1978

Effects of an auditory stimulus on pulse rate, blood pressure and galvanic skin resistance

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EFFECTS OF AN AUDITORY STIMULUS ON PULSE RATE, BLOOD PRESSURE AND GALVANIC SKIN RESISTANCE

by

Randall J. Garrett

An Abstract

of a project submitted in partial fulfillment
of the requirements for the degree of
Master of Science in the School
of Health, Physical Education
and Recreation at
Ithaca College

September 1978

Project Advisor: Dr. A. Craig Fisher

ABSTRACT

The effects of an auditory stimulus (pep talk) upon pulse rate, blood pressure, and galvanic skin response was examined. Eleven male members of the Ithaca College graduate and undergraduate physical education department, with prior athletic experience, volunteered as subjects.

The subjects' blood pressure, pulse rate, and galvanic skin response was monitored for 21 minutes with a three-minute Knute Rockne pep talk beginning after 12 minutes. All subjects were instructed to try and mentally place themselves in a locker room situation as the pep talk was listened to. Only one trial was allowed and each subject's pulse rate, blood pressure and galvanic skin response were graphed to note any significant changes from pre-treatment, treatment, and post-treatment conditions. Pulse rates and blood pressures were graphed for each subject and interpreted in a "clinical" sense, while galvanic skin response data were uninterpretable.

From the present study it can be observed that the auditory stimulus had a significant effect on blood pressure in the treatment condition. However, the pep talk had little or no effect on the pulse rate during the treatment and post-treatment conditions. It was also noted that in the post-treatment condition, average blood pressure

decreased significantly and almost returned to the normal resting state.

These data led to the partial rejection of the null hypothesis that stated the three-minute pep talk will have no effect upon arousal as monitored by blood pressure. On the other hand, the data accepted the null hypothesis that stated the three-minute pep talk will have no effect upon arousal as monitored by pulse rate.

EFFECTS OF AN AUDITORY STIMULUS ON PULSE RATE, BLOOD PRESSURE AND GALVANIC SKIN RESISTANCE

A Research Project Presented to the Faculty
of the School of Health, Physical
Education and Recreation
Ithaca College

In Partial Fulfillment of the
Requirements for the Degree
Master of Science

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by
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September 1978

Ithaca College
School of Health, Physical Education and Recreation
Ithaca, New York

CERTIFICATE OF APPROVAL

MASTER OF SCIENCE RESEARCH PROJECT

This is to certify that the Research Project of

Randall J. Garrett

submitted in partial fulfillment of the requirements for the degree of Master of Science in the School of Health, Physical Education, and Recreation at Ithaca College has been approved.

Research Project Advisor: _____

Candidate: _____

Chairman, Graduate Program in Physical Education: _____

Director of Graduate Studies: _____

Date: Sept. 30, 1978

ACKNOWLEDGMENTS

The investigator wishes to extend his appreciation to the following people:

1. To Dr. A. Craig Fisher, my project advisor, whose patience, guidance, and hard work, especially during the golf season, was the main factor for the completion of this study.

2. To Gayle, my wife, for her love, guidance, and willingness in helping pursue my goals and making this paper a reality.

3. To my parents for providing love and support these past 27 years.

4. To my parents-in-law for providing room and board this summer.

5. To Mike Smith, a close friend, who provided friendship and motivation through all my school years and even now.

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Chapter 1

INTRODUCTION

There are many facts, fallacies, and myths surrounding successful athletic performance today. Many of these facts, myths, and fallacies are difficult to separate, measure and evaluate, but a lot of coaches, physical educators, parents, and even some athletes believe that certain rituals must be performed before a contest or else the team will not be ready to play. For many years coaches and physical educators have supported and utilized the idea of an auditory stimulus (i.e., pep talk) to "psych-up" a team or an individual athlete before a contest. Perhaps this is so because there is widespread agreement that one of the most widely accepted principles of human behavior is that people perform best when motivated or aroused (45). However, the degree of arousal necessary for optimum performance varies with the individual, with the particular sport, with the position on the team, and with many other circumstances surrounding the particular event or contest (6,8,45). Consequently, various research projects have discussed the different arousal levels as significant physiological constructs that either impair or facilitate motor behavior (4,6,32,43).

It is a fairly well accepted fact that a high level

of arousal is essential for optimal performance in gross motor activities involving strength, endurance, and speed. However, a high level of arousal interferes with performances involving complex skills, fine muscle movements, coordination, steadiness, and general concentration (45).

It is entirely possible then that coaches of some sports do more "psyching-out" than "psyching-up" when delivering fiery pregame pep talks. Knute Rockne, a famous football legend at Notre Dame, in correspondence with Coleman Griffith (39:2) at Illinois said: "I do not make any effort to key them up, except on rare, exceptional conditions." Rockne went on to say that he attempted to make his players take the game less seriously than some other coaches did.

Apparently there is some movement today away from the overemphasis on the pep talk as a way of preparing athletes for competition (7). Morgan (51) provides a concise treatise on the wisdom of using this motivational gimmick. If one believes that the concept of individual differences applies to athletes, then how can one expect a group activation technique to be beneficial to all?

Although opinions vary regarding pep talks, the potential of a verbal stimulus to alter arousal level may be measured through various means. Among the most popular physiological measures which may be employed are the electroencephalograph (EEG), galvanic skin response (GSR), palmar sweat index (PSI), pulse rate (PR), blood pressure

(BP), and skeletal muscle tension (6,14,23,24).

It is the purpose of this study to investigate and measure, through three physiological parameters, differences between individuals in the degree of arousal elicited by an auditory stimulus. It is also the author's intention to investigate the possibility that pep talks have little or no influence on changing arousal levels, either from an immediate or long lasting perspective.

Scope of Problem

This study dealt with the effects of a three-minute Knute Rockne pep talk upon arousal as measured by galvanic skin response, blood pressure, and pulse rate. Eleven male students of the Ithaca College graduate and undergraduate physical education department volunteered as subjects and were tested one at a time. All subjects were provided a brief explanation of the testing procedures followed by a short demonstration of the equipment by the investigator prior to the actual testing. The experiment was conducted in the Psychomotor Performance Laboratory at different times of the day. The subject's blood pressure, pulse rate, and galvanic skin response was monitored for 21 minutes with the pep talk beginning after 12 minutes. All subjects were allowed only one trial and each subject's printout was recorded on graph paper.

Statement of Problem

The purpose of this study was to determine the

effects of a three-minute pep talk upon arousal as monitored by blood pressure, pulse rate, and galvanic skin response of male college students with prior athletic experience.

Null Hypothesis

The three-minute pep talk will have no effect upon arousal as monitored by blood pressure, pulse rate, and galvanic skin response.

Assumptions of Study

The following were assumed in this study:

1. The subjects were placed in a situation where true resting levels of arousal were obtained.

2. One trial was adequate to obtain data to test the null hypothesis.

3. The subjects mentally placed themselves in a locker room situation listening to a pep talk before competition, as requested in the instructions.

Definition of Terms

The following terms were operationally defined for the purpose of this study:

1. Arousal. Variations in neural excitation of an individual which may produce changes in behavior brought about by degree of significance of, or demands of a situation

as indicated through physiological, electrocortical, and behavioral measures (6,42).

2. Auditory Stimuli. A three-minute pep talk by Knute Rockne excerpted from the film entitled The Knute Rockne Story.

3. Blood Pressure (BP). The pressure of the systolic exertion of the heart over the diastolic pressure. The systolic sound is the point at which the heart is maximally contracting to pump blood through the body. The diastolic sound is heard when the heart is again filling with blood (1).

4. Pulse Rate (PR). The frequency of pressure waves (waves per minute) propagated along the peripheral arteries, such as the radial artery (1).

5. Resting Level Of Arousal. The means of the following three physiological measures of rest: blood pressure, pulse rate, skin resistance.

6. Skin Resistance (SR). The resistance to passage of electrical currents across the skin is a measure of arousal. The more aroused or alert the individual, the less resistance is afforded by the skin and the more freely the current flows. A galvanometer measures the amount of skin resistance and records the galvanic skin response (GSR) on a graph (7).

7. Volar Sweating. Sweating on the soles and palms. This is emotional sweating and is not for the purpose of thermoregulation (3).

Delimitations of Study

The delimitations of the study were as follows:

1. Only 11 volunteer male students with prior athletic experience from Ithaca College, Ithaca, New York, were included in this study.

2. Only three measures of physiological assessment were utilized.

3. Only one pep talk by Knute Rockne, presented from a cassette recording was utilized.

4. One, 21-minute monitoring period was used in the evaluation of arousal patterns.

Limitations of Study

The limitations of the study were as follows:

1. Resting rates of arousal may not be true due to the anticipation of the stimulus and the testing environment.

2. The subjects selected for this study may not have put themselves in the locker room situation as requested in the instructions.

Chapter 2

REVIEW OF RELATED LITERATURE

The review of literature for the purpose of this investigation had as its concentration the following important areas: (1) physiological assessment of activation, (2) activation response, and (3) activation and sport performance.

Physiological Assessment of Activation

Measurement of the intensity of the activation response (i.e., the degree of excitation, arousal, activation, or energy mobilization) may be achieved through various means (6,26). Two major classifications of physiological responses are affected by physiological arousal: (a) adrenal gland secretions, and (b) autonomic nervous system changes. Among the physiological measures which may be employed are galvanic skin response (GSR), muscle tension, pulse rate (PR), respiration rate, blood pressure (BP), and palmar sweat index (PSI) (14,23,24,26,27 35,41,42). All of the physiological parameters mentioned are a function of the autonomic nervous system (14,19). In respect to the activity of the heart, the relative levels of epinephrine and norepinephrine secreted by the sympathetic nerve endings bear a close relationship to

emotional arousal (14). In the case of volar sweating, acetylcholine is the apparent transmitting agent, which is also released from the sympathetic nerves (19). Sympathetic stimulation has been associated with the release of glucose by the liver into the blood stream, increases in metabolism rate and an increase in mental activity (9).

These measures show intercorrelations, although the correlation coefficients are not always high since there is patterning in the excitation of the individual, the nature of which appears to depend upon the specific stimulus situation and upon organic factors within the individual (6, 18,19,21,22). Ax (21) reported a low correlation of .12 between heart rate, blood pressure, respiration, galvanic skin resistance, and temperature. A low correlation was also noted by Basler, Fisher, and Mumford (22) in a study that investigated arousal and anxiety correlates of gymnastic performance. They reported a correlation of .10 between pulse rate and PSI which is not surprising because each is an indicant of a different physiological mechanism--cardiovascular and palmar sweating.

In a study by Harmon and Johnson (33) four tests of emotional reactivity were selected: pulse rate, systolic blood pressure, diastolic blood pressure and galvanic skin response. It was concluded that emotional disturbance just preceding athletic contests is evidently of sufficient intensity to be measured by three of the four physiological indicators selected. Galvanic skin response, however, closely

approximated the composite criterion and was the best single indicator. From the point of view of simplicity, however, pulse rate, which is demonstrably responsive to emotional excitation, may well be the most practical coaching tool. Although pulse rate may be the easiest physiological parameter to measure, Lykken (14) argues that pulse rate is also one of the most dubious indicators of activation.

Physiological measurements made in a variety of situations have shown the expected correspondence between the degree of arousal and the apparent degree of significance of the situation. The fact that contracting muscles create muscle action potentials makes them useful indicators of activation (20,25). For example, men undergoing flight training were found to show more tensions of the muscles during the solo stage of training than during other stages; and during the maneuvers of take off and landing than during other maneuvers (54). Mental tasks can give rise to irrelevant muscle contractions, and measurement of the EMG during mental activity could possibly be used to provide a rough idea of the relative mental effort involved in different tasks (19).

