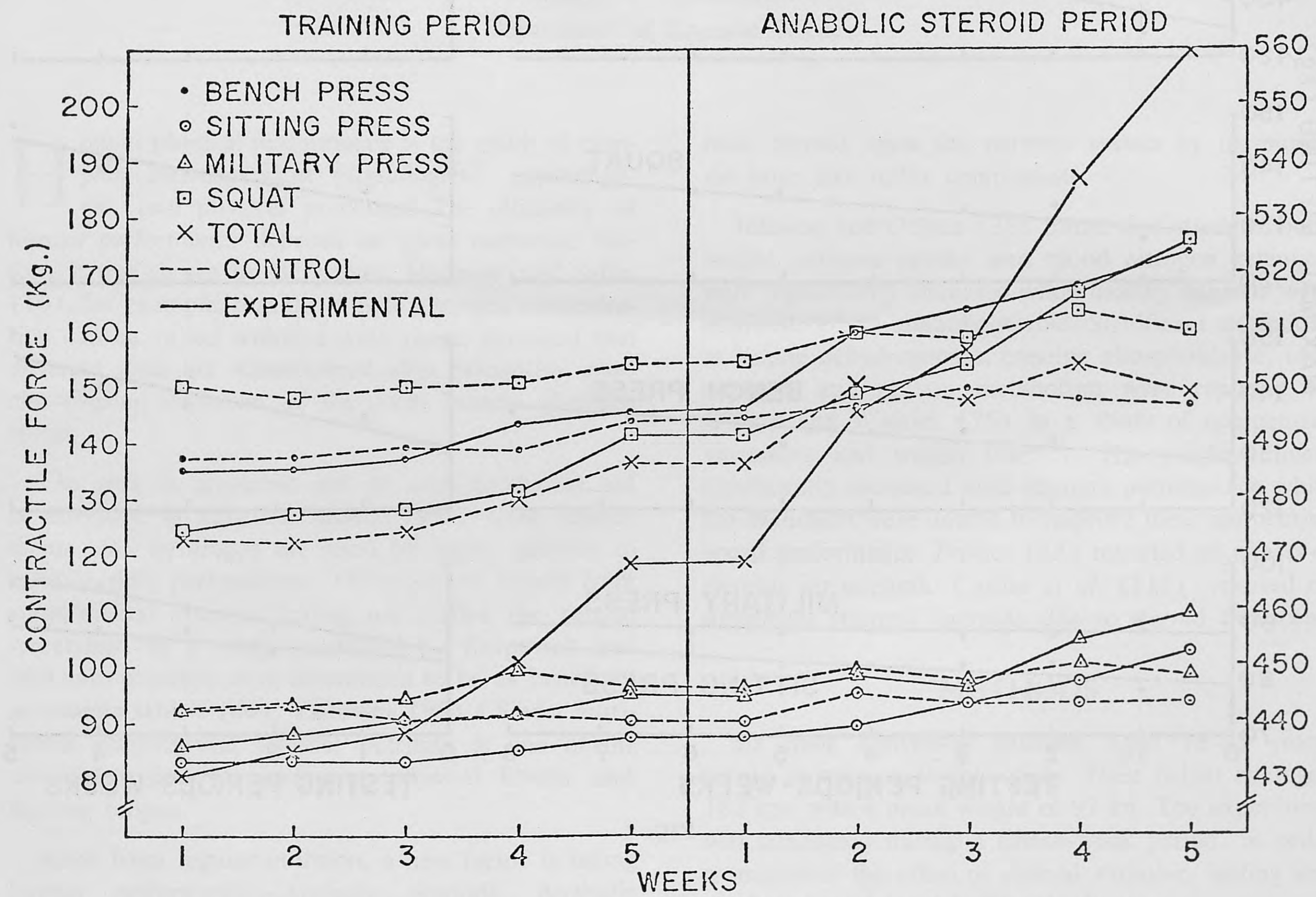
steroids were made available to the subjects. From the eighth to the 11th week of the study all the subjects were given placebo pills daily and informed they contained 10 mg. of Dianabol (Methandrostenolone), an oral anabolic steroid. The present investigators are convinced that the subjects believed they were being administered the anabolic steroid. From the 12th to the 15th week of the study a double blind technique was used. Three of the subjects received 10 mg. of the oral anabolic steroid and the remaining three subjects continued to receive the placebo. The oral anabolic steroid and the placebo were assigned to the subjects by code by the University Health Service and the investigators were not informed which subject received the steroid until the conclusion of the experiment. Thus, the experiment was divided into three periods: training period, placebo period, and anabolic steroid period. Lifting tests were administered throughout the whole experiment. Reflex components were obtained during the placebo and the anabolic steroid periods only.

Total patellar reflex time and reflex latency were obtained on the right limb. A Lafayette knee reflex apparatus was used. An adjustable hammer was used to deliver a strike to the ligamentum patella. The hammer was released at 60 degrees. The heel of the subject was held relaxed against a plate depressing a microswitch. The recording was started when the microswitch in the hammer was activated by the stride. The microswitch closed the circuit, causing an electric Hunter clock to start when contact was made by the hammer head with the ligamentum patella. As soon as the reflex arc was

TABLE 1 A Slope Analysis of Regression Lines Representing Strength Measurements in a Training and a Placebo Period

Exercise:	Reg. Coef. Training Period	Placebo Period	d.f.	M.S.	F-ratio
Bench press	0.95	3.28	1	40.25	8.37* (1,8)
Military press	0.09	2.54	1	43.98	43.76**(1,8)
Sitting press	0.84	1.44	1	2.64	2.79 (1,8)
Squat	1.24	2.80	1	17.70	5.75* (1,8)
All exercises combined	3.13	10.06	1	354.71	27.65**(1,8)

*F-ratio significant at the 0.05 level of confidence.
**F-ratio significant at the 0.01 level of confidence.



EFFECT OF ANABOLIC STEROID (DIANABOL) UPON THE MUSCULAR CONTRACTILE FORCE

FIG. 2

completed, a mechanical movement of the limb caused the subject's heel to raise the heel plate which again opened the circuit and stopped the electric clock. The time elapsed is the total reflex time.

The subject was seated on a specially constructed knee reflex apparatus. A movable back rest was adjusted until the subject was comfortably seated with his heel against the adjustable heel plate. Electrodes were placed directly over the rectus femoris motor point which was located by the standard procedures indicated in the TECA Operator's manual (102) for the variable pulse generator and chronaximeter model CH3. The electrodes were connected to the TECA electromyograph model B2 oscilloscope. At the time when the hammer struck the ligamentum patella, a beam swept across the oscilloscope, and as the nerve impulse reached the motor point electrodes, a spike potential was displayed on the oscilloscope. This time interval was the latency. The difference between the total reflex time and the latency is the motor time. Ten reflex trials were consecutively taken on each subject at each testing session.

TABLE 2 A Slope Analysis of Regression Lines Representing Skeletal Muscle Contraction Force Between the Training Period and the Anabolic Steroid Period and Between the Control and the Experimental Groups

	Reg. Coef.		d.f.	M.S.	F-ratio	
Control Group	TP	AP				
1. Bench P.	(1.591)	(0.454)	1	6.464	1.97	(1,6)
2. Military P.	(1.336)	(0.378)	1	4.589	2.25	(1,6)
3. Seated P.	(–0.605)	(0.607)	1	7.345	2.87	(1,6)
4. Squat	(1.138)	(1.363)	1	0.253	0.08	(1,6)
5. Total	(3.260)	(2.802)	1	1.049	0.05	(1,6)
Experimental Group						
6. Bench P.	(2.689)	(6.475)	1	71.669	9.98*	(1,6)
7. Military P.	(1.915)	(3.637)	1	14.826	5.53	(1,6)
8. Seated P.	(0.986)	(3.864)	1	41.414	52.73**	(1,6)
9. Squat	(3.865)	(8.637)	1	113.860	13.41**	(1,6)
10. Total	(9.055)	(22.613)	1	919.100	35.09**	(1,6)
Training Period	C	E				
11. Bench P.	(1.591)	(2.689)	1	6.033	1.79	(1,6)
12. Military P.	(1.336)	(1.915)	1	1.676	1.17	(1,6)
13. Seated P.	(–0.605)	(0.986)	1	12.656	12.34*	(1,6)
14. Squat	(1.138)	(3.865)	1	37.183	6.20*	(1,6)
15. Total	(3.260)	(9.056)	1	167.910	8.13*	(1,6)
Anabolic Period						
16. Bench P.	(0.454)	(6.475)	1	181.262	25.54**	(1,6)
17. Military P.	(0.378)	(3.637)	1	53.105	16.20**	(1,6)
18. Seated P.	(0.607)	(3.864)	1	53.040	22.72**	(1,6)
19. Squat	(1.363)	(8.637)	1	276.469	47.85**	(1,6)
20. Total	(3.260)	(9.056)	1	1962.379	75.85**	(1,6)

*F-ratio significant at the 0.05 level of confidence
**F-ratio significant at the 0.01 level of confidence

Reg. Coef. = Regression coefficients
TP = Training period
AP = Anabolic steroid period

C = Control Group
E = Experimental Group

Data is reported for the control (placebo) and the experimental groups (Dianabol), and comparisons between the training period (1st seven weeks), the placebo period (next four weeks) and the anabolic steroid period (last four weeks) have been statistically tested.

RESULTS

As strength gains are a function of training over a period of time, neither the "t-test" nor one-way-analysis of variance for "before" and "after" conditions were deemed totally adequate analysis techniques. The relationship between both the gains in strength and changes in reflex components and the effect of time for the training, placebo and anabolic steroid periods suggested a comparison of slopes of the regression lines for these three periods to investigate the physiological and psychological influences upon contractile force of skeletal muscles and reflex components.

Figure 1 illustrates the regression lines of the strength test measurements for the training period and the placebo period. Table 1 illustrates the analysis of the slopes of these regression lines for the same two periods. A comparison of the two slopes or regression coefficient for the two periods is reported.

From Table 1, significant F-ratios are reported between the slopes of the Bench press, Military press, and the squat exercises and for all the exercises combined. This significant effect illustrates that gains of contractile force in the placebo period were significantly greater than those in the training period. When the total progress in all four exercises for the two periods was tested, the subjects had a significant improvement (0.01 level) during both periods. When these gains were compared a significant difference was evident in favor of the placebo period.

Figure 2 presents the changes in contractile force for both control and experimental groups for the placebo and anabolic steroid periods. A comparison of regression lines between the placebo and the anabolic periods and a comparison between the control and experimental groups is reported in Table 2.

