USE OF HEART RATE MONITORS TO MEASURE CARDIOVASCULAR FITNESS OF SEVENTH GRADE GIRLS

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CHAPTER I

INTRODUCTION

Cardiovascular disease is still a serious problem in the United States and accounts for almost one-half of the deaths. Cardiovascular disease, which includes heart attack and stroke, remains America's number one killer of men and women. It is the leading cause of death for males, females, whites, blacks, Asians, Pacific Islanders, Hispanics, American Indians, and Alaskan Natives (American Heart Association, 1997). The American Heart Association and the Center for Disease Control consider physical inactivity a major risk factor for cardiovascular disease, along with smoking, hypertension, and hyperlipidemia. (Appendix A)

Regular physical activity increases life expectancy, can help older adults maintain functional independence, and enhances the quality of life. The beneficial impact of physical activity touches widely on various diseases and conditions. Regular physical activity can help to prevent and manage coronary heart disease, hypertension, diabetes, osteoporosis and depression. It has also been associated with a lower rate of colon cancer and stroke and may be linked to reduced back injury. It is an essential component of weight loss programs (Healthy People 2000, 1992).

Physical activity is a complex behavior, and its relationship with health is multifaceted. Regular vigorous physical activity promotes cardiorespiratory fitness and helps prevent coronary heart disease. Activity that builds muscular strength, endurance, and flexibility may protect against injury and disability. Any activity that expends energy is important in weight control. Physical activity can also produce changes in blood pressure, blood lipids, clotting factors, and glucose tolerance that may help prevent and control high blood pressure, coronary heart disease and diabetes (Health People 2000, 1992).

While activity should be habitual, it need not be unduly strenuous. People who engage daily in light to moderate exercise, equivalent to sustained walking for about 30 minutes a day, can achieve substantial health gains. Increasing evidence suggests that even small increases in light to moderate activity by those who are least active will produce measurable health benefits (Health People 2000, 1992).

Of particular importance is the role of physical activity in preventing coronary heart disease, the leading cause of death in the United States. A sedentary lifestyle appears to be an independent risk factor for coronary heart disease, nearly doubling a person's risk. Its effect on coronary heart disease risk is almost as great as the better known risk factors, such as cigarette smoking and high blood pressure. Because more people are at risk of coronary heart disease due to physical inactivity than to any other single risk factor, it has an especially great public health impact (Health People 2000, 1992).

Few Americans engage in regular physical activity despite the potential benefits. Currently, only 22% of adults engage in at least 30 minutes of light to moderate physical activity 5 or more times per week, and only 12% report that they are this active 7 or more times a week. Less than 10% of the population exercises 3 or more time a week at the more vigorous level necessary to improve cardiorespiratory fitness. Nearly 25% of adults report no leisure-time physical activity, and the prevalence of sedentary behavior increases with advancing age (Healthy People 2000, 1992). (Appendix B)

Research such as the Harvard Alumni Study (Paffenbarger, Jr., Hyde, Wing, & Hsieh, 1986) revealed that physical activity did provide protection against disease. Physical exercise such as walking, stair climbing, and sport play were examined and were related inversely to total mortality primarily to death due to cardiovascular or respiratory causes. Alumni mortality rates were significantly lower among the physically active. This classic study did demonstrate that physical activity does have an influence on the length of life. Physical activity does, in fact, add man years to life. The study (1962-1978) examined 16,936 Harvard alumni, aged 35-74 years old for 16 years. Paffenbarger and the other researchers stated at the conclusion of their study that, "In view of the data base and the consistency represented in the study, it seems likely that the observed patterns are predictive."

There is a widespread and outstanding popular belief that adequate physical exercise is necessary to preserve life and its desirable qualities into old age.

Discussions of this thesis date back to antiquity and have intensified in recent times. The present study adds new evidence to support this view.

Another classic American study concerning physical activity and life-style is the Framingham Heart Study. It just celebrated its 50th birthday, and was highlighted in the September 7, 1998 issue of U.S. News and World Report. Michael DeBakey MD., renowned heart surgeon, and distinguished professor of surgery at Baylor College of Medicine in Houston said, " It (Framingham Heart Study) has set the model in epidemiology. It is truly one of the great studies of this century" (Brink, 1998).