Underlying the physiological responses of the body to levels of arousal is the idea that man is preparing himself for "fight or flight" (2). To ready the body for muscular exertion the heart rate and, therefore, blood pressure are increased to better supply the muscles with

oxygen needed for work. Several studies (14,24,27) supported the indication that volar sweating increases the resistance of the skin, thus aiding the subject in protection. From these two inferences the two responses to emergency seem to be closely related to one another. As stated previously, however, there is not the high correlation between the two responses as it might seem.

Darrow (23) put forth the idea that there are two physiological and psychological processes apparent in arousal. The first process is the immediate reflex response to sensory excitation and is manifested by changes in the peripheral mechanisms such as vasoconstriction, perspiration, and volar sweating. The second process is the response to the association processes or ideas that threaten. These responses are seen in increased blood pressure and heart rate.

There is considerable evidence to support the hypothesis that the plantar and palmar (sole of foot and palm of hand) skin surfaces change as a result of arousal (14). Kaelbling (37) found neither auditory startle stimulus or electric shocks were able to produce significant increases in heart rate, although the galvanic skin response changed readily for all the stimuli. Lykken (41) and Plutchick (46) both report that the galvanic skin response was sensitive to a sudden noise or brief shock.

On the same idea, palmar sweat gland activity has become one of the more popular areas to measure because

it is easily recorded and quantified, and is sensitive to stimuli from external and internal sources. A technique for measuring sweat gland secretion was developed by Sutarman and Thompson (49) and further refined by Johnson and Dabbs (36). Martens (43), Mumford (52), and Boon (50) all utilized the PSI technique to determine arousal in the performance of a motor skill. Fisher (7) notes that galvanic skin response may be the most important psychophysiological measure in assessing levels of activation.

In areas of extreme excitation where threats to personal safety, property, or prestige are perceived, Darrow (24) suggested that heart rate and blood pressure bypass cortical control and revert to a lower control center. Darrow theorized that with the onset of this extreme excitation the adrenalin released into the blood stream actually reduces the value of volar sweating as an indicator of arousal.

In a study by Epstein and Clarke (28) on the influence of two variables upon reactions to a threatening situation, heart rate and skin conductance were the physiological parameters utilized. The results showed that physiological arousal during the anticipation period was directly related to anticipatory intensity of noxious stimulation, and that high threat groups had a significantly higher heart rate but no significant difference was found in skin conductance. Futhermore, Grossberg and Wilson (31) found that there were marked

increases from base level in both heart rate and skin conductance when fear and neutral scenes were read to subjects.

Nomikos, Opton, and Averill (44) also found increased heart rate and skin conductance between long and short anticipation of a harmful confrontation. Johnson (35), in a study that examined emotion revealed in football and wrestling contests, noted that in most cases a condition of painful tension was characterized by high blood pressure accompanied by relatively low heart rate. When both blood pressure and heart rate were quite high, the subjects tended to be excited and eager but not painfully emotional.

Clearly the physiological measures mentioned all respond to the need of the body to prepare for "fight or flight," however, the intensity and nature of the stimulus appear to affect the reactions of the indicators.

Because of the low intercorrelations among the various physiological measures mentioned, it is never quite possible to use one variable to represent the degree of activation (18). For example, the heart rate alone is one of the most dubious indicators of activation because it does not vary directly with the degree of arousal or emotional excitment (14). Both Duffy (26) and Lacey (12) agree that different measures of physiological arousal should be obtained, rather than a single measure.

Activation Response

It has been established earlier in the chapter that there is a response to various stimuli by the general arousal system. However, some studies have indicated that there are significant differences between individuals in these reactions (19,26). Duffy (26) explained that the reaction to a stimulus is affected by the basal arousal level. If the basal level of one individual is higher than that of another individual, the response to the stimulus will be higher in that individual with the higher basal level. Other factors have a significant affect on the accurate assessment of arousal level. Among these are the specific stimulus situation, the individual's expectations, and the environmental and hereditary influences on behavior (19,26). Individual differences explain why the correlations within an individual between the various measures of arousal are higher than between individuals.

Activation, then, does affect different parts of individuals in many ways. Some of the more common visible physiological effects of arousal on the athlete before a contest might include nausea (butterflies), vomiting, cramps, sweating, frequent urination, and cotton mouth. These visible effects, along with the physiological effects already mentioned such as increased pulse rates, blood pressure and skin resistance, give evidence to the reader

that arousal has some effect on the "motivating" or "emotional" value of the situation to the individual (7). A basic understanding of the physiological perspective of activation is essential to fully comprehend the level of arousal with which so many coaches and physical educators are concerned.

Hebb (10) stated that there are two main ways in which a sensory excitation affects cortical activity. The first is the specialized sensory pathways (direct routes from the eyes, ears, skin and proprioceptors) and the second kind of pathway is nonspecific. The specialized sensory pathways keep each sense distinct from others and keep messages within the same sense distinct. The nonspecific pathway pools the excitations and delivers them to all parts of the cortex. Thus, one source for arousal is the specialized sensory organs, and another source is the cortex itself. The resultant effect of these two sources on the arousal system produces a general level of arousal. High levels of excitation in the arousal system or ascending reticular activation system (ARAS) cause alertness and emotional states (17).

The hypothalamus is also part of the arousal system. This structure receives input from higher brain centers as well as from other internal organs of the body. The posterior segment of the hypothalamus has an important control over the autonomic nervous system. Thus, stimulation of the posterior hypothalamus accelerates the

functions of the internal organs--heart rate and blood pressure are increased, digestion is hurried, and sweating becomes more profuse. Futhermore, stimulation of the adrenal gland and release of the adrenal hormone epinephrine further stimulates the autonomic nervous system. Homeostatic balance is maintained in the body by the anterior portion of the hypothalamus. It controls the pituitary or master gland of the body and controls secretion of the endocrine glands (7,10,17).

Two other areas in the body also are involved in the arousal process. Fisher (7) notes that the limbic system functions in conjunction with the hypothalamus and plays a special role in regulating motivational and emotional responses to environmental events. A final structure that has a relation to arousal is the adrenal medulla (7,17). This structure is excited by the autonomic nervous system's activity under the control of the hypothalamus. Epinephrine is secreted from the adrenal medulla directly into the blood stream, where it affects the functions of the glands, the heart, and the smooth muscles of the intestine, bladder and lungs.

All of the structures mentioned above play a role in over-all arousal. However, nothing has been mentioned about individual differences in normal arousal level. It has been pointed out that the autonomic nervous system controls body processes and is responsible for the physiological changes that occur in states of

arousal or excitation. Since there is little control over the autonomic activity manifested by the smooth muscles and glands, blood pressure, heart rate and sweating may increase any time there is a display of emotions or arousal (17).

Observation of athletes prior to contests would lead one to believe that individuals do have different levels of arousal. It can be observed that some athletes are relaxed while others express higher states of excitment through visible physiological signs such as sweating, frequent urination, and so forth. These differences in normal arousal levels and their effects on learning and performance have been studied by numerous people. Shaffer (48) examined the problem of fear as experienced by normal young men who had faced the imminent danger of death during the latest phase of World War II. The physiological signs of emotion predominated, including rapid heart rate, dryness of the mouth, sweating, stomach sensations, and frequent urination. Muscular evidences included tension and trembling. The inventory of immediate symptoms show that fear is a state of profound bodily changes, with the most frequently noticed effects in the circulatory, muscular, grandular, digestive and execretory systems. From the results of this study, there seems to exist a relationship between the physiological assessments mentioned to those experienced by certain athletes before competition, or in a stressful situation. Many of the

reactions listed could be perceived by a coach or self-reported by the athlete before a particular contest. In the study by Harmon and Johnson (33) referred to earlier; 42 football players were tested on four physiological measures at a normal level and pre-game level. It was concluded that team performance had a significant relationship to the arousal level of the individuals who played in the game regularly. The individual performers were also markedly variable in their physiological reactions from game to game. It was also concluded, that emotional reactivity goes with "upness" for football competition. When the players were "down" the team performance was down. In this research, the team was measurably "up" or "down" before every contest.

Fisher (7) noted that individual patterns of identical reaction occur in different situations. Apparently everyone has his own way of reacting to environmental stimuli and how the individual perceives those stimuli is what colors his emotional response. A lot of people, especially coaches, feel that individuals perceive stimuli in the same way and that an optimum level of performance is conducive to successful athletic performance. Oxendine (45) states that the optimum arousal state varies from person to person, and from day to day. The degree of arousal necessary for optimum performance varies with the individual, with the particular sport, with the position on the team, and with many other

circumstances surrounding the particular contest or event. Morgan (51) and Fisher (7) agree with Oxendine by emphasizing that the arousal continuum is likely to extend all the way from phlegmatic to frenetic on any team. Morgan questions the use of pep talks as a device to bring every athlete to a level of optimum performance. He states that, if all coaches use such a technique, what is gained? If the athletes have merely all been moved along the arousal continuum (assuming the pep talk has an effect on arousal), has anything really been changed?

Activation and Sport Performance

It is a fact that most sport psychologist agree that different tasks require different levels of arousal for obtaining the most effective performance (5,34,45). It was stated earlier that when the activation mechanism is stimulated the system produces an alerting kind of response. This response is motivating up to a point at which conflicting activities in the cortex begin to interfere with one another, preventing the dominance of one activity that would produce one set of organized responses to the situation (10).

Freeman (30) reported in a study that effort to work above the congenial pace is accompanied by increased performance and decreased palmar skin resistance; conversely, the instruction to work below the congenial pace tends to

produce lowered performance and increased skin resistance. This study gave an inverted U-shaped curve when plotted on a graph. Relating this U-shaped curve to sport performance, it has been noted that the level of performance increases as the level of arousal increases up to a certain point. Duffy (6) explained that after the optimum point is reached, disorganization of responses frequently reported during "overmotivation" or "emotion," for example, may be conceived of as resulting in part from too high a degree of arousal. The drive theory, on the other hand, postulates that as drive increases, the dominant response is increasingly emitted whether correct or not. Thus, increased arousal sometimes facilitates performance and sometimes impairs performance (7).

Oxendine (45) has examined both theories of arousal and has reformulated the Yerkes-Dodson Law to make it more applicable to sport. Oxendine made the following generalizations on the basis of research literature, scientific literature, and empirical observation: (a) a high level of arousal is essential for optimal performance in gross motor activities involving strength, endurance, and speed; (b) a high level of arousal interferes with performance involving complex skills, fine muscle movements, coordination, steadiness, and general concentration; and (c) a slightly-above-average level of arousal is preferable to a normal or subnormal arousal

state for all motor tasks.

Research studies on the effects of arousal on sport performance are numerous and varied (11,22,33,38, 40,47). Harmon and Johnson (33) found that a major college football team played its best game of the season when aroused to the highest level. On the other hand, the team performed poorest when the arousal level was at the lowest state. Ryan (47), using a galvanic skin conductance to measure arousal, reported a relationship between arousal and performance on a stabilometer, which would be classified as a gross motor task, although it is not a sport skill. High arousal groups performed better than low arousal groups in this study.

Klavora (11) examined the relationships between playing performance and the precompetitive anxiety of athletes and attempted to derive inverted-U curves based on these relationships. The findings of this study suggested that both the low and the high A-trait subjects have to be approached in the same way. They all have to be activated before competition if they are to perform well. Another study by Klavora (38) investigated the possible differences in pre-competition emotional arousal level of football players assigned to different playing positions and whose subsequent game performance was rated optimal. The results indicated no significant differences in optimal pre-competition emotional arousal level in football players who were playing different positions,

suggesting that playing positions in football do not differentially affect emotional arousal in the individuals playing these positions. The findings also implied that a wide range of individuals, in terms of their emotional arousal level may perform well in tasks that require rather delicate responses of fine muscle groups and in tasks that require only brute strength and speed in blocking or tackling.