Considering the differences between the placebo and the anabolic steroid periods, a comparison of regression lines yields the following results. No differences were found between the placebo period and the anabolic steroid period for the control group (Table 2: 1–5). Significant differences between the slopes of the regression lines were found in the bench press, seated press, and the squat exercises, for the experimental group between the placebo period and the anabolic steroid period (Table 2: 6,8,9). A significant difference was found when all exercises were combined for the experimental group (Table 2: 10).

TABLE 3 A Slope Analysis of Regression Lines Representing Reflex Components Between the Training Period and the Anabolic Steroid Period and Between the Control and the Experimental Groups

	Reg. Coef.		d.f.	M.S.	F-ratio
Control Group	TP	AP			
1. Latencies	(0.049)	(–0.267)	1	0.333	16.27** (1,6)
2. Motor Times	(–0.641)	(–0.849)	1	0.144	0.07 (1,6)
3. Total Reflex	(–0.614)	(–1.130)	1	0.888	2.93 (1,6)
Experimental Group					
4. Latencies	(0.141)	(0.961)	1	2.266	25.64** (1,6)
5. Motor Times	(–0.625)	(–12.005)	1	359.079	9.15* (1,6)
6. Total Reflex	(–1.491)	(–11.041)	1	304.008	7.30* (1,6)
Training Period	C	E			
7. Latencies	(0.049)	(0.141)	1	0.021	1.00 (1,6)
8. Motor Times	(–0.641)	(–1.626)	1	2.426	1.56 (1,6)
9. Total Reflex	(–0.614)	(–1.491)	1	1.923	1.11 (1,6)
Anabolic Steroid Period					
10. Latencies	(–0.261)	(0.961)	1	7.466	96.22** (1,6)
11. Motor Times	(–0.849)	(–12.005)	1	722.282	22.20** (1,6)
12. Total Reflex	(–1.300)	(–11.041)	1	499.140	14.53** (1,6)

*F-ratio significant at the 0.05 level of confidence.
**F-ratio significant at the 0.01 level of confidence.

Reg. Coef. = Regression coefficients
d.f. = Degress of freedom
M.S. = Mean Square
TP = Training period

AP = Anabolic steroid period
C = Control Group
E = Experimental Group

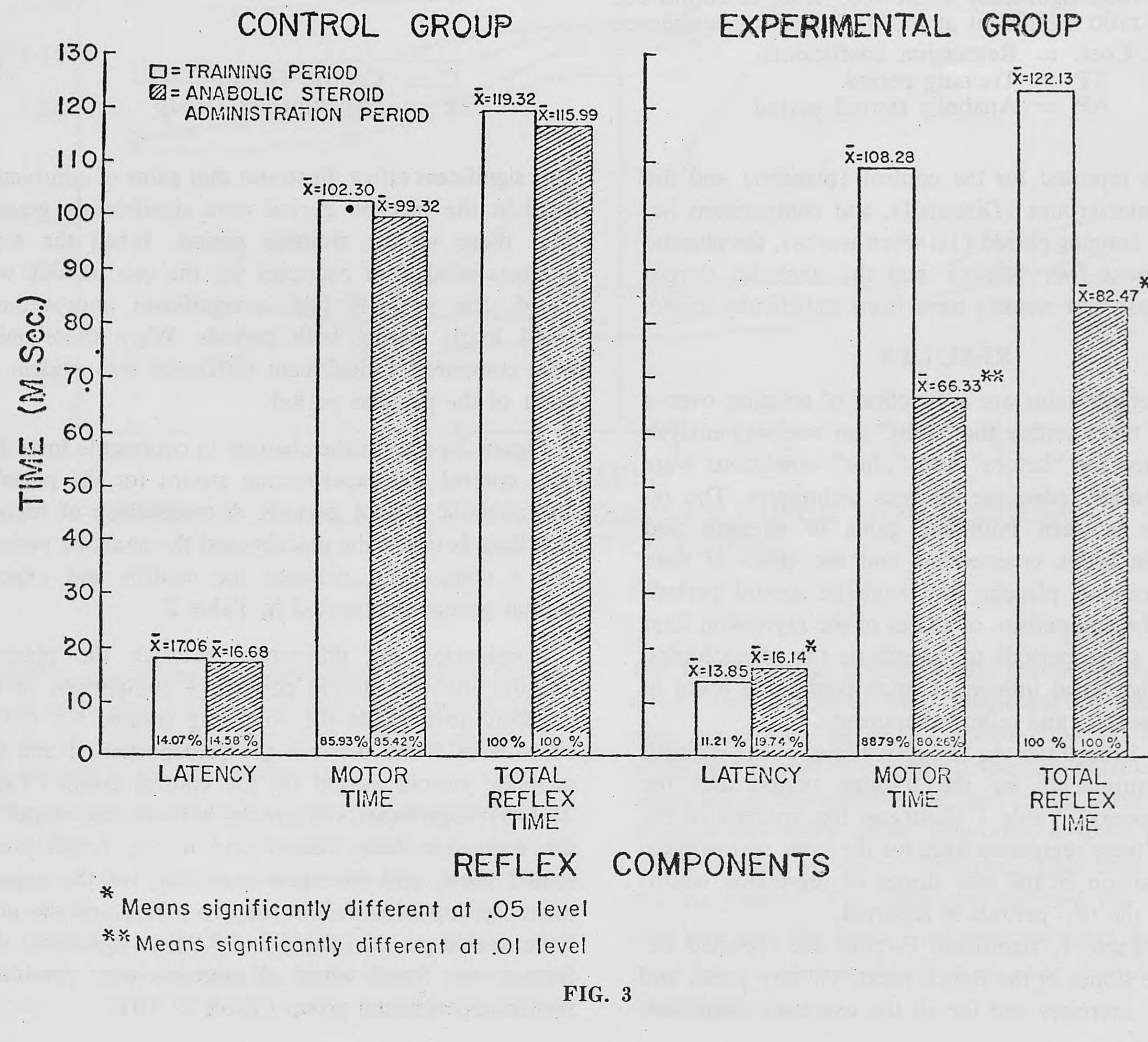


FIG. 3

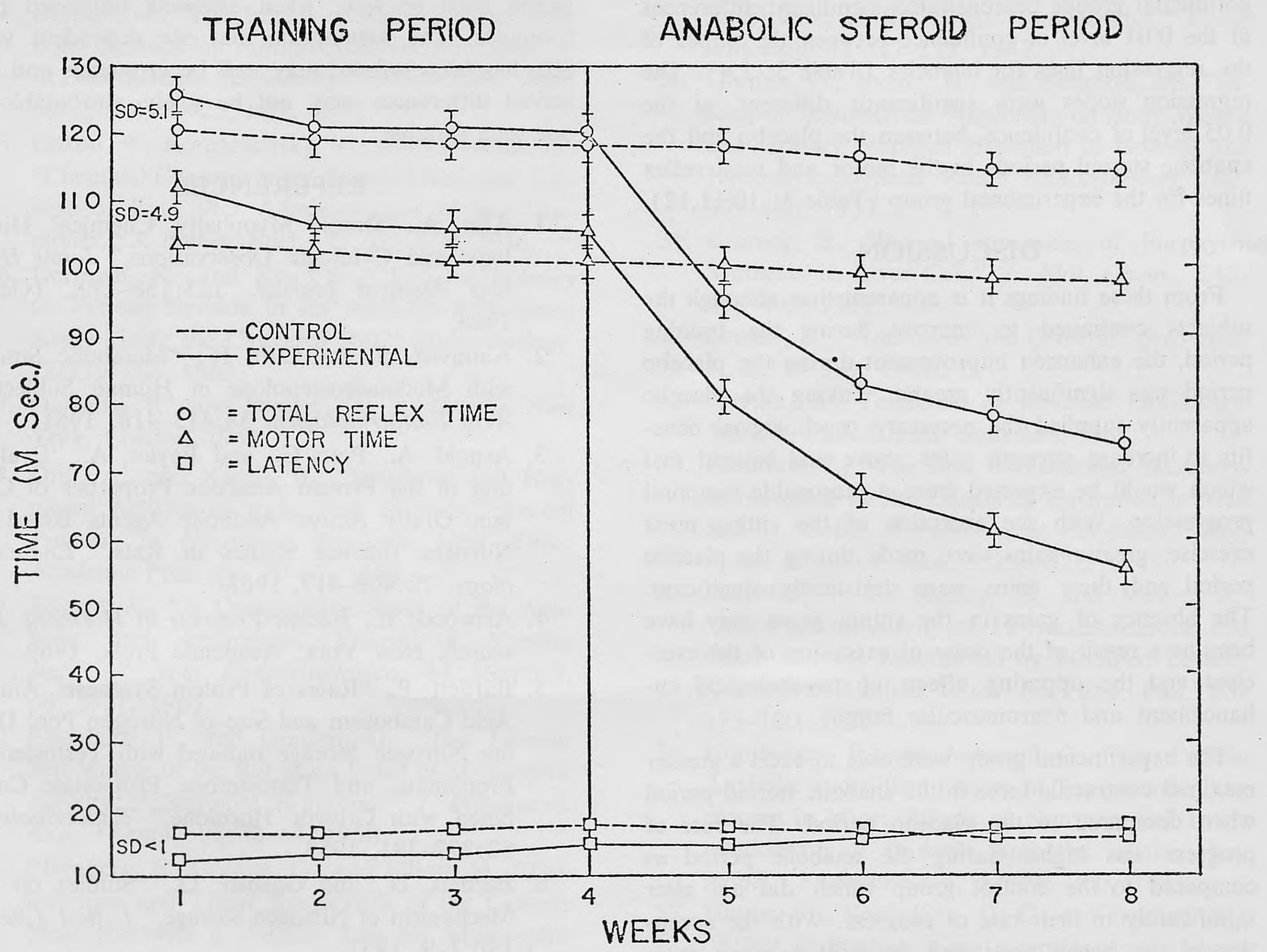


FIG. 4

When comparing the slopes of the control group to the experimental group, no significant difference was found in the placebo period in the bench press and seated press exercises (Table 2: 11,12). However, significant difference were found in the same exercises during the anabolic period (Table 2: 16,17). Significant differences between the control and the experimental groups were found in the seated press, and the squat exercises and when all exercises combined, for the placebo period as well as the anabolic steriod period (Table 2: 13,14,15,18,19,20).

Figure 3 presents the means and the relative percentages of each reflex component in the placebo and anabolic steroid periods for both the control and the experimental groups. Figure 4 presents the variability of the means and the changes in the reflex components for both control and experimental groups for the same two periods. A slope analysis for regression lines between the placebo period and the anabolic steroid period and of regression lines between the experimental and the control groups are presented in Table 3.