The study is on-going, and was named for the town in which it began, Framingham, MA. The study was begun due to the fact that so many Americans had cardiovascular disease. The National Heart, Lung, and Blood Institute (NHLBL) gathered 5, 209 healthy townspeople between ages of 30-60 years to help solve the medical mystery: How does cardiovascular disease develop? The participants in the study had detailed physical exams every two years.

Research Milestones from the Framingham Heart Study are:

1960-cigarette smoking found to increase the risk of heart disease

1961-cholesterol level, blood pressure and electrocardiogram abnormalities found to increase risk of heart disease

1967-physical activity found to reduce the risk of heart disease, obesity found to increase the risk of heart disease

1988-high levels of high-density lipoprotein (HDL) actually protect against heart disease (Voelker, 1998).

William P. Castelli, MD. has been directly involved with the Framingham Heart Study for nearly 33 years. He stated,

> The real issue here is the fact that doctors do not do preventive medicine and the situation is not going to get better in this new era of medicine. It is going to get worse. The HMO approach with primary care doctors as gatekeepers means doctors have to see so many more patients to make these systems financially viable. The CEO has to make his millions.
>
> We, at the Framingham Cardiac Institute, are treating patients first with diet and exercise. If those do not work, then we go to drugs. We can tell in a

month how they are going to do on diet and exercise. Despite advances in heart disease treatment and prevention, adolescents have an increasing prevalence of overweight and decreasing levels of physical activity. Foods are getting richer and richer. We need to get back to an old time diet, with more exercise (Voelker, 1998).

Further advice from the Framingham Heart Study is eat a sensible diet, exercise, quit smoking, and drink only moderately. Just as important, know your blood pressure and cholesterol numbers, and take medication if you can't get them under control through diet and exercise (Brink, 1998).

Despite the impact of physical activity on cardiovascular disease and other lifestyle degenerative diseases, low levels of activity and fitness remain a major public health problem in the United States accounting for up to 250,000 deaths per year (Hahn, Teutsch, Rothenburg, & Marks, 1990). The problem is not exclusive to adults.

The 1996 Report of the Surgeon General speaks to the physical activity and health of the nation. The report was a collaborative effort between the:

- Centers for Disease Control and Prevention (CDC)
- President's Council on Physical Fitness and Sports (PCPFS)
- American College of Sports Medicine (ACSM)
- American Alliance of Health Physical Education Recreation and Dance (AAHPERD)
- National Institute of Health (NIH)
- American Heart Association (AHA)

The major purpose of the report was to summarize the existing literature on the role of physical activity in preventing disease and on the status of interventions to increase physical activity. The facts from the report on physical activity and health section of the Surgeon General's Report that relate to adolescents and young adults are:

- Nearly half of American youths aged 12-21 years are not vigorously active on a regular basis.

- About 14% of young people report no recent physical activity. Inactivity is more common among females (14%) than males (7%) and among black females (21%) than white females (12%).
- Participation in all types of physical activity declines strikingly as age or grade in school increases.
- Only 19% of all high school students are physically active for 20 minutes or more, five days a week, in physical education classes.
- Daily enrollment in physical education classes dropped from 42% to 25% among high school student between 1991 and 1995.
- Well-designed school-based interventions directed at increasing physical activity in physical education classes have been shown to be effective.
- Physical activity reduces the risk of premature mortality in general, and of coronary heart disease, hypertension, colon cancer, and diabetes mellitus in particular. Physical activity also improves mental health and is important for the health of muscles, bones, and joints (Healthy People 2000, 1992).