Basler, Fisher, and Mumford (22) investigated arousal and anxiety correlates of gymnastic performance and concluded that there are limited relationships between gymnastic performance and arousal/anxiety measures. The researchers concluded that, as expected, gymnastic ability was the best correlate of gymnastic performance.

Langer (40) tested the hypothesis that personality and anxiety were related to football performance as a direct function of stress. He pointed out that coaches can and do communicate stress feelings to their players. These in turn influence player performance as a function of certain personality variables. The better player seems capable of responding to stress in a controlled manner. One clinical observation made repeatedly was that the consistently better players seemed to display a typical anxiety pattern for each game. Indeed, absence of this pattern usually indicated a poorer performance.

It would be a misconception to say that there is a relationship between higher levels of arousal and better

sport performance. Over the years, however, many coaches have thought it commonplace in sport to use pep talks to achieve higher arousal levels to facilitate performance. Lawther (13) related that in many communities the coach's impassioned talk before the game and between halves is a revered tradition. The athletes expect "the treatment" and would be disappointed not to receive it. Lawther claimed that the more experienced athletes playing at a more sophisticated sports level are less likely to react to a soul-stirring oratory before a game. If you have a mixed group of experienced and beginner athletes, a pep talk might arouse one individual to the upper end of the continuum, while another individual might react in a way that causes more harm than good. Fisher (7) pointed out that as an individual advances on the learning curve, the level of optimum arousal required for maximum performance naturally increases. The responses are becoming well learned, and increased arousal (up to a point) will enhance performance.

Several studies have assessed arousal relative to experience and skill ability. Epstein and Fenz (29) reported that experienced and novice parachutists rated their approach and avoidance feelings at different points in time preceding and following a parachute jump. For the novice parachutists, self rated avoidance increased up to a point shortly before the jump, and then decreased. For the experienced parachutists, self-rated avoidance

increased up to the morning of the jump, decreased to the jump, and increased after the jump. It was concluded that with experience, the point of greatest anxiety is displaced backward in time.

In a similar study, Sullivan (53) noted that veteran wrestlers reported low approach feelings the night before the match but these feelings peaked at the handshake to begin the match. The inexperienced wrestlers, on the other hand, reported their highest feelings the night before but as the meet approached, these feelings declined until they were at a low at competition time.

It certainly can be concluded from these studies that adaptation relative to experience and skill in a task will effect arousal. Besides this it is also important to know task characteristics and conditions under which the task is to be performed before a coach delivers a pep talk to try and enhance arousal. Knowledge of individual differences as discussed previously prompts us to question the value of team motivation and pep talks to the entire squad (7).

Sabock (16), in talking about qualities of a good coach, stated that the slightest amount of motivation will effect performance to some degree, but an attempt to increase motivation excessively may result in poorer performance. The problem is to determine how much and what kind of motivation it takes to get a team to its peak. Sabock argues that playing on the emotions of an individual

athlete or group of athletes is a delicate technique since there is such a fine line between too little motivation, too much, and too soon or too late. Morgan (51), in addressing the relationship between activation and sports performance, argued that there are psychological differences between the successful and unsuccessful athlete right from the beginning. The successful athletes are less tense, have more vigor, and are less confused than nonsuccessful athletes before competition. If this is true, does one still try and "psych-up" all the athletes and get their tensions up pre-competitively? If one did, would the successful athlete still be successful?

Summary

Studies conducted by Ax (21) and Harmon and Johnson (33) utilized three or more physiological parameters when a certain type of arousal was measured. The measures used were pulse rate, systolic blood pressure, diastolic blood pressure, galvanic skin response, respiration, and temperature.

Studies completed by Basler, Fisher, and Mumford (22), Martens (43), and Sutarman and Thompson (49) indicated that the palmar sweat index was a popular technique to determine arousal in the performance of a motor skill.

Duffy (25), Woodworth and Schlosberg (20) and Williams amd Macmillian (54) have felt that contracting

muscles create muscle action potential which makes them useful indicators of activation.

Duffy (26), Hebb (10), Sage (17), and Fisher (7) studied the response to various stimuli by the general arousal system. They have indicated that different structures play a role in over-all arousal. Different levels of arousal were studied and their effects on learning and performance have been studied by Shaffer (48), Harmon and Johnson (33), Fisher (7), Oxendine (45) and Morgan (51).

Studies by Freeman (30), Duffy (6) and Oxendine (45) gave an inverted U-shaped curve when plotted on a graph. Relating this U-shaped curve to sport performance, it has been noted that the level of performance increases as the level of arousal increases to a certain point. After that point performance is impaired.

Klavora (11,38) in a couple of studies did not derive a U-shaped curve when graphing his results.

Several studies by Epstein and Fenz (29), and Sullivan (53) have assessed arousal relative to experience and skill ability.

Fisher (7), Lawther (13), Morgan (51) and Sabock (16) all discussed the pep talk in certain terms and have argued about the pep talk's pros and cons.

Chapter 3

METHODS AND PROCEDURES

This chapter outlines the methods and procedures used in gathering the data for this study. More specifically this chapter deals with: (1) selection of subjects, (2) testing design, (3) testing environment and procedure, (4) methods of data collection, (5) scoring of data, (6) treatment of data, and (7) summary.

Selection of Subjects

The subjects for this study were 11 volunteer Ithaca College graduate (N=4) and undergraduate (N=7) students. All subjects ranged in age from 19 to 25 years ($\bar{X}$=22 years) and had prior athletic experience.

Testing Design

A time sampling technique was utilized in which physiological data were collected at periodic intervals before, during, and after completion of the taped pep talk. This was done for the purpose of having multiple pieces of data in the pre-treatment, treatment, and post-treatment phases of the experiment.

Testing Environment and Procedure

A complete explanation and viewing of the testing

equipment was provided before the experiment. The subject was told that the experiment would take 21 minutes and that he was to be isolated in a darkened, soundproof room for that time. The subject was told to sit and relax in a comfortable chair with his elbows resting on the chair arms.

It was explained that blood pressure was to be monitored by an electrosphygmomanometer every four minutes, starting with the first minute, by an inflatable cuff placed over the radial artery of the left arm. Also pulse rate was recorded by a photoelectric pulse pickup attached to the ring finger. Galvanic skin response was recorded by a Fels Dermohmmeter attached to an Esterline Angus Recorder using electrodes attached to the index and middle finger of the left hand. All of the methods were harmless, although the blood pressure cuff did fill with air and create some tension on the subject's arm.

The subject was told that after monitoring pulse rate, blood pressure and galvanic skin response for 12 minutes, a Knute Rockne pep talk would play on a tape recorder for three minutes. The pep talk was an excerpt from the film, <u>The Knute Rockne Story</u>. It was comprised of the Notre Dame fight song, crowd cheering, a very excited Knute Rockne talking to his players before a football game, players' reaction to Knute Rockne and it ended with the fight song. During this time, the subject was asked to mentally try and experience the situation.

After the pep talk, the experimenter monitored the

blood pressure, pulse rate and galvanic skin response for six additional minutes. Upon completion of the experiment, the experimenter opened the door and removed all the monitoring devices.

Methods of Data Collection

The experiment was administered in the Psychomotor Performance Laboratory at Ithaca College by the investigator. The subject's blood pressure and pulse rate was monitored by a physiograph, while the galvanic skin response was monitored by an Fels Dermohmmeter. All monitoring equipment and tape recorder were set up in an adjacent room to where the subject was sitting. During the first minute the blood pressure was taken three times. This procedure was repeated every four minutes, therefore blood pressure rates were recorded at 1 minute, 5 minutes, 9 minutes, 13 minutes, 17 minutes, and 21 minutes. The pulse rate and galvanic skin response were monitored throughout the 21-minute experiment.

Scoring of Data

Blood pressure and pulse rate were recorded on a physiograph sheet. From this sheet the experimenter could graph the subjects' pulse rate every minute and the mean of three blood pressure recordings taken every four minutes. The pulse rate was indicated by vertical lines at the top of the physiograph paper. Time was indicated by markings

on the paper every five seconds. The blood pressure readings were recorded in terms of systolic and diastolic. The systolic reading was utilized for analysis. The galvanic skin response was recorded automatically for the entire time by an Esterline Angus Recorder.

Treatment of Data

All data were graphed for each subject separately and interpreted in a "clinical" sense.

Summary

The subjects for this study were 11 Ithaca College male graduate and undergraduate students with prior athletic experience. Each subject was shown and explained the testing procedures and seated in a room for 21 minutes while the experimenter recorded the blood pressure, galvanic skin response and pulse rate. After 12 minutes, a three-minute Knute Rockne pep talk was piped into the room. This was followed by six minutes of silence. Each inividual's pulse rate, blood pressure and galvanic skin response were graphed to note any signifigant changes from pre-treatment, treatment, and post-treatment phases.

Chapter 4

ANALYSIS OF DATA

This chapter presents the results of the data of each subject graphed separately and interpreted in a "clinical" sense. The findings are presented in terms of the following: (1) pre-treatment, treatment, and post-treatment, and (2) summary.

Pre-Treatment, Treatment, and Post-Treatment Conditions

In the pre-treatment, treatment, and post-treatment periods the subjects' pulse rate, blood pressure, and galvanic skin response was monitored for 21 minutes. During the 12-minute pre-treatment period, resting pulse rate, blood pressure, and galvanic skin resistance was monitored. During the three-minute treatment period, each of the physiological measures was monitored to assess the effects of a verbal stimulus. During the six-minute post-treatment condition, the resting pulse rate, blood pressure, and skin resistance was again monitored. The pulse rate represents heart beats per minute, the blood pressure represents the systolic recording, and the galvanic skin resistance represents the passage of electrical currents across the skin. Each subject's recordings were graphed and the effects and duration

of the verbal stimulus was noted. However, for analysis of data, only pulse rate and blood pressure were used since GSR's were uninterpretable.

Subject SL

Subject SL's pulse rate recordings were as follows: pre-treatment 52, 52, 59; treatment 58; and post-treatment 61, 57. Subject's SL's blood pressure recordings were as follows: pre-treatment 129, 128, 130; treatment 139; and post-treatment 135, 128 (see Figure 1). It can be observed that in the pre-treatment phase the subject's pulse rate increased seven points, while the blood pressure increased two points. In the treatment phase the pulse rate decreased one point, while the blood pressure increased nine points. The post-treatment phase showed an increase in pulse rate of three points and then a decrease of four points, while blood pressure decreased 11 points.

Subject DW

Subject DW's pulse rate recordings were as follows: pre-treatment 59, 57, 61; treatment 59; and post-treatment 59, 64. Subject DW's blood pressure recordings were as follows: pre-treatment 135, 137, 130; treatment 147; and post-treatment 135, 133 (see Figure 2). It can be observed that in the pre-treatment condition the pulse rate increased two points, while the blood pressure increased two points and then decreased seven points.