In Figure 3, only slight changes are seen between the percentages of the different components for the control group and the mean differences were not statistically significant. However, the effect of the anabolic steroid on the experimental group is marked and statistically significant. The reflex latency of 11.21 percent changed to 19.74 percent during the anabolic steroid period; the motor time component decreased from 88.79 percent to 80.26 percent of the total reflex time. The mean motor time of 108.28 ms. was reduced to 66.33 ms. (significantly different at the .01 level of confidence). Figure 3 serves to show that there was an increase in the length of the reflex latency component of the experimental group during the anabolic steroid period. This lengthening of the latency component was statistically significant despite the small mean difference. The faster motor time and its effect upon the total reflex time are clearly seen to be more marked for the experimental group who received the anabolic steroid during this period.

A comparison of regression lines between the placebo and the anabolic steroid periods yields the following results (Table 3). The control and the experimental groups demonstrated significant differences at the 0.01 level of confidence between the slopes of the regression lines for latencies (Table 3: 1,4). The regression slopes were significantly different, at the 0.05 level of confidence, between the placebo and the anabolic steroid periods in the motor and total reflex times for the experimental group (Table 3: 10,11,12).

DISCUSSION

From these findings it is apparent that although the subjects continued to improve during the training period, the enhanced improvement during the placebo period was significantly greater. Taking the placebo apparently supplied the necessary psychological benefits to increase strength gains above and beyond that which would be expected from a reasonable temporal progression. With the exception of the sitting press exercise, greater gains were made during the placebo period and these gains were statistically significant. The absence of gains in the sitting press may have been as a result of the order of execution of the exercises and the opposing effects of psychological enhancement and neuromuscular fatigue.

The experimental group were able to exert a greater maximal contractile force in the anabolic steroid period when compared to the placebo period. The rate of progress was higher during the anabolic period as compared to the control group which did not alter significantly in their rate of progress. With the acception of the bench press and the military press exercises, all the other exercises yield significant differences between the control and the experimental groups under the experimental conditions.

Clearly, the anabolic steroid had a significant effect upon the components of the knee jerk reflex. This was achieved by reducing the time of execution of the portion of the reflex from the electrobiochemical coupling to the mechanical expression of movement. The time of the neural component (the latency) was slower under the experimental conditions. The specific biochemical changes that facilitate this faster motor time and slower latency need to be further examined. possible contributing factors are permeability changes in membranes that permit an altered rate of exchange of the increased calcium and potassium concentrations that have been reported (2).

Anabolically active 17-alpha-alkylated steroids have been shown to enhance creatine synthesis and excretion. The phosphocreatine content of muscle after treatment with steroids should be determined.

With these indications of an anabolic steroid effect upon psychological, physiological and neurological factors in human performance further research is needed to isolate the mechanism involved. Investigators must be wary when assessing improved performance. The assumption that one dependent variable has been isolated may well be erroneous and observed differences may not be solely attributable to one such variable.

REFERENCES

1. Afifi, A., "Steroid Myophatly, Chemical, Histologic and Cytologic Observations," *Johns Hopkins Medical Journal,* 123:158–173, (Oct.), 1968.
2. Almqvist, S. and Luft, R., "Metabolic Studies with Methandrostenolone in Human Subjects," *Acta Endocrinologica,* 38:413–418, 1961.
3. Arnold, A., Potts G., and Beyler, A., "Evaluation of the Protein Anabolic Properties of Certain Orally Active Anabolic Agents Based on Nitrogen Balance Studies in Rats," *Endocrinology,* 72:408–417, 1963.
4. Astwood, E., *Recent Progress in Hormone Research,* New York: Academic Press, 1969.
5. Bartlett, P., "Rates of Protein Synthesis, Amino Acid Catabolism and Size of Nitrogen Pool During Nitrogen Storage Induced with Testosterone Propionate, and Testosterone Propionate Combined with Growth Hormone," *Endocrinology,* 52:272–281, 1953.
6. Bartlett, D., and Gaebler, O., "Studies on the Mechanism of Nitrogen Storage," *J. Biol. Chem.,* 196:1–9, 1952.
7. Bartlett, D., and Glynn, M., "Studies on the Mechanism of Nitrogen Storage," *J. Biol. Chem.,* 187:253–265, 1950.
8. Bartlet, D., and Stevenson, A., "Effects of Protein Anabolic Hormones on Rates of Protein Degradation and Protein Loss in the Fasting Dog," Endocrinology, 55:200–204, 1954.
9. Berg, P., "Acyl Adenylates, and Enzymatic Mechanism of Acetate Activation," *J. Biol. Chem.,* 222:1025–1031, 1956.
10. Bergstrom, J., Huttman, E., and Saltin, B., "Diet, Muscle Glycogen and Physical Performance," *Acta Physiol. Scand.,* 71:140–150, 1967.
11. Boris, A., Stevenson, R., and Trmol, T., "Comparative Androgenic Myotropic and Antigonadotropic Properties of Some Anabolic Steroids," *Steroids,* 15:61–71, 1970.
12. Borsook, H., and Keighley, G., "Continuing Metabolism of Nitrogen in Animals," *Proc. Roy. Soc. London,* 118:488–502, 1935.
13. Brenoman, J. "Massive Intra Articular Injection of Methylpednisolone Without Harmful Side Effect," *Michigan Medical Journal,* 68:135–136, 1969.

14. Bullock, G., "The Effects of Catabolic and Anabolic Steroids on Amino Acid Incorporation by Skeletal-Muscle Ribosomes," *Biochemical Journal,* 108:417–425, July, 1968.
15. Coxon, R., Korenchevsky, V., and Lawrence, A., "Chemical Changes in the Heart, Liver, and Kidneys of Rats after Administration of Sex Hormones," *J. Pathol. Bact.,* 72:613–620, 1956.
16. Dorfman, R., and Kincl, F., "Relative Potency of Various Steroids in an Anabolic-Androgenic Assay Using the Castrated Rat," *Endocrinology,* 72:259–266, 1963.
17. Dorfman, R., and Shipley, R., *Androgens,* New York, London, 1956.
18. Drill, A., and Riegel, B., "Structural and Hormonal Activity of some New Steroids," *Recent Progress in Hormonal Research,* New York: Academic Press, pp. 29–67, 1958.
19. Edgren, A., "A Comparative Study of the Anabolic and Androgenic Effects of Various Steroids," *Acta Endocrinologica,* 44 (Suppl.), pp. 3–21, 1963.
20. Eisenberg, E., and Gordon, G., "The Levator Ani Muscle of the Rat as an Index of Myotrophic Activity of Steroidal Hormones," *J. Pharmacol. Exp. Therap.,* 99:38–44, 1950.
21. Eisenberg, E., Gordan, G., and Elliott, H., "Testosterone and Tissue Respiration of the Castrate Male Rat with a Possible Test for Myotrophic Activity," *Endocrinology,* 45:113–119, 1949.
22. Eisenberg, E., Gordan, G., and Elliott, H., "The Effect of Castration and of Testosterone upon the Respiration of Rat Brain," *Science,* 109.
23. Fowler, W., "Effect of an Anabolic Steroid on Physical Performance of Young Men," *J. Appl. Physiol.,* 20:1038–1040, 1965.
24. Fritz, I., "The Effect of the Adrenal Cortex on the Release of N-15 from Tissue Proteins of Rates Previously Fed N-15-Glycine," *Endocrinology,* 58:484–493, 1956.
25. Frye, B., *Hormonal Control in Vertebrates,* New York: MacMillan, 1967.
26. Ganong W., and Martini, L., *Frontiers in Neuroendocrinology,* New York: Oxford University Press, 1969.
27. Gershbein, L., "Liver Regeneration in the Presence of High Levels of Steroid Hormones," *Proc. Soc. Exp. Biol. Med.,* 125:1063–1067, Aug.-Sept., 1967.
28. Good, T., "Anabolic Steroids in Cystic Fibrosis of the Pancreas," *Amer. J. Dis. Child.,* 111:272–277, March, 1966.
29. Gordan, G., and Elliott, H., "The Action of Diethylstilbestrol and Some Steroids on the Respiration of Rat Brain Homogenates," *Endocrinology,* 41:517–518, 1947.
30. Gordan, G., Evans, H., and Simpson, M., "Effects of Testosterone Propionate on Body Weight and Urinary Nitrogen Excretion of Normal and Hypophysectomized Rats," *Endocrinology,* 40:375–380, 1937.
31. Granick, S., "Steroid Induction of Porphyrin Synthesis in Liver Cell," *J. Biol. Chem.,* 242:458–493, 1967.
32. Greene, R., "Androgens and Growth," *Brit. Med. J.,* 2:379–389, 1969.
33. Guyton, A., *Textbook of Medical Physiology,* 3rd Ed., Philadelphia: Saunders, 1967.
34. Hamilton, J., "The Role of Testicular Secretions as Indicated by the Effects of Castration in Man and by Studies of Pathological Condition," *Rec. Progr. Hormone Res.,* 3:256–322, 1948.
35. Hershberger, L., Shipley, E., and Meyer, R., "Myotrophic Activity of 19-Nortestosterone and Other Steroids Determined by Modified Levator Ani Muscle Method," *Proc. Soc. Exp. Biol.,* 83:175–180, 1953.
36. Homburger, F., and Pettengill, O., "The Protein Anabolic and Other Effects of Testosterone Propionate in Mice: Effects of Nutrition and Interrelationship of Biologic Activities of the Hormone," *Endocrinology,* 57:296–300, 1955.
37. Humm, H., Kochakian, D. C., and Bartlett, M., "Effect of Castration and Steroids on the Arginase and Phosphatases of the Organs of the Guinea Pig," *J. Biol. Chem.,* 155:251–254, 1948.
38. Johnson, L., and O'Shea, J., "Anabolic Steroid: Effects on Strength Development," *Science,* 164:957–959, 1969.
39. Jungck, E., and Greenblatt, R., "Methandrostenolone, an Oral Anabolic Agent," Reprint of *Southern Medical Journal,* 57:909–913, 1964.
40. Karpovich, P., and Millman, N., "Vitamin B_1 and Endurance," *New England J. Med.,* 226:881–882, 1942.
41. Kenyon, A., Sandiford, I., Bryan, A., Knowlton, K., and Koch, F., "The Effect of Testosterone Propionate on Nitrogen, Electrolyte, Water and Energy Metabolism in Euruchoidism," *Endocrinology,* 23:135–153, 1938.
42. Kinsell, W., Michaels, D., Li, H., and Larsen, W., "Studies in Growth," *J. Clin. Endocrinology,* 8:1013–1036, 1948.
43. Kipnis, D., and Reiss, E., "The Effect of Cell Structure and Growth Hormone on Protein Synthesis in Striated Muscle," *J. Clin. Investigation,* 39:1002–1013, 1960.
44. Koch, F., "The Male Sex Hormones," *Physiol. Rev.,* 17:153–238, 1937.