The problem of youth fitness is not new, and not one that has been ignored. As a matter of fact, it has been an issue of great concern in the United States since 1953 when the results of the Kraus-Weber Fitness Test revealed American children were less fit than their European counterparts (Kirchner & Fishburne, 1995). The physical education profession has worked to improve the fitness level of American youth ever since the report was published, but the results have not been very encouraging. According to the National Children and Youth Fitness Studies I and II in the report of the President's Council on Physical Fitness and Sports, the current status of physical education throughout the United States is relatively low. In addition, the current report from the President's Council on Physical Fitness and Sports in 1996 has shown no improvement in the fitness level of children for the last twenty years. Two other studies (Kuntzleman & Reiff, 1992) also indicated that fitness has not improved. Children are heavier today than in previous years, and as measured by distance runs, there has been a decline in the aerobic fitness of children.

Dr. Stephen Blair states, "Although data supporting the hypothesis are sparse, we assume activity and fitness levels in childhood tend to track into adulthood, when sedentary habits have their impact." "If this is true, then twenty percent of our children, or close to 9 million school-age individuals, are at risk because of low fitness. The problems associated with sedentary lifestyles may persist for the next generation" (Blair, 1992).

In the United States, cardiovascular fitness continues to decline, body fat percentages continue to increase, and risk factors for heart disease are now known to exist in nearly half of the elementary children in this country. It is costing this country nearly $130 billion a year to treat cardiovascular disease (Polar Electro Inc., 1997).

In a study in which physical activity in young children was tracked, using heart rate monitors, it was found that physical activity behavior does tend to track during early childhood. A strength of the study was definitely the use of heart rate monitoring since it is an objective measure of physical activity. Importantly, heart rate monitoring avoids problems with recall and subjectivity, and is relatively inexpensive to administer in large-scale studies (Pate, et al, 1996).

The results of Pate's study clearly highlighted the need for physicians and other primary health care providers to become actively involved in the promotion of physical activity and fitness in children and youth. This study challenges primary health care providers to make preventive services a greater component of their practice (Pate, et al, 1996).

Since the lack of cardiovascular fitness is an individual risk factor for children and youth, and tends to carry over into adulthood, as has been discovered in several national surveys conducted by several countries, it is imperative that physical education professionals work together to discover innovative ways to introduce physical activity as a daily part of one's lifestyle. One way to accomplish this may be with user friendly teachable tools that provide feedback to children while exercising. If students realize the value of cardiovascular fitness and have knowledge about valid and reliable instruments for measuring their fitness, then it would be hoped that a healthy fitness lifestyle would result for each student. One such tool may be the heart rate monitor (HRM). The transmitter is attached to the body using chest straps while the watch is worn on the wrist. The HRM can measure uninterrupted activity. It is easily teachable and user friendly.

HRMs appear to be a promising instrument for physical education use, from the available data regarding their validity, reliability and functionality, and accuracy.

When performing cardiovascular exercise it is important to know, and just as important to work within the correct target heart rate zone (THRZ). The intensity of exercise is reflected in the heart rate. Thus, the harder the student exercises, the higher the heart rate. In order to obtain the desired exercise intensity level each student needs to know, reach, and maintain his/her own THRZ to fully realize the benefits of regular aerobic exercise and to begin to build a foundation of knowledge regarding implementation of lifetime fitness. (Appendix C)

Most children and youth know little about exercise, its effects on their bodies, and how to gain maximum benefit. However, with the emergence of quality and accurate heart rate monitors, students and teachers are now able to monitor exercise intensity. Even children in first grade can be taught fundamental principles of heart physiology and the heart's function during exercise. The knowledge acts as a building block for future training, whether it is for personal fitness or athletic competition (Hinson, 1994). Brad Strand, Associate Professor, Health, Physical Education, Recreation at Utah State University, stated, "If our nation's adult health and fitness problem is as serious as some believe, it is imperative that physical education teachers learn how to develop positive attitudes toward lifetime fitness and activity in their students and to evaluate fitness training and achievement in an objective manner. The heart rate monitor is one tool that can help us do so" (Strand & Mathesius, 1993).

Purpose of This Study

The purpose of this study was to examine the accuracy of the palpate method as compared to the accuracy of the heart rate monitor. The results may be useful to physical education teachers in regard to the importance of cardiovascular fitness when planning their curriculum.