In the treatment phase the pulse rate decreased two points, while the blood pressure increased 17 points. During the

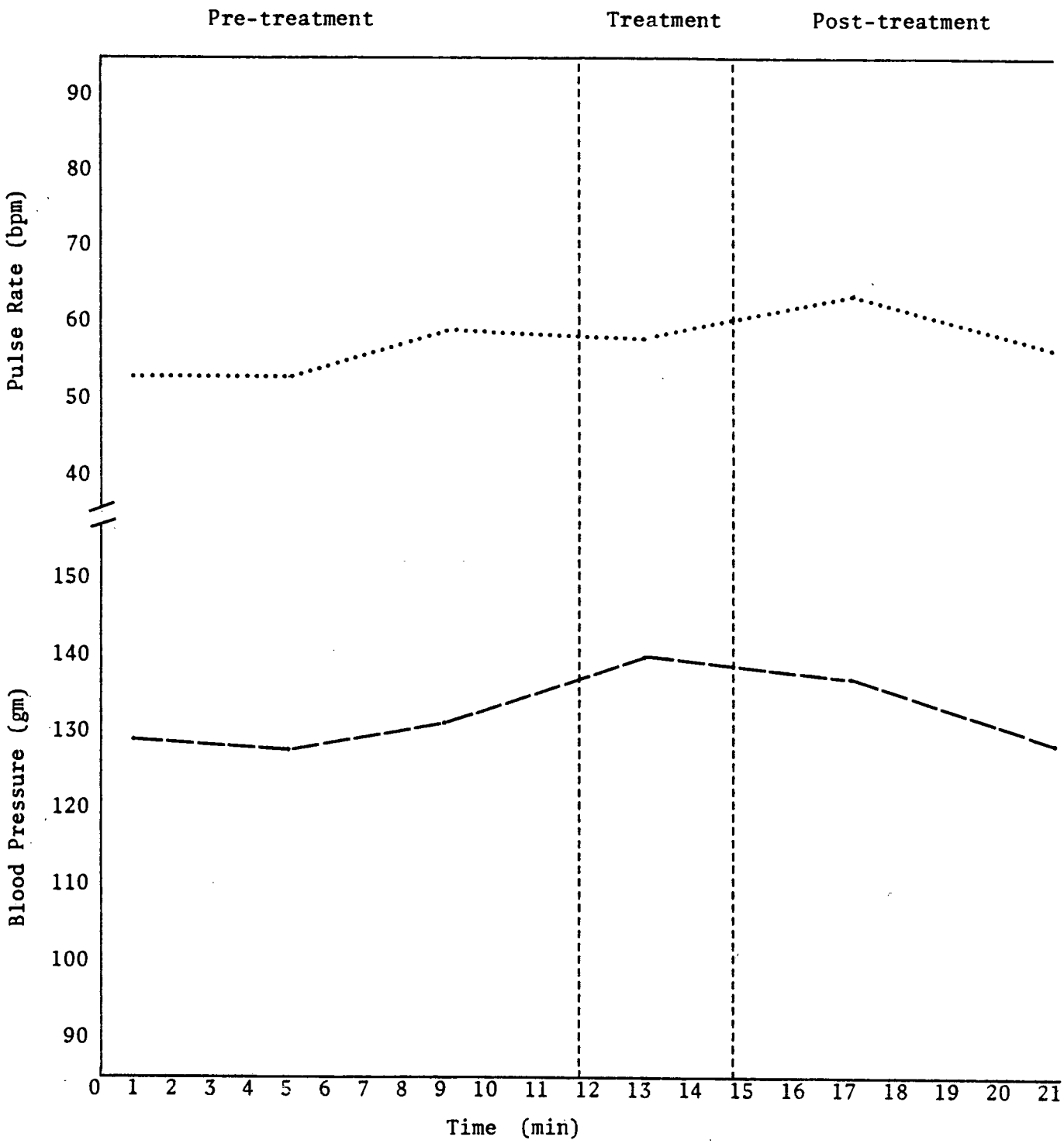

Figure 1

Subject SL

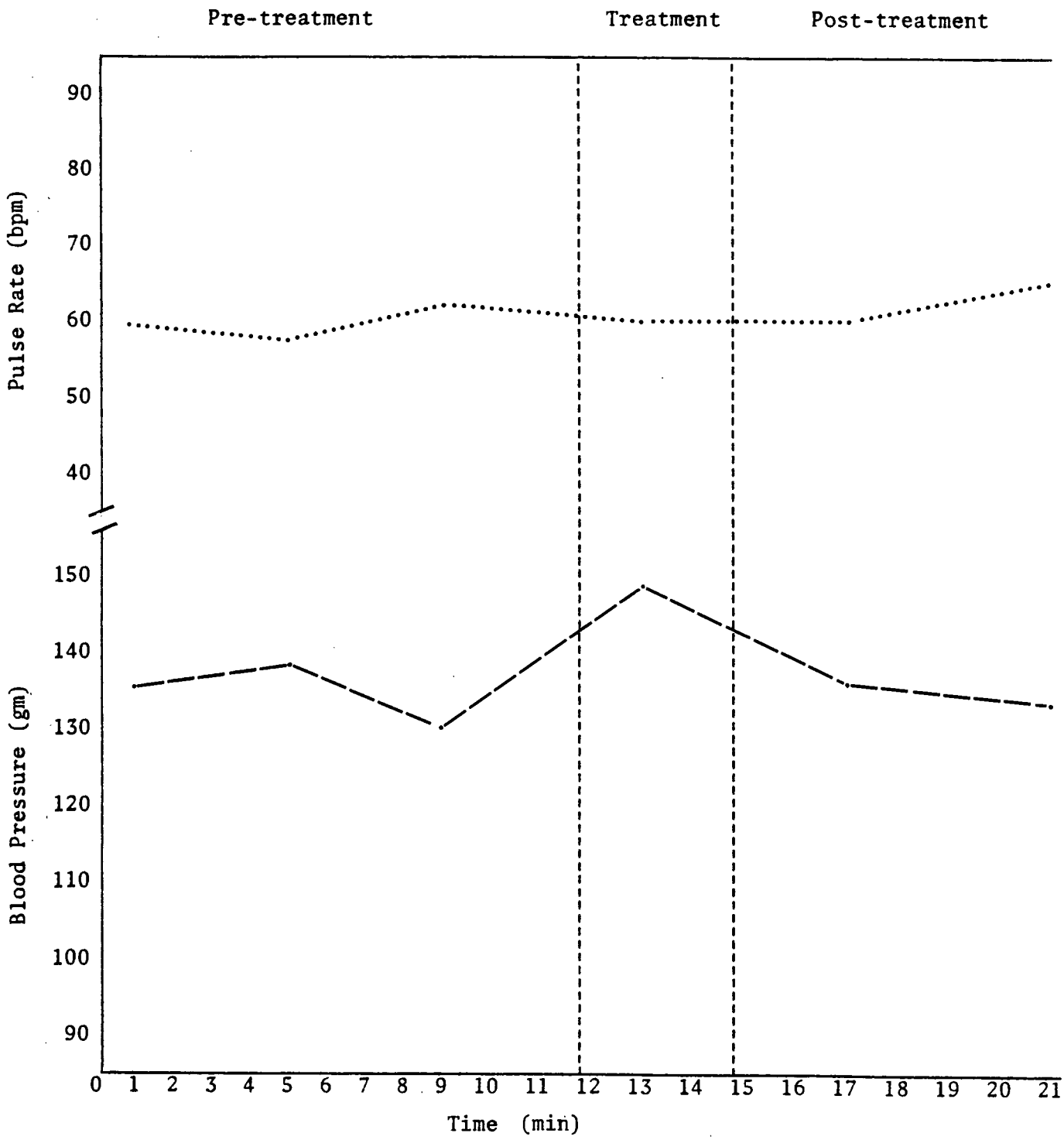

Figure 2

Subject DW

post-treatment phase the pulse rate was not immediately affected, however, it did increase five points in the last four minutes. On the other hand, the blood pressure decreased a total of 14 points.

Subject DR

Subject DR's pulse rate recordings were as follows: pre-treatment 74, 80, 78; treatment 81; and post-treatment 78, 78. Subject's DR's blood pressure recordings were as follows: pre-treatment 123, 125, 125; treatment 136; and post-treatment 125, 125 (see Figure 3). It can be observed in the pre-treatment phase that the pulse rate increased six points and then decreased two points, while the blood pressure increased two points. In the treatment phase the pulse rate increased three points, while the blood pressure increased 11 points. During the post-treatment phase the pulse rate decreased three points, while the blood pressure decreased 11 points.

Subject JC

Subject JC's pulse rate recordings were as follows: pre-treatment 63, 67, 68; treatment 68; and post-treatment 67, 65. Subject JC's blood pressure recordings were as follows: pre-treatment 128, 120, 119; treatment 135; and post-treatment 130, 122 (see Figure 4). It can be observed that in the pre-treatment phase the subject's pulse rate increased five points, while the blood pressure decreased nine points. In the treatment phase the pulse rate remained the same, while the blood pressure increased 16 points.