45. Kochakian, C., "The Protein Anabolic Effects of Steroid Hormones," *Vitamin and Hormones,* 4: 255–305, 1946.
46. Kochakian, C., "Protein Anabolic Action of Testosterone Propionate in Hyperthyroid Castrated Rats," *Endocrinology,* 66:786–802, 1960.
47. Kochakian, C., "Comparison of Protein Anabolic Property of Various Androgens in the Castrated Rat,"*Amer. J. Physiol.* 160:53–61, 1950.
48. Kochakian, C., "Testosterone and Testoterone Acetate and the Protein and Energy Metabolism of Castrate Dogs," *Endocrinology,* 21:750–755, 1937.
49. Kochakian, C., and Costa, G., "The Effect of Testosterone Propionate on the Protein and Carbohydrate Metabolism in the Depancreatized-Castrated Dog," *Endocrinology,* 65:298–308, 1959.
50. Kochakian, C., Cohn, L., Quigley, E., and Trybalski, E., "Effect of Testosterone Propionate on Nitrogen and Chloride Excretion and Body Weight of Castrated Rats During Recovery From Fasting," *J. Biol. Chem.,* 155:272–277, 1948.
51. Kochakian, C., Humm, H., and Bartlett, M., "Effect of Steroids on the Body Weight, Temporal Muscle and Organs of the Guinea Pig," *J. Biol. Chem.,* 155:242–254, 1948.
52. Kochakian, C., Moe, J., and Dolphin, J., "Protein Anabolic Effect on Testosterone Propionate in Adrenalectomized and Normal Rats," *Amer. J. Physiol.,* 162:581–589, 1950.
53. Kochakian, C., and Murlin, J., "The Effects of Male Hormone on the Protein and Energy Metabolism of Castrate Dogs," *J. Nutrition,* 10: 437–459, 1935.
54. Kochakian, C., and Murlin, J., "The Relationship of the Synthetic Male Hormone Androstendion, to the Protein and Energy Metabolism of Castrate Dogs and the Protein Metabolism of a Normal Dog," *Amer. J. Physiol.,* 117:642–657, 1936.
55. Kochakian, C., and Endahl, B., "Influence of Androgens on Transaminase Activities of Different Tissues," *Am. J. Physiology,* 186:460–462, 1956.
56. Kochakian, C., and Stettner, C., "Effect of Testosterone Propionate and Growth Hormone on the Weights and Composition of the Body and Organs of the Body and Organs of the Mouse," *J. Biol. Chem.,* 155:255–261, 1948.
57. Kochakian, C., and Stettner, C., "Effect of Testosterone Propionate and Growth Hormone on the Arginase and Phosphatases of the Organs of the Mouse," *J. Biol. Chem.,* 155:262–264, 1948.
58. Kochakian, C., and Tillotson, C., "Influence of Several C-19 Steroids on the Growth of Individual Muscles of the Guinea Pig," *Endocrinology,* 60:607–618, 1957.
59. Kochakian, C., Tillotson, C., and Endall, C., "Castration and The Growth of Muscles in The Rat," *Endocrinology,* 58:226–230, 1956.
60. Kochakian, C., Tillotson, C., Austin, J., Dougherty, E., Hagg, V., and Coalson, R., "The Effect of Castration on the Weight and Composition of the Muscles of the Guinea Pig," *Endocrinology,* 58:315–326, 1956.
61. Kolodny, L., "Methandrostenolon in Clinical Management of Weight Deficit," *Medical Times,* 91:3–12, 1963.
62. Kowalewski, K., and Blkesi, G., "Observations on Tissue Oxygen Consumption and Glycolysis in Rats Treated With Anabolic Androgen," *Acta Endocrinologica,* 33:406–411, 1960.
63. Jungck, E., and Greenblatt, R., "Methandrosteonolone, an Oral Anabolic Agent," Reprint from *Southern Medical,* 57:909–913, 1964.
64. Leonard, S., "Succinic Dehydrogenase Level in Striated Muscle in Relation to Male Hormone," *Endocrinology,* 47:260–264, 1950.
65. Liddle, G., and Burke, H., "Anabolic Steroids in Clinical Medicine," Reprint from *Helvetica Medica Acta,* 27:504–513, 1960.
66. Marquardt, H., Fisher, I., Levy, P., and Dowben, R., "Effect of Anabolic Steroids on Liver Function Tests and Creatine Excretion," *J. Am. Med. Asso.,* 175:115–117, March, 1961.
67. Mayer, J., and Bullen, B., "Nutrition and Athletic Performance," *Exercise and Fitness,* Chicago: The Athletic Institute, 1960.
68. Meyer, R., and Hershberger, L., "Effects of Testosterone Administration on Acid Soluble and Insoluble Glycogen in the Levator Ani Muscle," *Endocrinology,* 60:397–401, 1957.
69. Mazur, A., and Harrow, B., *Biochemistry: A Brief Course.* Philadelphia: Saunders, 1968.
70. Metcalf, W., and Gross, E., "Influence of Anabolic Steroids on Uptake of Alpha-Aminoisobutyric Acid by Levator Ani Muscle," *Science,* 132: 41, 1960.
71. Meyer, A., and Danow, H., "Influence of Methyltestosterone on Metabolism of Normal, Castrate and Thyroidectomized Rats," *Proc. Soc. Exper. Biol.,* 49:598–601, 1942.
72. Mountcastle, V., *Medical Physiology,* 12th Ed., Saint Louis: Mosby, 1968.
73. Novak, A., "Effects on Androgenic Hormones on the Rate Incorporation of Labeled Amino Acids in Male Adult Mice," *Amer. J. Physiol.,* 191:306–312, 1957.

74. Oser, B., *Hawk's Physiological Chemistry,* 14th Ed., New York: McGraw-Hill, 1964.
75. O'Shea, J., and Winkler, W., "Biochemical and Physical Effects of an Anabolic Steroid in Competitive Swimmers and Weight Lifters," *Nutrition Report International,* 2:351–362, 1970.
76. Overbeek, G., and DeVisser, J., "A Comparison of the Myotrophic and Androgenic Activities of Phenylpropionates and Decampates of Testosterone and Mandrolone," *Acta Endocrinologica,* 38:285–292, 1961.
77. Overbeek, G., et al., "Anabolic Properties of Ethylestrenol," *Acta Endocrinologica,* 40:133–139, 1962.
78. Papanicolaou, G., and Falk, E., "General Muscular Hypertrophy Induced by Androgenic Hormone," *Science,* 87:238–239, 1938.
79. Pincus, G., *Recent Progress in Hormone Research,* New York: Academic Press, 1958.
80. Sandber, A., Slaunwhite, W., and Antoniadis, H., "The Binding of Steroids and Steroid Conjugates to Human Plasma Protein," *Recent Progress in Hormone Research,* 13:209–236, 1957.
81. Schaffner, F., Popper, H., and Chesrow, E., "Cholestasis Produced by Administration of Norethandrolone," *Amer. J. Med.,* 26:249–254, Feb., 1959.
82. Selye, H., "The General Adaptation Syndrome and the Diseases of Adaptation," *J. Clin. Endocrin.,* 6:117–230, 1946.
83. Selye, H., "Further Evidence in Support of the Alarm Reaction Theory of Adrenal Insufficiency," *Amer. J. Physiol.,* 119:400–401, 1937.
84. Selye, H., "A Syndrome Produced by Diverse Nocuous Agents," *Nature,* 138:32, 1936.
85. Schoenheimer, R., *The Dynamic State of Body Constituents,* Cambridge: Harvard University Press, 1942.
86. Schoenheimer, R., Ratner, S., and Rittenberg, D., "Studies in Protein Metabolism," *J. Biol. Chem.,* 130:703–732, 1939.
87. Schoenheimer, R., Ratner, S., Rittenberg, D., and Heidelberger, M., "Interaction of Blood Protein of Rat with Dietary Nitrogen," *J. Biol Chem.,* 144:545–561, 1942.
88. Scow, R., and Roe, J., "Effect of Testosterone Propionate on the Weight and Myoglobin Content of Striated Muscle in Gonadectomized Guinea Pigs," *Am. J. of Physiol.,* 174:22–27, 1953.
89. Scow, R., and Hagan, S., "Effect of Testosterone Propionate on Myosin, Collagen and other Protein Fractions in Striated Muscle of Gonadectomized Male Guinea Pigs," *Am. J. of Physiol.,* 180:31–36, 1955.
90. Sirek, O., and Best, C., "The Protein Anabolic Effect of Testosterone Propionate and its Relationship to Insulin," *Endocrinology,* 52:390–394, 1952.
91. Tallan, H., Moor, S., and Stein, W., "Studies on the Free Amino Acids and Related Compounds in the Tissues of the Cat," *J. Biol. Chem.* 211: 927–942, 1954.
92. Wainman, P., and Shipounoff, G., "The Effects of Castration and Testosterone Propionate on the Straiated Perineal Musculature in the Rat," *Endocrinology,* 29:975–978, 1941.
93. Weisenfeld, S., "Effect of 17-Ethyl-19-Nortestosterone on Hyperglycemic of Glucagon in Humans," *Proc. Soc. Exper. Biol.,* 97:764–767, 1958.
94. Williams, R., *Textbook of Endocrinology,* 3rd Ed., Philadelphia: W. B. Saunders, 1962.
95. Wotiz, H., Van Baerle, R., and Leman, H., "Studies in Steroid Metabolism," *J. Biol. Chem.,* 213:969–976, 1955.
96. Yakovlev, N., "Nutrition of the Athlete," *Track Technique,* 20:612–614, 1964.
97. Snedecor, G. W., and Cochran, W. C., *Statistical Methods.* The Iowa State University Press, Ames, Iowa, pp. 432–436, 1967.
98. Ariel, G., and Saville, W., "Characteristics of Different Reflex Components Before and After Work," A study presented for publication in *Ergonomics.*
99. Botwinick, J., and Thompson, L., "Premotor and Motor Components of Reaction Time," *J. Exper. Psych.,* 71:9–15, 1966.
100. Kroll, W., "Patellar Reflex Time and Latency Under Jendrassik and Crossed Extensor Facilitation," *Amer. J. Phys. Med.,* 47:292–301, 1968.
101. Weiss, A., "The Locus of Reaction Time Change with Set, Motivation and Age," *J. Ceront.,* 20: 60–64, 1965.
102. TECA Corporation, "Operating Notes, Medical Electronics Development," White Plains, N.Y.
103. Berger, R., "Strength Testing," *Journal for the Texas Asso. for Health, Physical Education, and Recreation,* 32:6, 1964.
104. Clarke, H., "Improvement of Objective Strength Tests of Muscle Groups by Cable-Tension Methods," *Res. Quart.,* 21:399–419, 1950.
105. Clarke, H., "Recent Advances in Measurement and Understanding of Volitional Muscular Strength," *Res. Quart.,* 27:263–275, 1956.
106. Kroll, W., "A Reliable Method of Assessing Isometric Strength," *Res. Quart.,* 34:350–355, 1963.