The Surgeon General's Report on Physical Activity and Health (1996) stated how little regular activity occurs in the lives of adolescents and young adults. Nearly half of American youths aged twelve to twenty-one years are not vigorously active on a regular basis. About fourteen percent of young people report no recent physical activity. Inactivity is more common among females (14%) than males (7%) and among black females (21%) than white females (12%). Only nineteen percent of all high school students are physically active for twenty minutes or more, five days a week, in physical education classes. Daily enrollment in physical education classes dropped from forty-two percent to twenty-four percent among high school students between 1991 and 1995 (A Report of the Surgeon General, 1996).

No state currently requires daily physical education from kindergarten through twelfth grade. Illinois was the last state to drop the requirement in 1996. As the above report states, activity is lacking and anything to restore physical education and the instruction of lifetime fitness is warranted. Research that supports the use of the HRM as an accurate measuring device could be a tool that may enhance the understanding of the value of cardiovascular fitness providing immediate feedback regarding exercise intensity. Such information could provide knowledge about the effectiveness of different activities to improve fitness that hopefully would be carried over into adulthood. When parents can see tangible results of the school's physical education curriculum, such as a hard copy of their child's heart rate which is available when using the heart monitor, it would be hoped that they would be motivated to ask that physical education again be reinstated on a daily or regular basis. Parents can actually see that the activity is really beneficial to their child. Success in other subject areas in school is determined through the use of the Iowa Tests of Basic Skills (ITBS) and Criterion Reference Tests (CRT's), now physical education could utilize the HRM as support for cardiovascular fitness success.

Statement of the Problem

The purpose of this study was to examine the accuracy of the palpate method—using the fingers for monitoring heart rate as compared to the accuracy of the heart rate monitor—using the chest strap and the watch for monitoring the heart.

Hypotheses

This study dealt with the hypotheses that there will be no significant difference in the measurement of heart rates between the palpate method and the heart monitor.

Definition of Terms

Body Mass Index (BMI): The ratio between weight and height. It is a mathematical formula that correlates with body fat.

Cardiovascular Fitness: The ability of the heart, blood vessels, blood and respiratory system to supply fuel, especially oxygen, to the muscles and the ability of the muscles to utilize fuel to allow sustained exercise.

Electrocardiogram (ECG): Electrical impulses registered from the heart by an electrocardiograph. A hard copy or tracing is made of the impulses of the heart.

Heart Rate (HR): A physiological measure of the number of times the heart completes one complete cardiac cycle in one minute or the number of heart beats per minute; the times per minute that the heart contracts.

Heart Rate Monitor (HRM): An instrument that evaluates or measures the heart rate during rest or during activity. Polar HRM (PHRM) was used in this study.

Maximum Heart Rate (MHR): The highest number of times your heart can contract in one minute. It is used in determining training intensities, because it can be individually measured or predicted.

Palpate: A method of using the fingers at the neck or wrist to count the pulse.

Resting Heart Rate (RHR): The number of beats in one minute when at complete rest. This indicates the individuals basic fitness level.

Target Heart Rate (THR): The predicted percentage of maximum heart rate derived from either a stress test or by calculation (age-predicted formula).

Target Heart Rate Zone (THRZ): Appendix C and D indicate how the subject can derive his/her target heart rate zone, the zone in which the subject works in order to receive the beneficial effects of a cardiovascular workout for his/her state of fitness.

Significance of the Study

Most of the premier, classic research in this field involved men. It was recognized that the intent of this research study was to add to the knowledge base that involves females in regard to cardiovascular fitness.

The United States Department of Health and Human Services recognized the inherent value of physical education when compiling the document Healthy People 2000: Objectives for a Nation. Not only is regular physical activity promoted, but quality physical education which enhances physical fitness is encouraged. The objectives outlined in this document could be used as a foundation for any school district's physical education performance outcomes. To meet these outcomes, physical educators must establish assessment practices that can accurately evaluate student performance. A shift to assessing the amount and intensity of students' physical activity may more accurately determine whether performance outcomes are met. Heart rate telemetry is one way to assess the intensity and duration of physical activity (Deal & Deal, 1995).