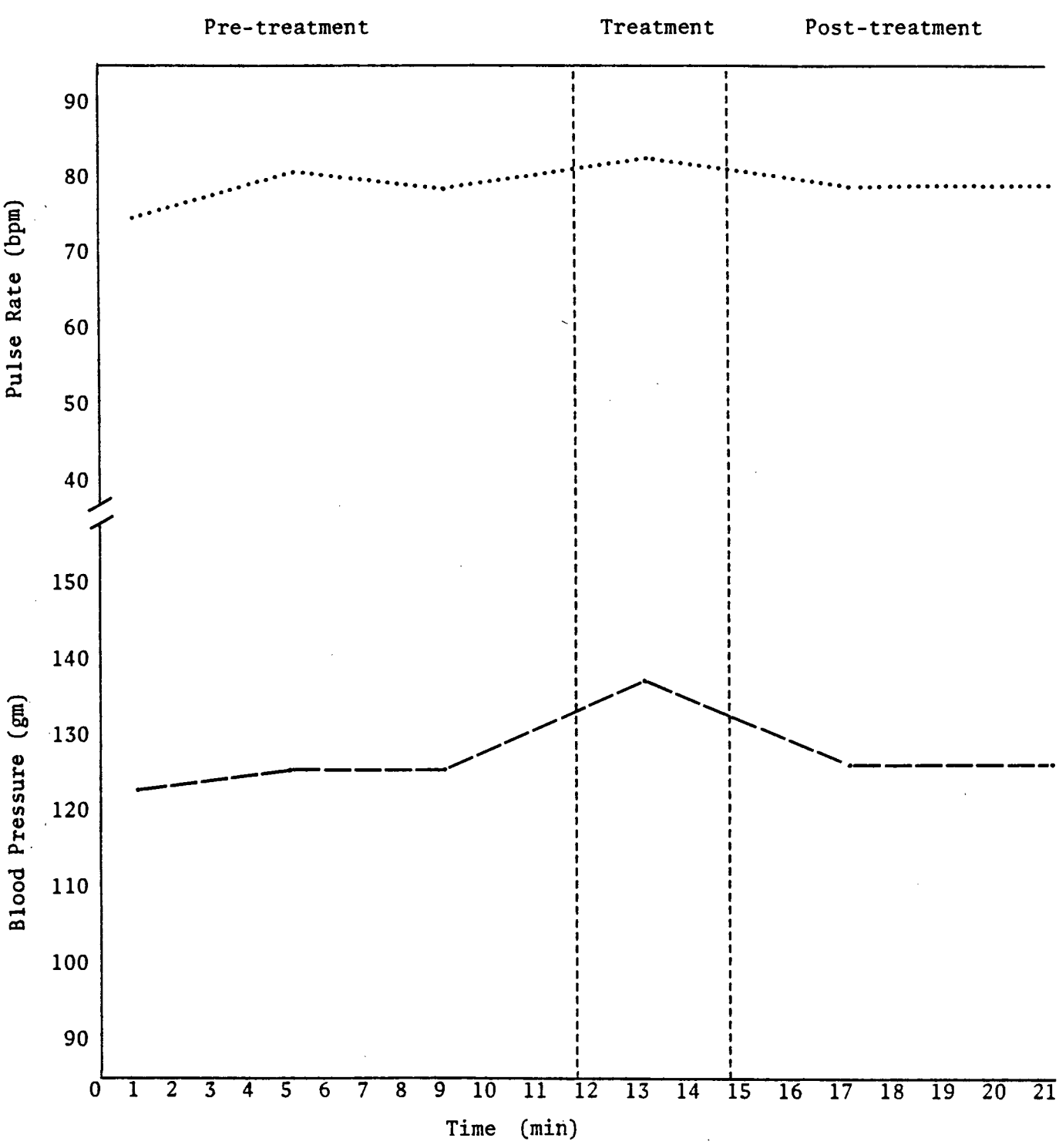

Figure 3

Subject DR

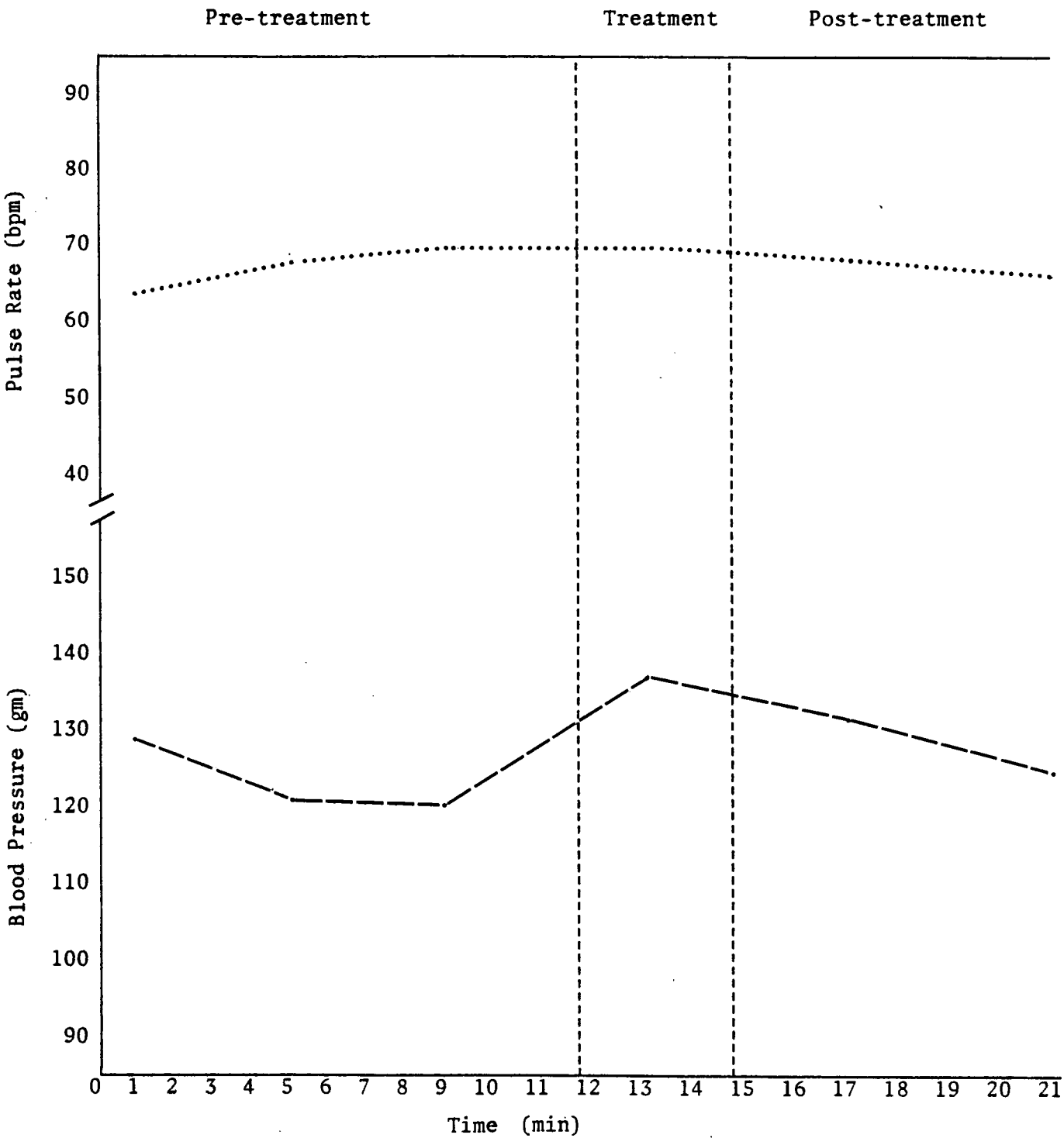

Figure 4

Subject JC

During the post-treatment phase the pulse rate decreased three points, while the blood pressure decreased 13 points.

Subject BM

Subject BM's pulse rate recordings were as follows: pre-treatment 49, 53, 53; treatment 53; and post-treatment 54, 56. Subject BM's blood pressure recordings were as follows: pre-treatment 125, 122, 120; treatment 132; and post-treatment 125, 122 (see Figure 5). It can be observed in the pre-treatment phase that the subject's pulse rate increased four points, while the blood pressure decreased five points. In the treatment phase the pulse rate remained constant, while the blood pressure increased 12 points. During the post-treatment phase the pulse rate increased three points, while the blood pressure decreased 10 points.

Subject ML

Subject ML's pulse rate recordings were as follows: pre-treatment 59, 60, 63; treatment 63; and post-treatment 63, 62. Subject ML's blood pressure recordings were as follows: pre-treatment 125, 120, 119; treatment 133; and post-treatment 128, 120 (see Figure 6). It can be observed in the pre-treatment phase that the subject's pulse rate increased four points, while the blood pressure decreased six points. In the treatment phase the pulse rate remained the same, while the blood pressure increased 14 points. The post-treatment phase showed a one point drop in pulse