107. Kroll, W., "Central Facilitation in Bilateral Versus Unilateral Isometric Contractions," *Amer. J. of Phys. Med.*, 44:218–223, 1965.

108. Kroll, W., "Level of Isometric Strength and Isometric Endurance in Repeated Contractions," *Res. Quart.*, 37:375–383, 1966.

109. Rasch, P., and Morehouse, L., "Effect of Static and Dynamic Exercises on Muscular Strength and Hypertrophy," *J. Appl. Physiol.*, 11:29–34, 1957.

110. Sills, F., and Everett, P., "The Relationship of Extreme Somatotypes to Performance in Motor and Strength Tests," *Res. Quart.*, 24:223–228, 1953.

111. Tinkle, W., and Montoye, H., "Relationship Between Grip Strength and Achievement in Physical Education Among College Men," *Res. Quart.*, 32: 238–243, 1961.

112. Wessell, J., and Nelson, R., "Relationship Between Grip Strength and Achievement in Physical Education Among College Women," *Res. Quart.*, 32:244–248, 1961.

113. Carlson, R., "Relative Isometric Endurance and Different Levels of Athletic Achievement," *Res. Quart.*, 40:475–480, 1969.

114. Cobley, J., "Straight from a Heavy: Jay Silvester," *Track and Field News*, pp. 16–17, May, 1971.

115. Casner, S., and Early, R., "Anabolic Steroid Effects on Body Composition in Normal Young Men," *J. Sports Med.*, 11:98–103, 1971.

Athletic Dermatology—Sixth in a Series

Parasitic Infestations

WM. J. HEMPHILL, M.D.
Eugene, Oregon

SCABIES (7-YEAR ITCH)

A diagnosis of scabies should be considered in everyone who has an itching eruption, especially of the hands and genitals. The characteristic distribution of this contagious disease is on the webbs of fingers, flexor surfaces of wrists, axillae, lower part of the abdomen and back (especially at the beltline), penis, and scrotum. Ordinarily scabies does not occur above the neck. The primary lesion is a small tortuous burrow with a tiny vesicle at one end. Excoriation, crusting and secondary infection tend to obscure the primary eruption except on the webbs of fingers and on the wrists at the base of the palm. Itching is a prominent symptom and it is worse when the patient is warm during exertion or after retiring for the night.

Pyogenic infection, including boils, is a frequent complication of scabies. This tends to be more severe in people with oily seborrheic skin. In most cases scabies is acquired by personal contact and by contact with infested clothing or bed linen.

The preferred treatment is with Quell ointment. The patient should take a bath followed by application of the ointment from chin to toes, *not missing a single square inch*. This is repeated on three successive nights and during this time all of the clothing and bedding should be laundered. At the end of the third day a second bath is taken and the patient puts on all fresh clothing. All close contacts should be treated at the same time. It is not unusual to continue itching for several days after treatment is completed while the skin damage heals, for this something simple such as calamine lotion or 0.25% Kenalog lotion can be applied. If itching persists beyond ten days, give a second course of Quell. If impetigo or boils are present, bacterial culture and sensitivity studies should be done and the appropriate antibiotic prescribed.

PEDICULOSIS PUBIS (CRABS, MECHANIZED DANDRUFF, CROTCH PHEASANTS)

The crab louse (Fig. 1) has strongly developed claws giving it a crablike appearance. It usually lives at the base of the hairs in the pubic region but may be found on all parts of the body in hairy individuals, including eyebrows and eyelashes. The louse itself is almost transparent and is difficult to see except in good light; it resembles a light brown freckle at the base of the hair. Picked off with tweezers a live insect can be observed to move if placed on a white sheet of paper. Oval shaped nits or eggs are firmly attached near the base of the hairs (Fig. 2). Itching with scratching and secondary infections are common, as in scabies. Transmission of the disease is by close contact as in shower rooms and locker rooms and by sleeping in the same bed with an infected individual. Toilet seats and locker room benches can spread this disease. Small drops of blood on underwear should arouse your suspicion about the presence of crab lice.

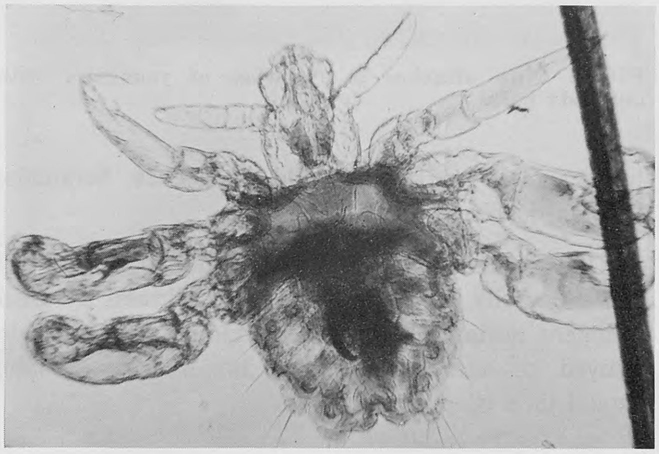


FIG. 1 Crab Louse with typical grip on hair.

Treatment consists of shampoo with Quell shampoo followed by application of Quell ointment. This should be continued every two to three days until no further evidence of the disease can be detected. Secondary infection can be controlled with Neo-sporin lotion and/or with internal antibiotics as indicated.

Parasites and nits of head lice are easily seen on examination of the scalp. The body louse lives in the seams of clothing and will not be seen on the skin. The skin lesions associated with body lice consists of red punctate bites, urticarial papules, pyoderma and

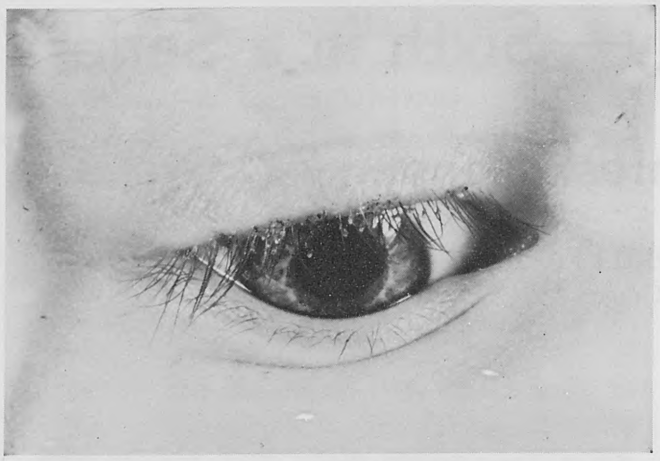


FIG. 2 Nits attached to eyelashes of youngster without body hair.

linear scratch marks on shoulder and back. Scratching is often deep and leads to bleeding.

The treatment of head lice is similar to that of crab lice. For body lice a thorough bath followed by Quell ointment during which time the clothing is either destroyed or autoclaved. Clean non-infected clothing should then be put on.

FLEAS

Many species of fleas bite man, causing erythematous wheals in the center of which is a reddish punctum (Fig. 3). The lesions are usually in groups of three or four or may be in a line. Not all persons react to flea bites: some apparently are immune while others develop large blisters or hemorrhagic lesions.

Dog and cat fleas are the most common source of these bites. These may be found around sawdust or sand or in the grass frequented by dogs and cats.

Treatment of flea bites consists mostly of prevention. Dust with 5% sulfur in talcum powder as a preventative or apply one of the newer repellents such as Off or 6-12 or RV Pellent. After the bites occur there may be a delay in onset of symptoms up to twenty-four hours followed by a reaction which may itch severely for two or three weeks. After the bites occur one of the anti-itching antihistamines such as Periactin or Tacaryl can be prescribed along with application of an antiseptic steroid cream if necessary.

TICKS

Ticks may be acquired by athletes in cross country running, although they would be somewhat rare, or while hunting game. Once the ticks are discovered they should be invited to drop off by touching the rear end with gasoline, ether, or a hot, burned out matchhead. Should the head break off, surgical removal is indicated. Tick paralysis may occur if the tick remains attached for several days.

FIG. 3 Flea bite: hemorrhagic puncta in center.

FIG. 4 Larva Migrans.

CHIGGERS

In the southern part of the United States chiggers or red bugs can cause considerable distress and itching. They inhabit grass, particularly long grass. They attack the skin below any tight constrictions such as garters or a belt. An initial wheal is followed by an intensely pruritic papule and often by secondary infection from scratching.

Treatment is prevention as in the case of flea bites. Topical steroid, antibiotic creams relieve the symptoms of the bite.

CREEPING ERUPTION (LARVA MIGRANS)

In the Gulf States and Pacific Coastal areas, dog and cat hookworm may be acquired by lying in the sand. The larvae are not sufficiently energetic to penetrate the blood stream for migration to the intestinal tract so they burrow around under the top layer of skin for several days until they die (Fig. 4). Itching and secondary infection from scratching may occur.

Treatment consists of freezing the area of skin ahead of the advancing edge of the burrow with dry ice or ethyl chloride spray. A newer treatment with thiabendazole given in appropriate dosage for the weight of the person is also effective.

BEES AND WASPS

The sting of bee, hornet, and wasp causes a painful lesion. However, this is not dangerous except in those few individuals who are hypersensitive to the insect in whom generalized urticaria may develop. Immediate measures including injection of adrenalin should be employed in such cases. Prophylactic measures include desensitization shots and taking an antihistamine tablet at least one hour before anticipated exposure.

Potpourri

EVEN INFANTS DO WATER EXERCISE

A program in Harvey, Illinois, in the YMCA's diaper division is involved with teaching infants to swim. Infants as young as 3 months enter a program where the mothers learn to exercise their babies and handle them in water. It is felt that swimming is easy at this age because the infant does not have any fear of the environment. After all he just came from the watery womb.

The program started from a desire to have infants exercised rather than just placed in the crib and left alone.