National standards for physical education describe what students should know and be able to do as a result of physical education. The standards emphasize the development of movement competency and proficiency, use of cognitive information to enhance motor skill acquisition and performance, establishment of regular participation in physical activity, achievement of health-enhancing physical fitness, (this is a set of attributes that include cardiovascular endurance, muscular strength and endurance, flexibility, and body composition) development of responsible personal and social behavior, understanding of and respect for individual differences, and awareness of values and benefits of physical activity participation. These standards provide a framework that should be used to design, implement, and evaluate physical education curricula that promote enjoyable, lifelong physical activity (Healthy People 2000, 1992).

Daily physical education from kindergarten through twelfth grade is recommended by the American Heart Association and the National Association of Sport and Physical Education and is also a national health objective for the year 2000. The minimum amount of physical education required for students is usually set by state law (Healthy People 2000, 1992).

The following national health promotion and disease prevention objectives for the year 2000 are related to physical activity and fitness among children and adolescents:

1.2 Reduce overweight to a prevalence of<20% among people aged>20 years and<15% among adolescents aged 12-19 years.

1.3 Increase to >30% the proportion of people aged>6 years who engage regularly, preferably daily, in light to moderate physical activity for >30 minutes per day.

1.4 Increase to>20% of the proportion of people aged>18 years and to >75% the proportion of children and adolescents aged 6-17 years who engage in vigorous physical activity that promotes the development and maintenance of cardiorespiratory fitness >3 days per week for >20 minutes per occasion.

1.5 Reduce to <15% the proportion of people aged>6 years who regularly perform physical activities that enhance and maintain muscular strength, muscular endurance, and flexibility.

1.6 Increase to >40% the proportion of people aged>6 years who regularly perform physical activities that enhance and maintain muscular strength, muscular endurance, and flexibility.

1.7 Increase to 50% the proportion of overweight people aged >12 years who have adopted sound dietary practices combined with regular physical activity to attain an appropriate body weight.

1.8 Increase to 50% the proportion of children and adolescents in first through twelfth grade who participate in daily school physical education.

1.9 Increase to 50% the proportion of school physical education class time that students spend being physically active, preferably engaged in lifetime physical activities (Healthy People 2000, 1992).

Schools and communities should promote physical activity among children and adolescents because many young people already have risk factors for chronic diseases associated with adult morbidity and mortality. For example, the prevalence of overweight is at an all-time high among children and adolescents (Healthy People 2000, 1992).

People begin to acquire and establish patterns of health-related behaviors during childhood and adolescence; thus, young people should be encouraged to engage in physical activity. However, many children are less physically active than recommended. Physical activity declines during adolescence, and enrollment in daily physical education has decreased (Healthy People 2000, 1992).

Increased awareness of the health benefits of physical activity has led to increased recognition of the need to reduce sedentary lifestyles. The International Consensus Conference of Physical Activity Guidelines for Adolescents recommends that,

> all adolescents...be physically active daily, or nearly every day, as part of play, games, sports, work, transportation, recreation, physical education, or planned exercise, in the context of family, school, and community activities and that adolescents engage in three or more sessions per week of activities that last 20 minutes or more at a time and that require moderate to vigorous levels of exertion (Healthy People 2000, 1992).

The profession of physical education needs to move to a more fitness-and-science-oriented approach to teaching physical education. Teacher education programs in physical education must start to include the use of instruments such as the HRM in their education programs in order that the future physical educator may know about their value as well as how to use them. HRMs can be used in any or all of the following ways:

- watches are used to monitor endurance workouts;
- individual results from a previous day's lesson can be used as daily motivation;
- daily results provide valuable feedback;
- HRMs provide immediate feedback to a student wearing a watch;
- unsupervised individual workouts are easy to manage with the HRM;
- heart rate printouts can easily be used as homework assignments;
- printouts are very helpful during parent-teacher conferences (Strand & Reeder, 1993).