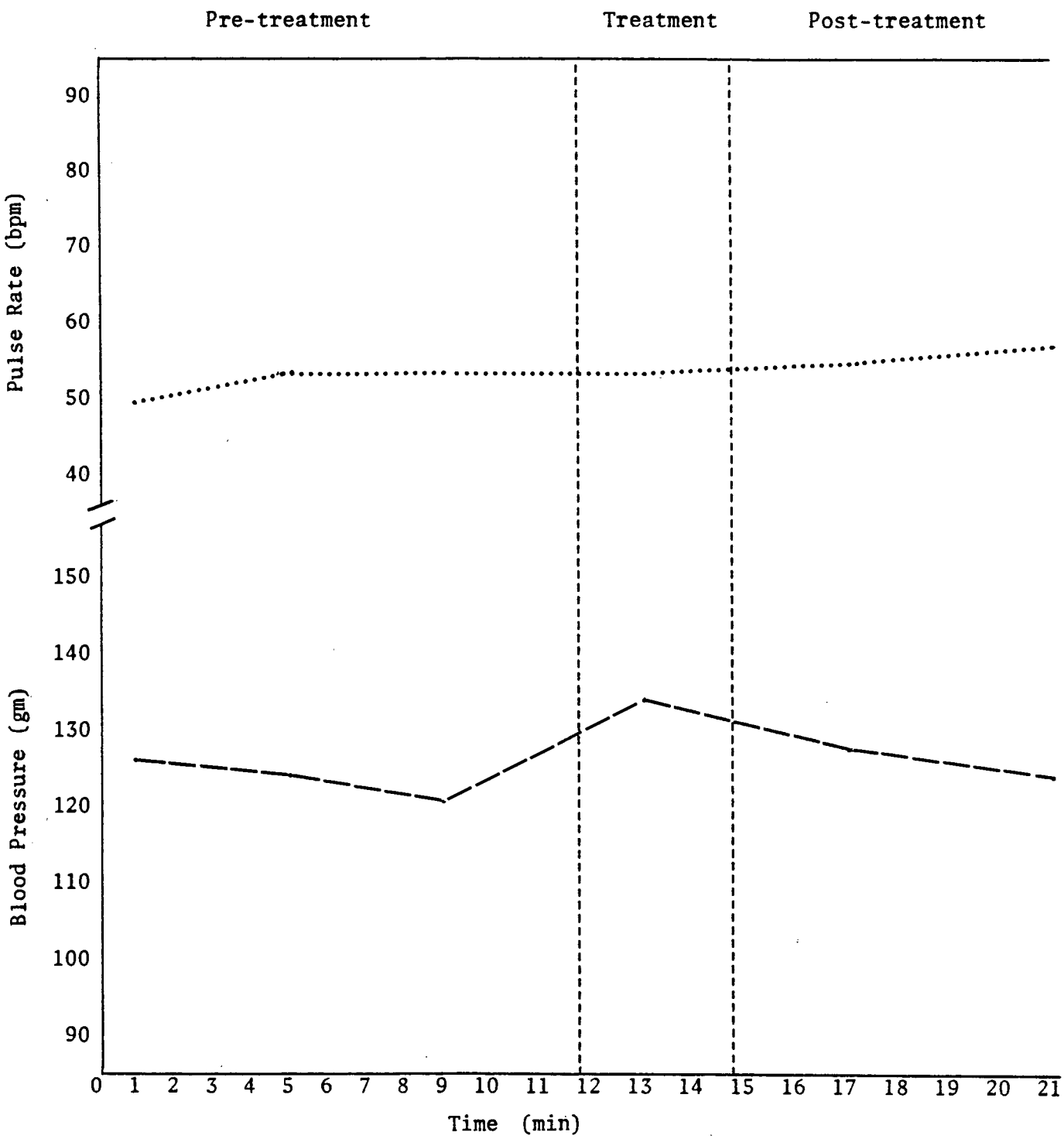

Figure 5

Subject BM

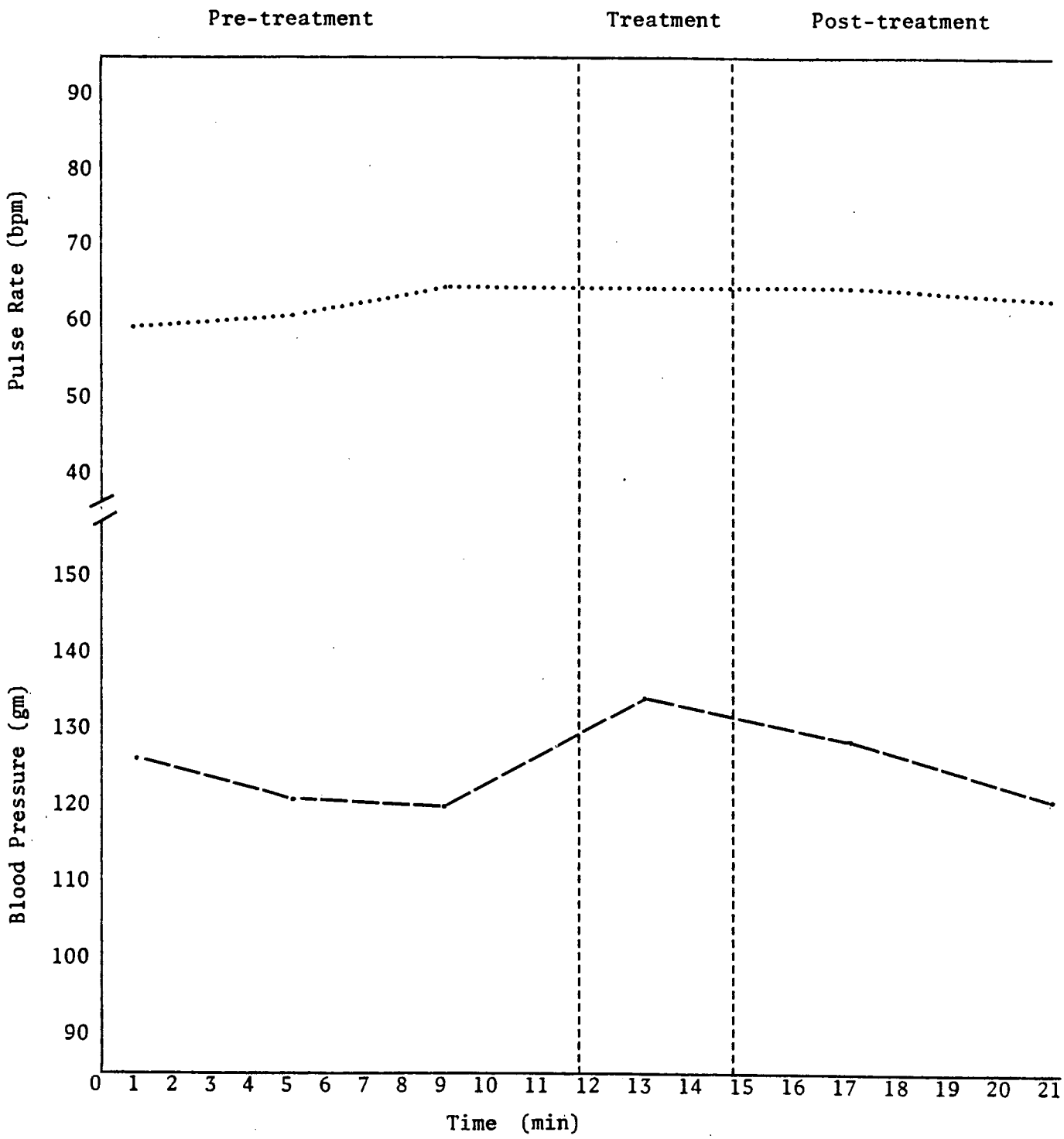

Figure 6

Subject ML

rate, while the blood pressure decreased 13 points.

Subject SV

Subject SV's pulse rate recordings were as follows: pre-treatment 52, 49, 48; treatment 48; and post-treatment 47, 56. Subject SV's blood pressure recordings were as follows: pre-treatment 110, 102, 102; treatment 106; and post-treatment 95, 102 (see Figure 7). It can be observed that in the pre-treatment phase the pulse rate decreased four points, while the blood pressure decreased eight points. In the treatment phase the pulse rate remained the same, while the blood pressure increased four points. In the post-treatment phase the pulse rate decreased one point and then increased nine points, while the blood pressure decreased 11 points and then also increased seven points.

Subject TC

Subject TC's pulse rate recordings were as follows: pre-treatment 77, 70, 70; treatment 74; and post-treatment 72, 74. Subject TC's blood pressure recordings were as follows: pre-treatment 107, 103, 105; treatment 111; and post-treatment 103, 101 (see Figure 8). It can be observed that in the pre-treatment phase the pulse rate decreased by seven points, while the blood pressure decreased four points and then increased two points. In the treatment phase the pulse rate increased four points, while the blood pressure increased six points. During the post-treatment phase the pulse rate decreased two points and then increased two points, while the blood pressure decreased

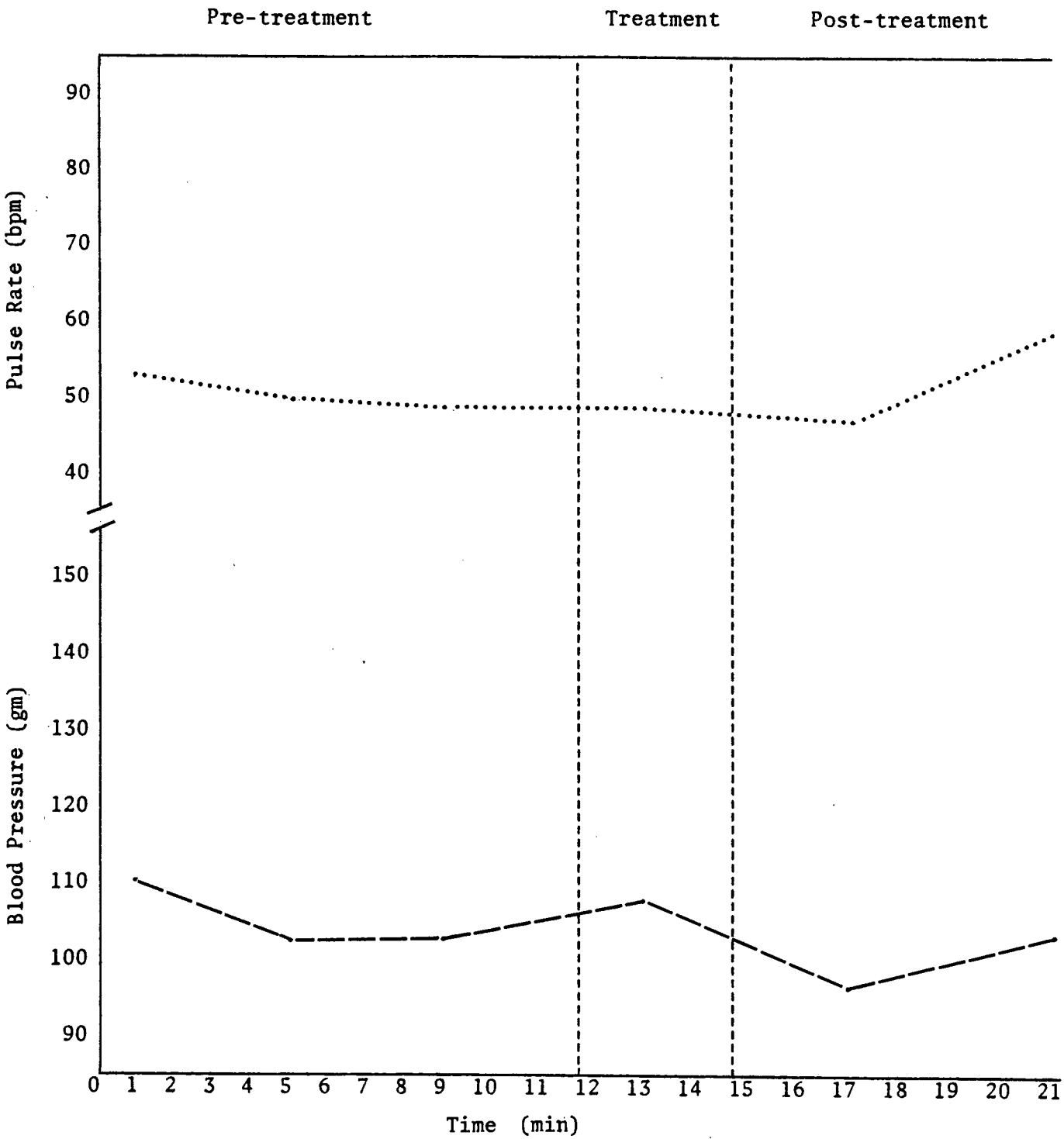

Figure 7

Subject SV

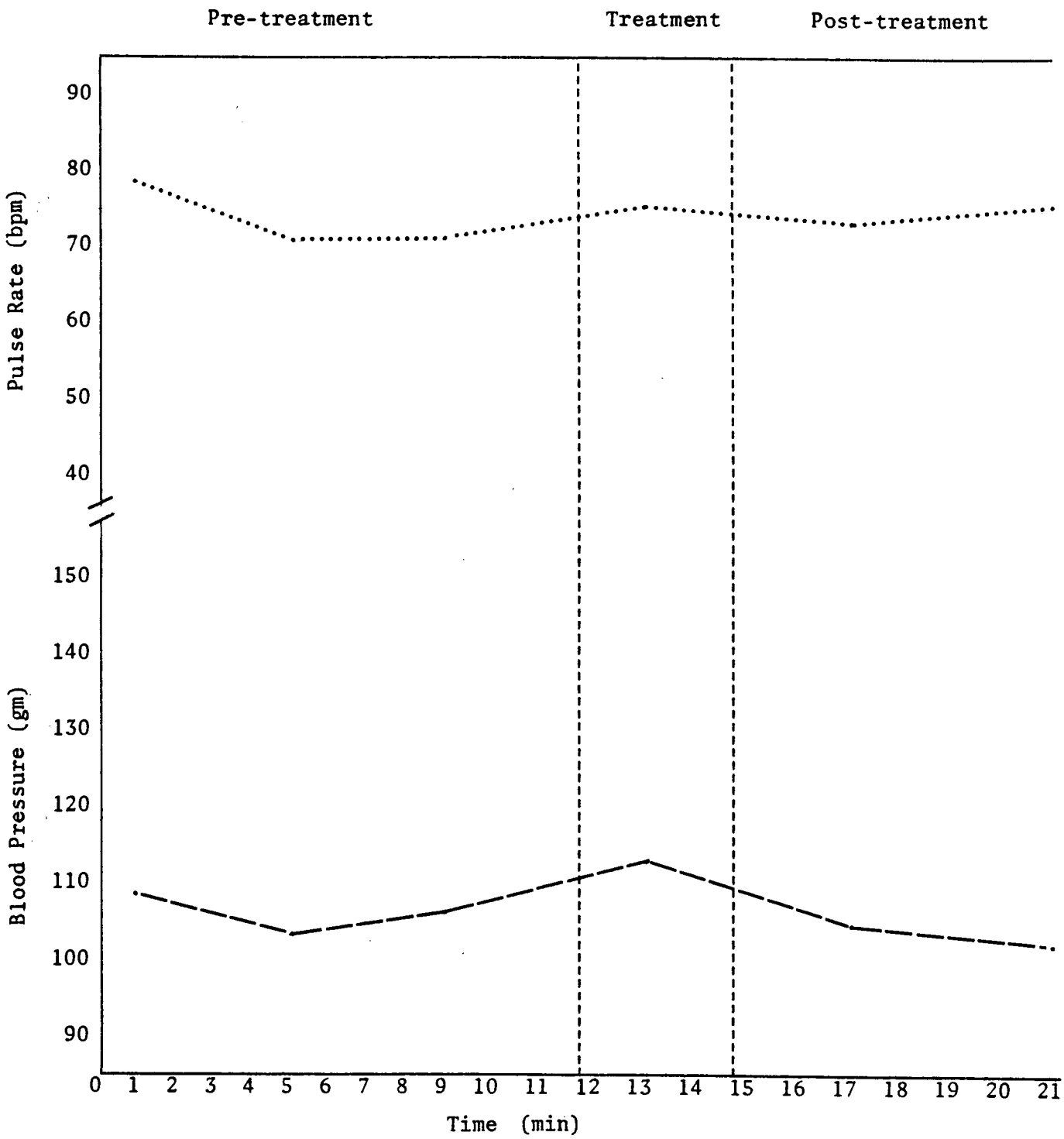

Figure 8

Subject TC

11 points.

Subject JO

Subject JO's pulse rate recordings were as follows: pre-treatment 46, 46, 49; treatment 47; and post-treatment 49, 52. Subject JO's blood pressure recordings were as follows: pre-treatment 122, 119, 119; treatment 122; and post-treatment 120, 118 (see Figure 9). It can be observed in the pre-treatment phase that the pulse rate increased three points, while the blood pressure increased three points. In the treatment phase the pulse rate decreased two points, while the blood pressure increased three points. During the post-treatment phase the pulse rate increased five points, while the blood pressure decreased four points.