GAL'S ANSWER TO BACKACHE

Chronic backache has long menaced the civilized world, especially women and more especially, post-pregnant women. According to Dr. Evalyn Gendel, director of the Kansas State Division of Maternal Health, the biggest cause of backache in post-pregnant women is the lack of physical activity and sports since childhood.

She set forth three basic concepts that can pertain to backaches for everyone: (1) Lack of physical activity is a major contributing cause to backache. (2) Lack of full-scale sports programs can lead to back problems in later life. (3) Back problems can be helped, but only by tedious corrective re-education of muscles.

This is not really a new theory concerning back problems. It has been followed for years, but all too often in the rushed atmosphere of the training room a quick hot or cold pack is all the attention a chronic low backache gets.

ABOLISH THE LITTLE LEAGUE PITCHER?

Dr. Joseph Godfrey, chief of orthopedic surgery at children's hospital in Buffalo, N.Y., and team orthopedic surgeon for the Buffalo Bills, recommended the position of pitcher be eliminated from little league baseball. He feels that the possibility of permanent elbow disability is too great from throwing overhand at an early age.

Dr. Godfrey suggests that methods such as the "iron mike" pitching machine, a hitting tee, or a toss-up mechanism be used to set the ball up to be hit in both practices and games. He felt that there isn't enough knowledge in this area to be sure that limiting the pitcher to two or three innings is sufficient.

CRYOTHERAPY COMFORT

A suggestion from the field indicates that initial comfort during the application of an ice pack or ice massage can be aided by applying a hot pack to either a foot or a hand of the patient.

CHOKING TO DEATH?

The "cafe coronary," choking to death on a piece of food, probably one of the most unrecognized causes of death, according to Dr. R. K. Haugen, a pathologist from Fort Lauderdale, Fla.

Since collapse without warning is a symptom of heart attack, these accidents, such as getting a large piece of meat stuck in the throat, are often so diagnosed. If the obstruction plugs the windpipe the individual can neither talk nor breathe, but he may remain conscious for two minutes.

The tragic aspect is that, in at least half the autopsied cases, if onlookers had only realized the food was clearly and visibly lodged at the top of the throat, they could have yanked it out.

To be sure the victim has not had a heart attack ask him if he can talk. "If he shakes his head 'no' it's proof he is choking," says Haugen.

WHIRLPOOL RIM PADDING

Bernice Krumhansl and Orlean Winston of the physical therapy department of St. Luke's Hospital in Cleveland, Ohio described a method for padding whirlpool rims that might be effective in the training room also. They used Armstrong refrigeration pipe insulation and cut a slit through its entire length and placed it over the top edge of the whirlpool. The pipe insulation is available through building and refrigeration supply houses.

HYPNOTISM IN SPORTS MEDICINE

Dr. William J. Bryan, physician-hypnotist, claims that hypnotism has a future in sports medicine. He says the time will come when a football team's training schedule will include relaxation on the doctor's couch.

Hypnotism could also be used by a physician to reduce a dislocation or fracture. Sore arm and fear of injury represent real and imagined maladies that may be treated by team physicians trained to use hypnotism medically and psychologically.

"As soon as a team wins a championship or shows success with hypnosis they'll all follow," says Bryan. "They'd simply have to, because the edge would be too great."

Heavy Equipment by

Elmer's
Weights, Inc.

No matter what your sport or season, training can be more productive and accomplished quicker by using Elmer's Weights-You-Wear. Case studies prove stamina and endurance are extended greatly while peak performances are accomplished early and maintained longer

Elmer's also provides a complete line of therapeutic weights for use by coaches and trainers. The weight way will have your injuries back on the active list sooner with fewer re-occurring injuries as a result of incomplete recovery. Write for both the therapeutic and training weights catalog today and let Elmer's show you the weight way to train 'em.

Elmer's WEIGHTS, INC.

P.O. BOX 5426 LUBBOCK, TEXAS 79417 PH. 806-886-4661

Abstracts

"Flexibility and Fitness," Kerns, R. D., and Klein, M., Scholastic Coach, November, 1971.

Johnson, et al., report that flexibility is the component of physical fitness that pertains to the functional capacity of the joints to move through a normal range of motion. Two types of exercises, ballistic and static, have been recommended for improving flexibility in selected joints. DeVries summarizes the major advantages of static over ballistic stretching as follows: "Stretching by jerking, bobbing or bouncing (ballistic) involves reflexes which actually oppose the desired stretches. Stretching by static methods invokes the inverse myotatic reflex, which helps relax the muscles which are to be stretched. Static stretching is safer than ballistic methods because it doesn't impose sudden stress upon the involved tissues." A word of caution is in order. The strength or toughness of any joint depends upon the stability of the articulation. The most frequently injured articulations are the freely movable type. These are constructed of two articulating surfaces with cartilage which absorb shock, ligaments which enclose the joint, and muscles and tendons which extend across most freely movable capsules. Increasing flexibility may reduce stability and contribute to joint injuries. Thus, with some athletes, joint stability may be more important than flexibility.

A. G. Edwards

"Pre-Season Training or Year Round Fitness," Gillingham, John, Journal of Physical Education, October, 1971, 13-16.

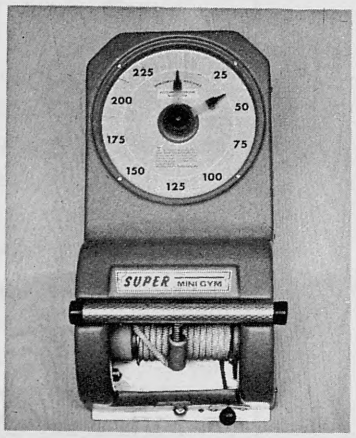
Setting fitness standards will help motivate the athlete to maintain a continuous total fitness program the year around. Examples of conditioning routines and variations are cited. The role of the team physician is stressed not only for the treatment phase of athletic injuries, but in the area of injury prevention and the promotion of health education.

G. Graham

ISOKINETICS *As Opposed to Fixed Weights*

Isokinetic resistance is ideal for Trainers. The resistance accommodates to the impaired part of the body because it is only equal to the force capacity of that injured area. This unique resistance is accomplished with a controlled speed braking mechanism that allows the patient to exert maximum effort, yet at the same time, can never exert what he is able to do at that specific angle, with that specific repetition.

The Isokinetic or "accommodating resistance" gives automatic adjustment for pain or fatigue and automatic progression in perfect pace with an improvement in capacity. A safer approach for the patient as he can never overdo his immediate capacity and it is virtually impossible for him to experience joint or muscle discomfort. A quicker approach for the Trainer because there are no exerciser adjustments to make, none to release as the different patients utilize the units for rehabilitation.



ACCOMMODATOR DIAL

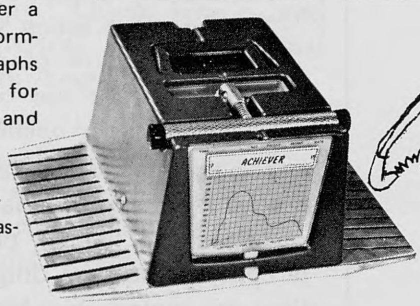
Model #125T — measures 5 to 65 lbs.

The Accommodator Dial easily detects arm and leg muscle weakness or strength through a full range of motion — with two hands similar to that of a clock. The first hand travels to one's peak effort, while the second hand fluctuates with the effort exerted throughout the range of motion.

ACHIEVER MODEL

Model #300T — measures 5 to 70 lbs.

The Isokinetic Achiever model with its pen marking mechanism provides a continuous graph tracing of the user's strength over a range of motion, measuring muscle performance with great accuracy. The paper graphs are easily inserted and may be retained for permanent record, yet may be reinserted and new tracings made with different colored pens for comparison. The recoil mechanism makes possible quick repetitious exercises. There is no setting or releasing of tension.

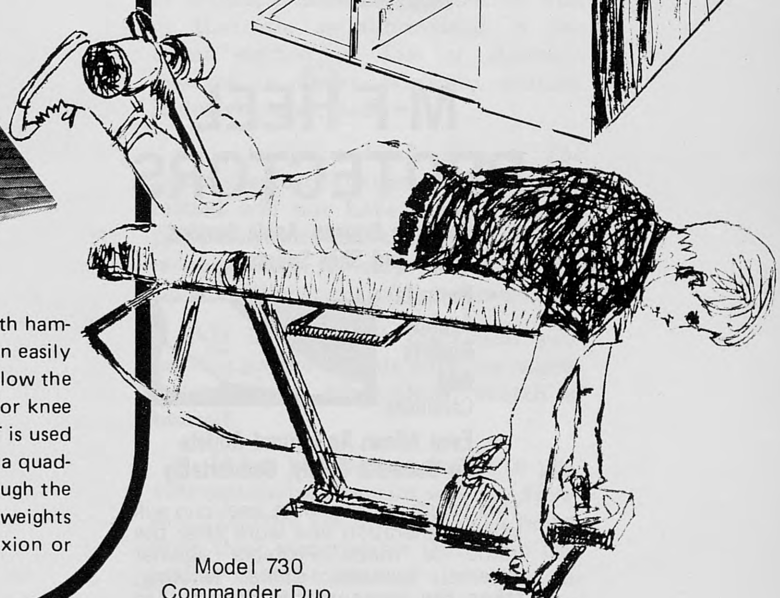


"COMMANDER DUO"

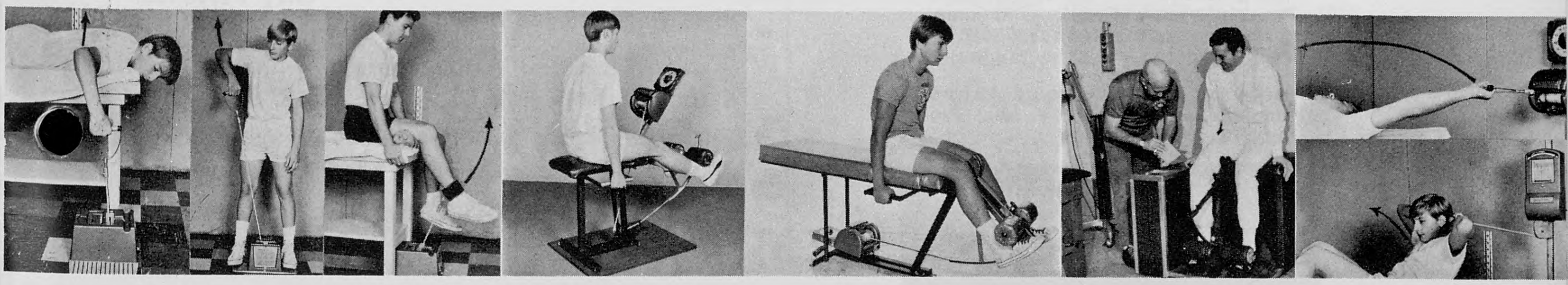
Model #730

The "Commander Duo" Model 730 Hamstring Exerciser is designed for both hamstring and quadricep exercise. As the patient does knee flexion, the individual can easily view the amount of effort he is exerting as the exerciser is stationed directly below the table. The seat slides back and the quadrant readjusts so the table is useable for knee extension as illustrated below. The Accommodator Dial Model #125A or #125T is used for this application. All isokinetic knee flexion and extension exercisers utilize a quadrant so the resistance always remains at the same position as one moves up through the range of motion. This feature is not available with other knee units as they use weights for the resistance and they lose their resistance as the user extends to full flexion or extension.