It is imperative for students to know the proper intensity level of the activity they are engaged in if they are to improve cardiovascular fitness. Moreover, if physical education teachers fail to raise heart rate levels to the required target heart rate zone for a required period of time, but continue to teach the traditional activities in the manner commonly found in most physical education classes, the state of youth fitness may never improve. HRMs could provide information to American children on how to become, and stay fit for a lifetime.

Knowing the heart rate during exercise helps the individual stay in the aerobic "target zone," the heartbeat range in which heart and lungs must work hard to meet the body's increased demand for oxygen. Research indicates that aerobic exercises such as running or swimming, done in a THRZ and sustained for at least twenty minutes, three to five times a week, strengthen the heart muscle, increase the amount of blood in the body, and thus, improve the muscle's ability to extract and utilize oxygen. All these cardiovascular improvements better equip the body to transport oxygen during exercise, so endurance increases as well.

Tracking your heart rate during exercise and at rest gives you an immediate comprehensible fix on your progress over the weeks and months in an organized training program. In an article in U. S. News and World Report in October, 1990, sixteen heartbeat monitors were tested. Physiologists at Georgetown University's cardiac exercise laboratory were asked to help see whether these heartbeat monitors met the standard. Of the sixteen tested, the chest-strap monitors were generally the most accurate and can be used in physical education classes (Popolsky, 1990).

Polar Heart Rate Monitors are so accurate that readings obtained simultaneously by Polar monitors and by electrocardiogram (ECG) monitors are almost identical. Some reasons for using the heart monitor while exercising are:

- It gives a precise measurement of your exercise intensity.
- It individualizes your exercise program.
- It is precise. Direct measurement of your heart rate during exercise is simply the most accurate way to ensure that you achieve your goals.
- Progress can be monitored and measured.
- It introduces objective observation.
- Heart rate monitoring provides the key to regulating the quantity and intensity of workouts and racing performance by providing accurate and immediate biofeedback data (Polar Electro Inc., 1997).

Assumptions

The study was based on the following assumptions:

- The junior high subjects were similar in their levels of fitness upon entry into the study.
- The subjects followed a normal mixed diet of foods for their nutrition during the study.
- The subjects were from similar socioeconomic backgrounds.
- The subjects were from several ethnic backgrounds.
- The subjects and parents did correctly fill out the questionnaire and approval forms.
- The physical education teachers did understand how the heart monitor and watch functioned and were able to assist subjects.
- All subjects did participate in the same aerobic activities.
- All subjects were volunteers and would be enthusiastic and eager to participate.

Limitations

This study was subject to the following limitations:

- There was no control on the lifestyle of the subjects.
- There was no control over the subjects desire and ability to accurately count the pulse when palpating.
- There was no control over the subjects concentration level while counting the pulse.
- There was no control over the ability of the subjects to observe and remember the heart beat count from the watch, the count of their pulse, and to accurately record both of the numbers.
- There was no control over the subjects ability to remember to start the watch when the transmitter was attached to the chest.

- There was no control over the subjects remaining constantly active during the activity in order to maintain a sustained heart rate.
- There was no control over the subjects' interest diminishing as the nine weeks of the study progressed.
- There was no control over the fact that the 60 participating subjects were divided between five physical education teachers. This may make for less harmony, less control and probably less enthusiasm than if all the subjects had been in the same class.
- There was no control over the fact that in the course of the nine weeks study two student teachers assisted in the classes, one female and one male.
- Nine weeks is a short duration for a heart rate study.
- This was the first time the seventh grade females used the HRM's, therefore they were learning how to read the watch and count their pulse at the some time. This may have affected the accuracy of both of their readings.
- There was no control over the amount or type of mortality that would occur.

Delimitations:

The delimitations of this study were:

- The subjects were limited to 60 female junior high subjects who volunteered to participate in the study.
- Only 46 subjects who completed the nine weeks activities were utilized in this study. For various personal reasons the remaining subjects terminated themselves from the study.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

An understanding of the value of cardiovascular fitness and exercise in children and youth is paramount if they are to continue a lifestyle of fitness into adulthood which can in turn improve their quality of life and decrease health care costs over their lifetimes. Cardiovascular fitness is an ingredient of the health-related aspects of fitness. It is vital for a benchmark of a physically fit individual.