Subject PA

Subject PA's pulse rate recordings were as follows: pre-treatment 54, 53, 56; treatment 58; and post-treatment 56, 59. Subject PA's blood pressure recordings were as follows: pre-treatment 135, 130, 133; treatment 148; and post-treatment 144, 134 (see Figure 10). It can be observed in the pre-treatment phase that the pulse rate decreased one point and then increased three points, while the blood pressure decreased five points and then increased three points. In the treatment phase the pulse rate increased two points, while the blood pressure increased 15 points. During the post-treatment phase the pulse decreased two points and then increased three points, while

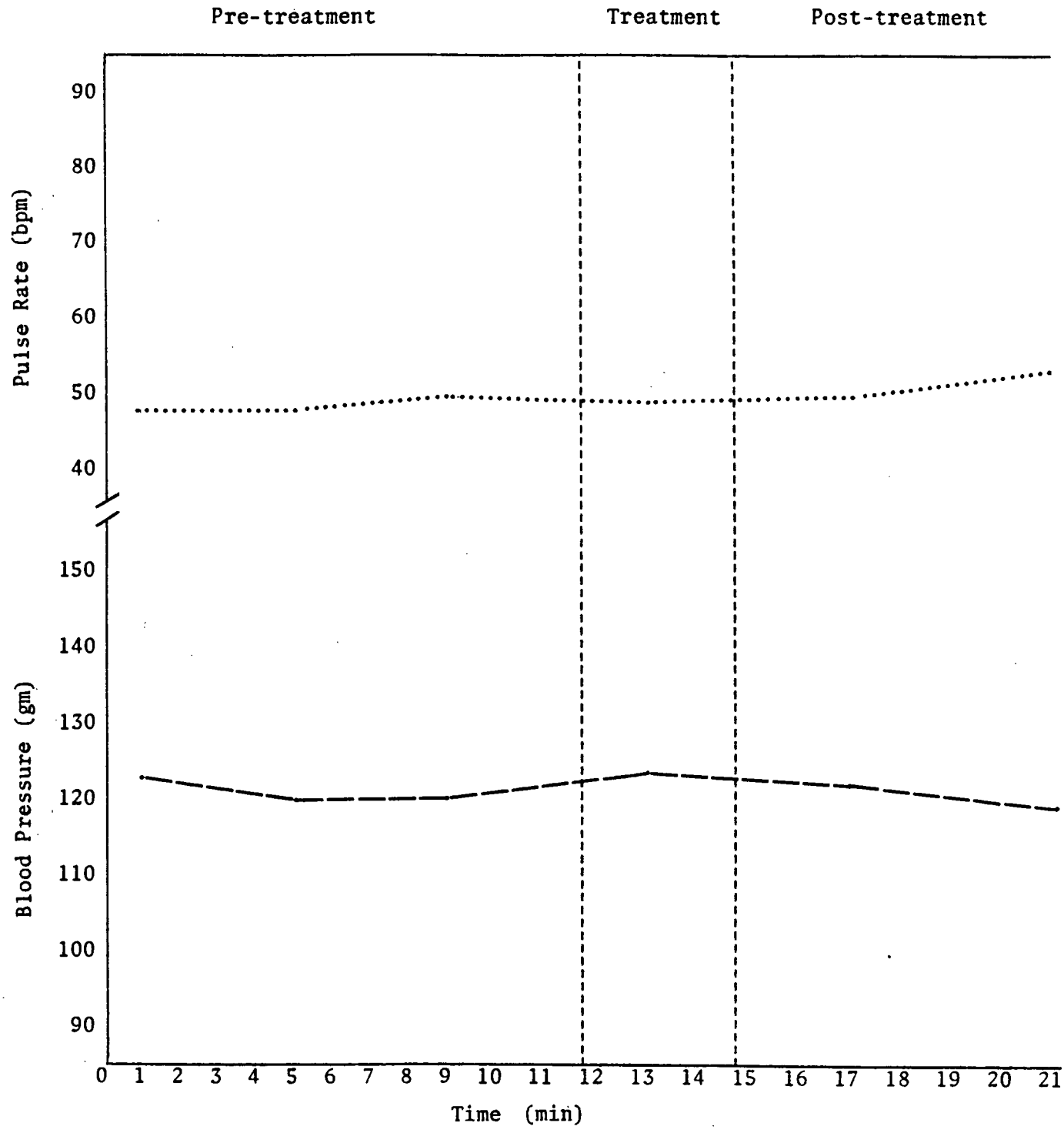

Figure 9

Subject JO

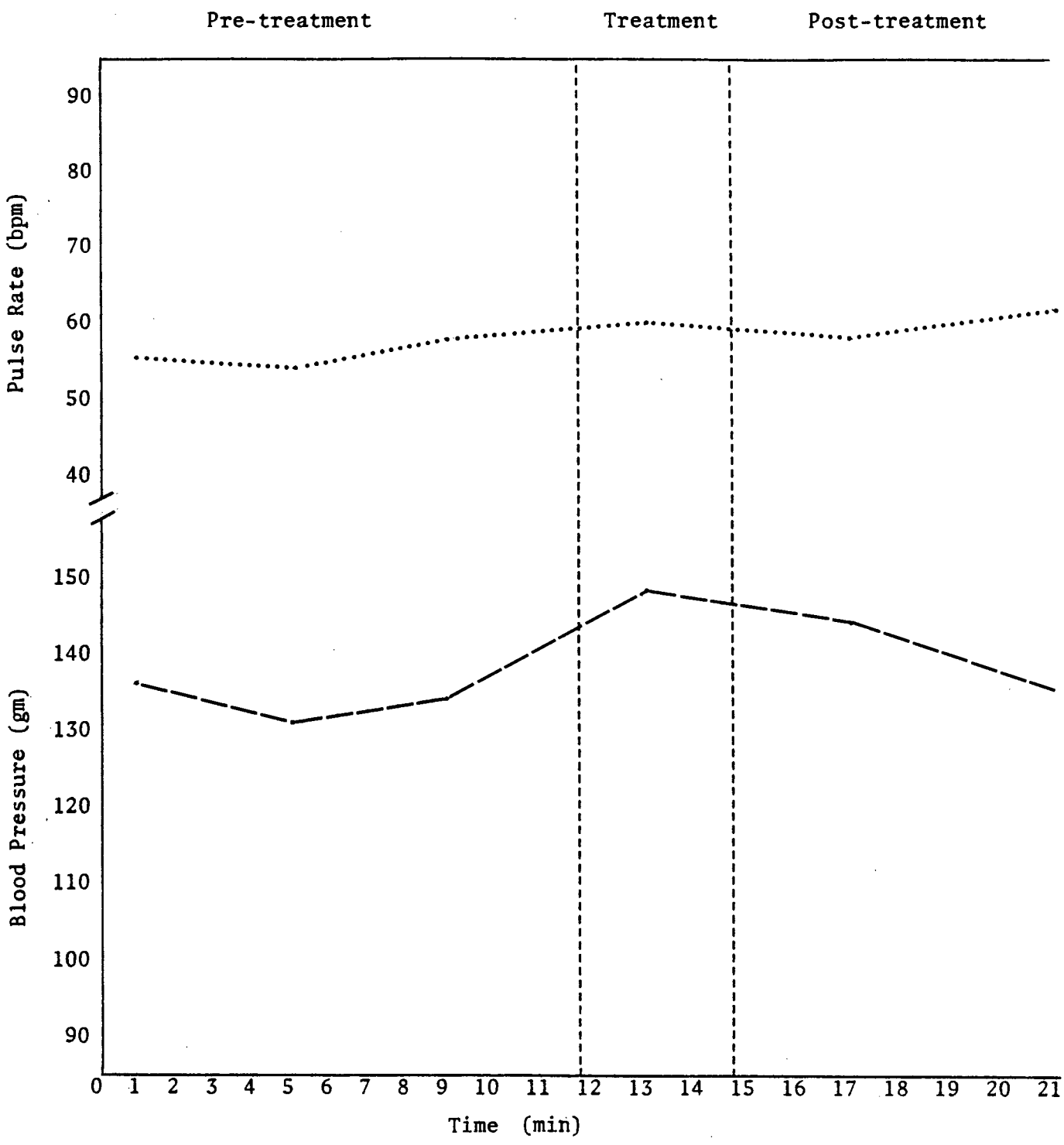

Figure 10

Subject PA

the blood pressure decreased 14 points.

Subject SH

Subject SH's pulse rate recordings were as follows: pre-treatment 64, 63, 67; treatment 72; and post-treatment 70, 66. Subject SH's blood pressure recordings were as follows: pre-treatment 122, 124, 124; treatment 137; and post-treatment 123, 121 (see Figure 11). It can be observed in the pre-treatment phase that pulse rate decreased one point and then increased four points, while blood pressure increased two points. In the treatment phase the pulse rate increased five points, while the blood pressure increased 13 points. In the post-treatment phase the pulse rate decreased six points, while the blood pressure decreased 16 points.

Summary

The results of the data of each subject graphed separately, utilizing pulse rate and blood pressure as the physiological parameters, were reported. The physiological measures were graphed every four minutes in the following conditions: pre-treatment, treatment, and post-treatment. Results were compared by assessing the increase or decrease in pulse rate and blood pressure from each individual's resting rate or pre-treatment condition. In the treatment condition, overall the blood pressure increased an average of 11 points, while the pulse rate increased an average of one point. This led to the