Model 700A or 700T
"Rehab" Table



Model 730
Commander Duo



Manufactured By MINI-GYM, INC., P. O. Box 266, Indep., Mo. (816) 836-1300

"An Administrator's View of Use and Misuse of Drugs Among Athletes," Smith, James C., The Journal of School Health, Vol. 42, No. 3, 170-171, March 1972.

In an attempt to halt the growth of drug abuse in Kanawha County (West Virginia) school system, a general drug policy has been adapted:

1. That schools be given discretionary powers regarding drug-involved students.
2. That schools should design a committee who, through training, become acquainted with techniques used to work with young drug users.
3. That guidelines be established to refer students with drug problems to the committee immediately.
4. That a central office referral committee be established which would offer the schools services, advise parents on treatment centers, and communicate with family doctors and other personnel.

The use and abuse of drugs by the athletic department was then studied using questionnaires distributed to coaches in the system, a group of high school guidance counselors, and a sampling of students. These were all variations of four questions:

1. Have any athletes in your program taken drugs?
2. If so, what action was taken?
3. Do you know of a coach who may have encouraged the use of drugs?
4. What is your opinion of drugs and athletes?

The findings showed that two football players, using relative's prescription, had taken amphetamines as a stimulant, one football player suffering from a form of epilepsy had used drugs, under a physician's direction, to control his hyperactivity, and that some coaches used tranquilizers to help cope with the pressures of their work.

Most coaches and counselors stated that there was no abuse of drugs by their athletes.

Student opinions differed depending on their own drug history. "Straight" students saw no drugs among athletes, while known users claimed drugs in abundance among school heroes.

In conclusion, though there is evidence of drug abuse in the Kanawha schools athletic programs, none of it is solid enough to warrant actual assurance of abuse.

Greg Vergamini

"Athletic Injuries: Application of Epidemiologic Methods," Robey, J. M., Blyth, C. S. and Mueller, F. O., JAMA, Vol. 217, No. 2, July 12, 1971.

This is the initial report on a five-year epidemiologic study of football injuries from a stratified cluster sample of student athletes from 43 North Carolina high schools. Data were collected from three areas: (1) personal characteristic data on all members of the study population, (2) objective data on each piece of protective equipment worn by each member of the study population, and (3) interviews weekly with coaches and athletes concerning injuries sustained. Injury incidence rates were computed for: (1) age of athlete, (2) time played in the game, (3) history of prior injury, (4) head injuries by make of helmet, (5) shoulder girdle area injuries by make of pads, (6) by practice activity exclusive of scrimmage, and (7) incidence and disability by offensive play activity.

Results of the first year indicated: (1) no significant difference in the rate of injury for players based on time exposed to risk exists, (2) injury risk increases with age, (3) a student with a history of prior football injury sustains injury at a significantly higher rate than his associates with no history, and (4) certain types of protective equipment are associated with injury incidence.

This study will continue through five years.

Kenneth Knight

"A Review of Cryotherapy," Olson, Jane E., and Stravino, Vincent D., Physical Therapy: Journal of APTA, Vol. 52, No. 8, August 1972.

The author's purposes are to: (1) discuss the physiologic effects of cold on the body; (2) review the literature on cryotherapy; (3) examine the benefits and limitations of the use of cold; and (4) stimulate interest in further clinical and laboratory research.

This article has covered cryotherapy most extensively with a list of 440 references at the end. Brought out are scientific results as well as the empirical on the most common uses of cryotherapy. Several theories for the relief of pain by cold are presented.

The authors point out that intramuscular temperature does not show a significant drop in temperature for at least 30 minutes whereas the skin has an immediate drop in temperature.

Clinical studies present indicate that heat and ice are equally effective for low back pain. Different techniques are presented as used by various authors. They call for more comparative studies of heat versus cold as well as for a larger member of subjects in the studies. Small members are not adequate for meaningful analysis.

This is a valuable article for teaching cryotherapy as well as an excellent review for those in the field.

Joe Gieck

Guide for Contributors

The editors of the *Journal of the National Athletic Trainers Association* welcome the submission of articles which may be of interest to persons engaged in or concerned with the progress of the athletic training profession. Submitted articles are considered as a contribution to the profession; no remuneration can be made. The following recommendations are offered to those submitting articles:

1. All manuscripts should be typewritten on one side of 8½ × 11 inch typing paper, double-spaced throughout.

2. Photographs should be black and white prints, preferably on glossy paper. Graphs, charts or figures should be clearly drawn on white paper, in a form which will be readable when reduced for publication.

3. When references are made to other published works, the list of references should be in the following order: a) books: author, title publisher with city and state of publication, year, page; b) articles; family names and initials of all authors, title of article, either the full journal title or the title as abbreviated in the latest edition of *List of Journals Indexed in Index Medicus*, volume, inclusive pages, date.

4. It is the understanding of *The Journal* editors that manuscripts submitted will not have been published previously; and that the author accepts responsibility for any major corrections or alterations of the manuscript.

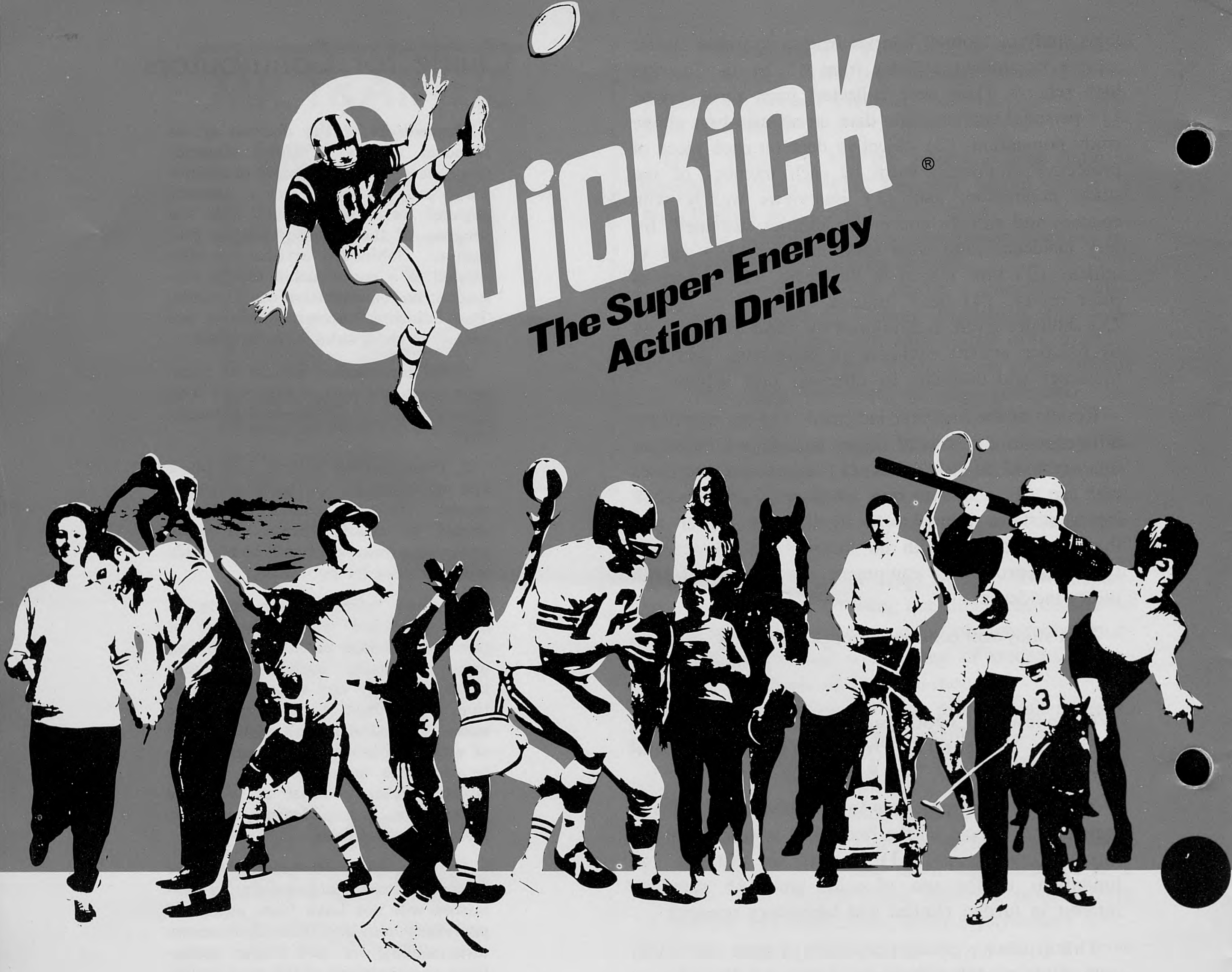
5. It is requested that each submitting author include with the manuscript a brief biographical sketch of himself.

6. It has become impossible to provide satisfactory reprint service. However, authors are authorized to reproduce their material for their own use, and it is recommended that they investigate the possibilities of having copies made at their own institutions, local job printers, or other reproduction agencies.

Unused manuscripts will be rereturned when accompanied by a stamped, self-addressed envelope.

Address all manuscripts to:

Clinton Thompson
Department of Athletics
Colorado State University
Fort Collins, Colorado 80521



WHY? "BECAUSE IT KEEPS 'EM GOING"

Professional trainers use Quickick to help keep their players going through workouts, practices and competitive conditions. Quickick was specially formulated as a thirst-quenching and energy-boosting drink for athletes. Quickick's four flavors help prevent taste fatigue and help prevent voluntary dehydration.

WHAT QUICKICK DOES!

It helps athletes maintain sharper reflexes in the latter stages of the game, which in turn helps reduce injury exposure from dulled reflexes, muscle spasms or heat cramps. Quickick helps restore body chemical balance quickly. Drinking Quickick is the proper way to rehydrate. It satisfies thirst and helps reduce body temperature without bloating. Consequently, your athletes can rehydrate while exercising, drink as much as they desire after practice and still have the desire to eat a large meal.

WHERE QUICKICK HAS HELPED BOYCOTT FATIGUE!

The Super Bowl
The Indianapolis 500
Major Golf Championships
The Baseball World
The Basketball World
In getting the World Swimming Endurance Record
Marching Band Contest
Industry
Hospitals

QUICKICK INC., Box 4006 Baton Rouge, Louisiana 70821

Spearing and Butt Blocking: Too Great a Risk

A comment by the National Federation of State High School Associations and the Committee on the Medical Aspects of Sports of the American Medical Association.

"Spearing" is the deliberate and malicious use of the head and helmet in an attempt to punish a ball carrier after his momentum has stopped. "Spearing" is an act committed by a defensive player.

A similar technique is sometimes used by the offensive player but goes by a different name. "Butt blocking" (stick blocking or head blocking) is an offensive technique involving initial and sustained contact with the head as the primary blocking surface either in close line play or in the open field. Both practices are dangerous for the player and the person he hits.

During the decade of the fifties, prior to the practices of spearing and butt blocking, about 67 per cent of the direct fatalities in interscholastic and intercollegiate football were caused by injury to the cervical spine and/or the brain. During the decade of the sixties over 90 per cent of the direct fatalities incurred in interscholastic and intercollegiate football were due to cervical spine and brain injuries. This was also the decade in which the faceguard became mandatory resulting in fewer dental and facial injuries but more head and neck injuries.

A survey of football head and neck injuries in one large sector of the country showed 60 per cent of players receiving head injuries had been taught to spear, and 44 per cent of those with neck injuries were coached similarly.

With the advent of the protective hard-shell helmet, the techniques of "spearing" and "butt blocking" developed. This blocking and tackling technique was initiated because the helmet and face mask were thought by some coaches to be sufficient armor to protect the head against injury. The player also is probably more prone to using it since he feels that his head and face are protected. The coach thought that spearing with the head would check the progress of the opponent more effectively than with the shoulder.

At first, spearing was defined only in terms of its most malicious purpose: butting an opponent who had already been felled or otherwise made defenseless. This is its most indefensible form and can be readily identified by game officials as an obvious act of flagrant unnecessary roughness and unsportsmanlike conduct. Later, however, it became obvious to team physicians that the vulnerability of the head and neck during this violation was as great during spearing (used as a defensive tactic) and during butt blocking.

When tackling is done with the head, the brunt of the blow is transmitted to the cervical vertebrae, and this part of the neck is most vulnerable to injury compared to the thoracic and lumbar vertebrae. The consequences are also more severe. Hyper-flexion, hyperextension or rotational injury to the cervical spine results. Of course, the skull absorbs a great deal of impact with such a blow and a concussion or intracranial hemorrhage may be the result. Interference with the brain and spinal cord always runs the risk of a permanently disabling and even life-threatening injury.

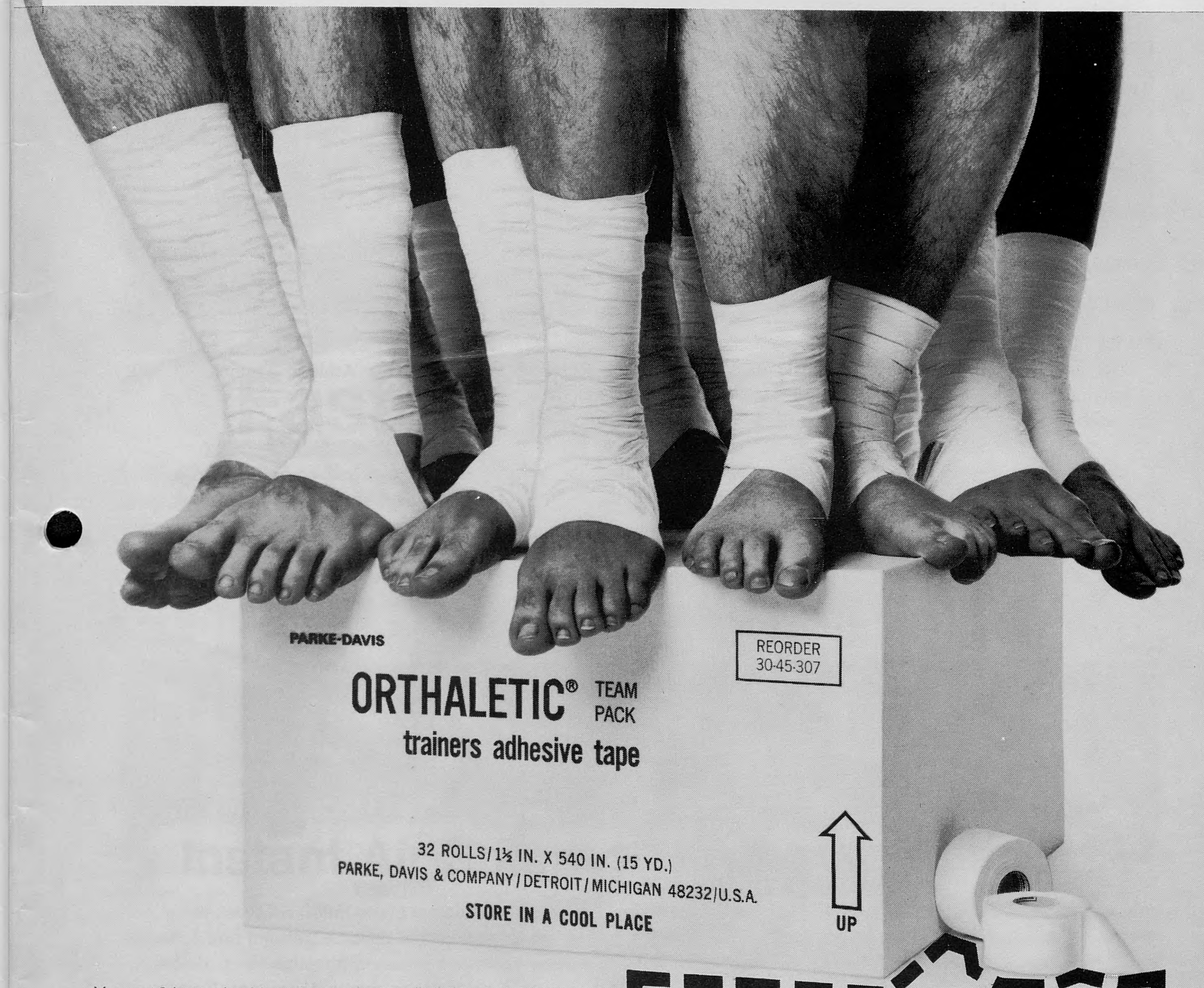
The player improves his performance when he tackles with his head up. With the head up (chin away from the chest) and neck "bulled" (drawn back onto the shoulders) the athlete has good visual field, the least chance of a direct blow to the head, and the most effective muscular control of his neck. He is in excellent position to stop the opponent by shoulder, chest and arm strength.

Conversely, in the flexed position (chin down toward chest) the athlete does not have the advantage of good vision, is likely to receive the full force of the impact on the head instead of shoulders and chest, is more apt to hit lower on the opponent's body (including the opponent's hard-driving knees), and exposes his cervical spine to impact while in its weakest position.

The National Federation of State High School Associations has had a rule against spearing for some time and in 1971, the National Collegiate Athletic Association adopted a ruling prohibiting its use. But spearing injuries continue to occur. Officials can control it to some extent. In the final analysis it is up to the coaches not to teach it, and the players to refuse to use it, since the possible serious injury that could result is far too much to risk for a game.

INDEX—Volume 7

One box will support 32 athletes



You get 64 taped ankles out of every Team Pack of ORTHALETIC 1½" Trainers Tape.

Easy stripping for quick strapping

ORTHALETIC Tape features special controlled-tension winding that allows the tape to unwind freely and easily... from the beginning to the very end of the roll.

Support your local athletes

Order a supply of ORTHALETIC Tape today. Available in both regular and heavy-duty weight... in tubes as well as Team Packs.

Orthaletic®
Adhesive Tape & Trainers Tape

PARKE-DAVIS *PARKE, DAVIS & COMPANY, Detroit, Michigan 48232*

Medical-Surgical Products Division. Att. Dept. 5434
PARKE, DAVIS & COMPANY, Detroit, Michigan 48232
Please send me complete information about athletic products available from PARKE-DAVIS.

NAME_______________________________

TITLE_______________________________

ADDRESS_____________________________

CITY______________ STATE__________ ZIP________

105871

CONDITIONING

DENTAL CONDITIONS

DISPOSABLE PLASTIC BAGS

HAMSTRING STRAIN

INJURIES

OSGOOD-SCHLATTER'S DISEASE

RESEARCH DESIGN

WHY Colorless Tuf-Skin?

In the beginning there was U.S.P. tincture of benzoin. It was a sticky—brown film and in 1930 the most appropriate base for tape. 1973 is a different story—There really is no need for color—the protective film is still there—the tannic acid which helps to toughen skin is still at work. The Colorless Tuf-Skin dries— really fast! It makes tape stick—solid. It does the job. Try some today and you will agree with "Field Testers" who make these remarks.

Bill Chambers, Head Trainer, Fullerton Junior College, California, says, "I have tried to test Colorless Tuf-Skin under every condition possible. The results are that I feel that it would be a great product to add to your line. If I were ordering right now, I would specify "Colorless Tuf-Skin". It does not leave a black build-up on the feet, it is easier to tape to, the athletes like it better, and there is less itching."

The late Ernie Biggs, Head Trainer, Ohio State University, said, "We used nothing for three days but Colorless Tuf-Skin on the entire squad for all types of bandages and tape jobs in preparing for practice. Nearly all players felt it was tackier, spread smoother, and adhered better. Generally preferred to any other adherent."

Elmer Brown, Head Trainer, Texas Christian University, says, "In my personal opinion, it is much better than regular Tuf-Skin because the tackiness is less gummy and the drying time is shorter. The ability to help tape stick was very good. The valuation of color is an excellent idea. This is one thing the kids mentioned all the time—no coloration."

Bryon Bird, Head Trainer, Oklahoma State University, says, "Over a period of two months I have tried to compare Colorless Tuf-Skin with another product. Our boys are sold on your new product."

It is packaged in two new convenient sizes—the slim pocket—fitting 10 oz aerosol can, and the handy, economical 16 oz. size for the training room. Available now from your favorite sporting goods store.

PRICE: 10 OZ. $1.95
16 OZ. $2.85

Cramer

cramer products, inc.

GARDNER, KANSAS U.S.A. 66030