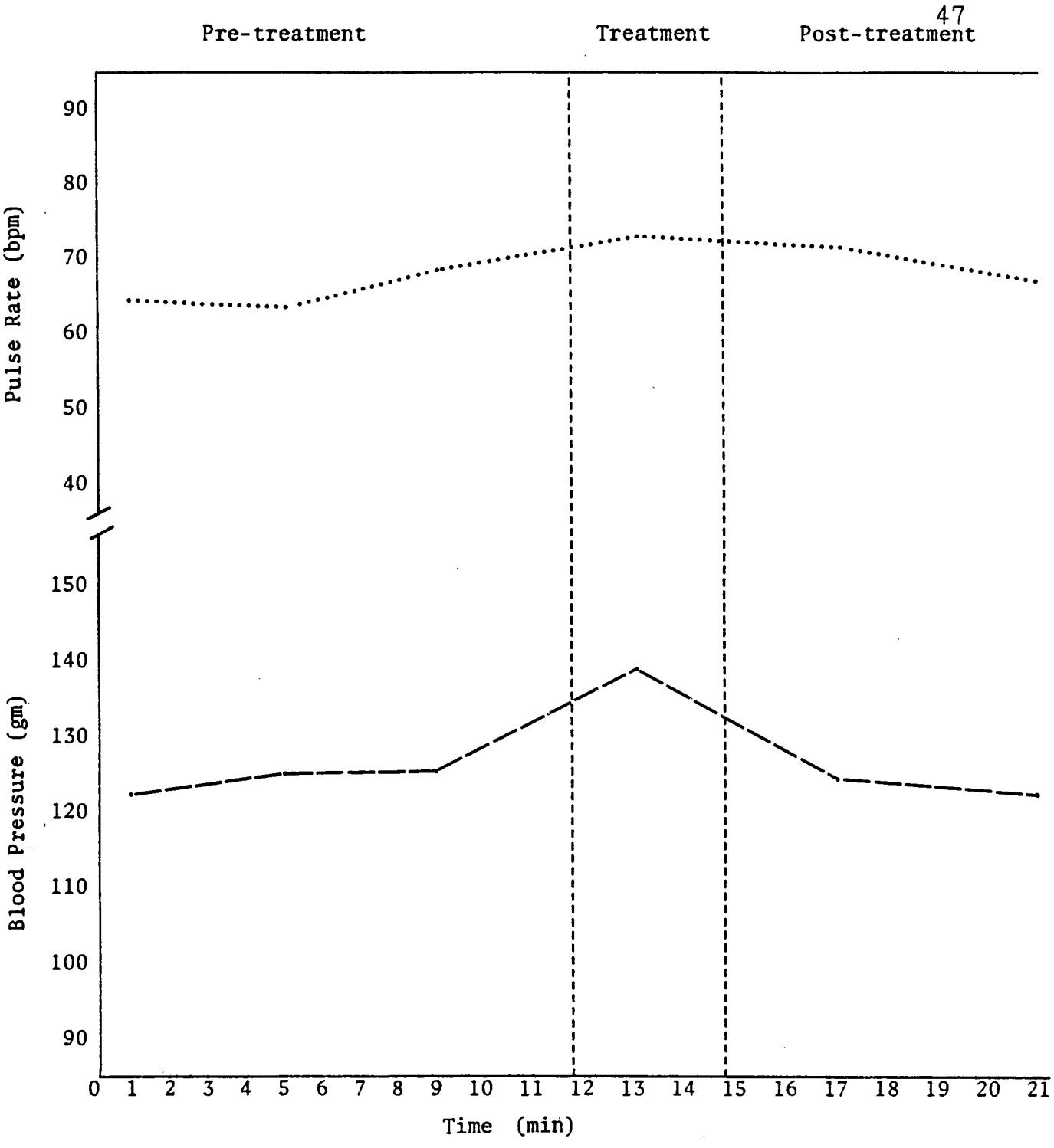

Figure 11

Subject SH

rejection of the null hypothesis that blood pressure will have no effect upon arousal and the acceptance of the null hypothesis that pulse rate will have no effect upon arousal. Four minutes after the treatment phase the blood pressure decreased an average of eight points, while the pulse rate increased an average of less than one-half point. These data support the theory that pep talks might have some initial effect on arousal, but the effect is not long lasting.

Chapter 5

DISCUSSION OF RESULTS

The discussion of results was conducted for the primary purpose of examining the following areas: (1) pulse rate and blood pressure as indicators of arousal, (2) individual responses to a pep talk, (3) pep talks and sport performance, and (4) summary.

Pulse Rate and Blood Pressure as Indicators of Arousal

Many studies have measured the intensity of activation using pulse rate and blood pressure as physiological measures. Harmon and Johnson (33), Nomikos, Opton, and Averill (44), Epstein and Clarke (28), and Grossberg and Wilson (31) all utilized pulse rate as a physiological indicator of some type of activation and found appropriate fluctuations under various arousal conditions. The present investigation also utilized pulse rate as a measure of arousal, but noted very little change between the pre-treatment, treatment, and post-treatment conditions. Although Harmon and Johnson (33) reported pulse rate to be a simple, practical coaching tool in which to measure emotional excitation, Lykken (14) has argued more recently that pulse rate is a dubious indicator of activation. Along this same line,

Johnson (35) stated that, in most cases, a condition of painful tension was characterized by high blood pressure accompanied by relatively low heart rate. Another study by Kaelbling (37) was unable to produce significant increases in heart rate.

Taking into consideration some of the related literature, the investigator offers another reason why the pep talk had little or no effect on the subjects' pulse rate. Perhaps the pep talk was not emotional or real enough to activate the sympathetic nerve endings to secrete epinephrine and norepinephrine into the blood stream to increase the heart rate (14). Because the pep talk was only three minutes long, was not delivered before an actual game, and did not include visual stimuli, might be additional reasons why the pep talk had little influence on the pulse rate. Whatever the reason, research (12,26) has agreed that different measures of physiological arousal should be obtained, as in the present study, since there is not always consensus between various parameters (21,22).

The other physiological parameter used in the present study was blood pressure. Research by Harmon and Johnson (33), Johnson (35), Cannon (2), and Darrow (23,24) all agreed that blood pressure was a reliable indicator of arousal. It was observed in the present study that blood pressure increased significantly between the pre-treatment and treatment conditions and decreased significantly

in the post-treatment condition. It can be noted that the subjects' average blood pressure increase was 11 points, while the average decrease, four minutes after the pep talk, was eight points. Therefore, the pep talk did have some effect on the subject's blood pressure, however, it was not long lasting.

Individual Responses to a Pep Talk

It has been generally agreed by researchers that there is a specific response to various stimuli and it involves many different parts of the body (10,15,17,19,26). Hebb (10) stated that one way in which sensory excitation affects cortical activity is through specialized sensory pathways. In the present research the specialized sensory pathway were the ears. As the pep talk was channelled to the arousal system via the sensory pathway, the effect, if any, produced a certain level of arousal. Sage (17) stated that high levels of excitation in the arousal system (ARAS) causes alertness and emotional states.

The individual results of the pep talk on pulse rate and blood pressure were varied as studies have indicated they would be (19,26,33,48). In the treatment condition, Subject DW's blood pressure increased 17 points (see Figure 11). This was the highest increase. On the other hand, Subject JO's blood pressure only increased three points (see Figure 9). Pulse rate differences in the treatment phase ranged from an increase of five points

(see Figure 11) to a decrease of minus three points (see Figure 2). In the first four minutes of the post-treatment phase, blood pressure differences ranged from a decrease of two points (see Figure 9) to a decrease of 14 points (see Figure 11). Also in the first four minutes of the treatment phase, pulse rate differences ranged from an increase of five points (see Figure 1) to a decrease of minus two (see Figures 8,10,11).

Observation of the analysis of data and also athletes prior to competition would lead one to believe that individuals do have different levels of arousal. Research by Shaffer (48), Harmon and Johnson (33), Fisher (7), Oxendine (45) and Morgan (51) all support the above hypothesis.

Pep Talks and Sport Performance

Oxendine (45), Cratty (4,5), Husman (34) and Freeman (30) all support the theory that different tasks require different levels of arousal for obtaining the most effective performance. Is it a fallacy, then, that pep talks must be delivered before a contest or else the team or individuals will not be ready to play? Studies by Harmon and Johnson (33) and Ryan (47) indicate, as the drive theory explains, that a higher arousal level will facilitate performance.

Basler, Fisher, and Mumford (22) revealed limited relationships between gymnastic performance and arousal/

anxiety measures. However, this relationship does not seem to warrant interpretation because it is difficult, at best, to locate any level of arousal on the continuum and label it as optimum for motor performance (15,22). On the other hand, Klavora (11), in opposition to Oxendine (45), noted that all athletes have to be activated before competition if they are to perform well. Klavora (38) also reported that a wide range of individuals may perform well in tasks that require delicate responses of fine muscles or tasks that require brute strength and speed.

The question one might ask now is whether a pep talk raises the arousal system to a significant level that would impair or facilitate performance. It can be observed from the present research that in the treatment phase, the average blood pressure increase was 11 points, while the average pulse rate increase in the same phase was one point. It is evident to the reader that the blood pressure increase was enough, at the time, to sufficiently activate the subjects. However, the pulse rate average increase was too low to activate any kind of arousal level. Consequently, there is evidence to support the hypothesis that the pep talk did have some effect on blood pressure.

Lawther (13), Epstein and Fenz (29) and Sullivan (53) have assessed arousal relative to experience and skill ability. Lawther claimed that the more experienced athletes playing at a more sophisticated sports level are less likely to react to a soul-stirring oratory before a game.

This could have been the case in Subject JO's increase of blood pressure in the treatment condition of only three points and pulse rate increase of only two points (see Figure 9). Subject SV also reacted to the pep talk as researchers say an experienced athlete would, as was seen by a blood pressure increase of four points and pulse rate decrease of minus two in the treatment phase (see Figure 7).

Morgan (51) and Fisher (7) questioned the use of pep talks as devices to bring every athlete to a level of optimum performance. It is observable in the data that the average blood pressure increase in the treatment condition was 11 points, while the pulse rate increase was one point. The average blood pressure in the first four minutes of the post-treatment phase decreased eight points, while the pulse rate increased less than one point. These data support the theory that pep talks might have some initial effect on arousal, but the effect is not long lasting. This is evident by the fact that the blood pressure and pulse rates in the post-treatment condition returned almost to their original resting level after four minutes.

These data should provide some knowledge to the coach and physical educator who tends to over emphasize the use of a pep talk as a way of preparing athletes for competition. The results show that blood pressure is increased during such an auditory stimulus, but that the

arousal level is not maintained. On the other hand, researchers have provided us with enough theorems that suggest that successful athletes do not need to be aroused by some external source. They are successful because they are less tense, have more vigor, and are less confused than nonsuccessful athletes before competition (51).

Summary

The three-minute pep talk had a significant effect on blood pressure in the treatment condition, while pulse rate was not effected in the same condition. The average blood pressure increase in the treatment condition was 11 points, while the pulse rate, which was not effected, increased one point. During the first four minutes of the post-treatment phase, the blood pressure dropped eight points and the pulse rate increased less than one point. Thus the null hypothesis that stated the three-minute pep talk had no effect upon arousal as monitored by blood pressure and pulse rate was partially rejected.

Chapter 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

Summary

The effects of an auditory stimulus (pep talk) upon pulse rate, blood pressure, and galvanic skin response was examined. Eleven male members of the Ithaca College graduate and undergraduate physical education department, with prior athletic experience, volunteered as subjects. The experiment was administered in the Psychomotor Performance Laboratory at Ithaca College, Ithaca, New York.

Subjects were provided a brief explanation followed by a short demonstration of the equipment prior to the actual testing. The subjects' blood pressure, pulse rate, and galvanic skin response was monitored for 21 minutes with a three-minute Knute Rockne pep talk beginning after 12 minutes. All subjects were instructed to try and mentally place themselves in a locker room situation as the pep talk was listened to. Only one trial was allowed and each subject's pulse rate, blood pressure and galvanic skin response were graphed to note any significant changes from pre-treatment, treatment, and post-treatment conditions. Pulse rates and blood pressures were graphed

for each subject and interpreted in a "clinical" sense, while galvanic skin response data were uninterpretable.

From the present study it can be observed that the auditory stimulus (pep talk) had a significant effect on blood pressure in the treatment condition. However, the pep talk had little or no effect on the pulse rate during the treatment and post-treatment conditions. It was also noted that in the post-treatment condition, average blood pressure decreased significantly and almost returned to the normal resting state.

These data led to the partial rejection of the null hypothesis that stated the three-minute pep talk will have no effect upon arousal as monitored by blood pressure. On the other hand, the data accepted the null hypothesis that stated the three-minute pep talk will have no effect upon arousal as monitored by pulse rate.

Conclusions

On the basis of the findings and within the limitations of this study the following conclusions were supported:

1. A pep talk will have a significant effect on blood pressure.

2. A pep talk will have little or no effect on pulse rate during the talk and after the talk.

3. A pep talk's significant effect on blood pressure is not long lasting.

4. Pep talks will not enhance performance if the task takes place four minutes or more after the pep talk.

Recommendations for Further Study

The following recommendations are offered for further investigation:

1. A future study could examine the effects of two or more auditory stimuli on pulse rate, blood pressure, and skin response.

2. A long range study could examine the effects of a pep talk upon individual arousal levels using pulse rate and blood pressure as the parameters. Then the investigator could use these data to assess the specific performance and establish the arousal-performance relationship.

3. A follow-up study could investigate the effects of a pep talk upon heart rate, blood pressure, and galvanic skin response in a real game situation and see if the results are long lasting.

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