Youth and adults alike need to be aware of the various problems that are associated with sedentary living and how these lifestyle patterns affect children, youth, and adults. One serious problem relating to sedentary living is that of being overweight. This is not just a concern in the United States but an international one as well.

The heart monitor is the technology that enables persons to have an immediate reading of their heart rate while exercising. It is the tool that can be very effective for monitoring and thus improving cardiovascular fitness. Heart monitors are being used more and more in physical education programs, and it is hoped that the trend will continue. It is an excellent method for teaching cardiovascular fitness and the fundamental facts of the benefits of exercise. Findings regarding the validity and reliability of the heart monitor for monitoring exercise intensity are increasing.

Internationally research is being conducted concerning the value of fitness, sedentary lifestyles and the heart monitoring of physical education activities. Countries that have conducted national surveys seem to have similar findings in regard to their citizens state of fitness and lifestyles.

Value of Fitness

In 1968, Dr. Kenneth Cooper conducted field tests on various distance runs, collecting data that indicated two basic principles:

- If exercise is vigorous enough to produce a sustained heart rate of 150 beats per minute or more, training-effect benefits begin about five minutes after the exercise starts and continue as long as the exercise is performed;
- If exercise is not vigorous enough to produce or sustain a heart rate of 150 beats per minute, but is still demanding oxygen, the exercise must be continued considerably longer than five minutes. The total period of time depends on the oxygen consumed (Cooper, 1968).

Cooper also indicated, in A Means of Assessing Maximum Oxygen Intake (Cooper, 1968), that in young, well-motivated subjects, field testing can provide a good assessment of maximum oxygen consumption. Field testing has been used both as an indication of cardiovascular fitness and as a method of monitoring changes in fitness.

The value of the validity and reliability of Cooper's field tests indicated that when exercising or training in the appropriate THRZ some of the effects on the body are:

- the lungs operate more efficiently;
- the blood supply increases, especially more red blood cells and hemoglobin;
- the body makes healthier body tissues and receives more oxygen;
- the heart becomes stronger and healthier;
- it enables you to eat better, digest better, and eliminate wastes better.

The effect on the body acts like preventative medicine.

Nine years after Cooper's field testing on distance runs he became even more convinced of the benefits of exercise. "Good health is the bedrock on which social progress is built. A nation of healthy people can do those things that make life worthwhile, and as the level of health increases, so does the potential for happiness" (Cooper, 1977).

Numerous studies have been done showing the value of aerobic or cardiovascular fitness: it bolsters the immune system, helps strengthen the bones, improves sleep patterns, helps to maintain proper weight, elevates metabolism, reduces the chance of disease, helps rid the body of toxins, reduces tension and stress, improves self-confidence and personal appearance, increases energy levels, helps clear fat out of the blood, and improves gut motility (Stricklin, 1996).

The organization, Shape Up America, also suggested benefits from exercise: increases your self-esteem, improves mood, boosts energy, strengthens the heart and the muscles, burns calories, improves cholesterol levels, relieves stress, lowers risk of heart disease, hypertension, and diabetes, prevents bone loss, and decreases risk of some cancers (http://www.shapeup.org).

The human body possesses great potential for functional and structural adaptation to vigorous physical exercise. Humans have been nomads and hunters throughout thousands of years of evolution. During recent history a drastic reduction has occurred in the amount physical activity in daily life because of labor-saving devices and motorized transport.

One result of this reduction in physical exercise has been a lowered state of physical fitness in the populations of the industrialized world, with a simultaneous increase in the prevalence of cardiovascular disease as a cause of death and disability. This suggested that the change to a sedentary life-style may be both detrimental to the individual and potentially expensive for society (IFSM, 1990).

Epidemiological evidence, as that presented in the Harvard Alumni Study, strongly suggested the beneficial effects of physical exercise in the prevention of coronary artery disease and the reduction of all-cause mortality when exercise constitutes an integral part of occupational and leisure time activities (Paffenbarger, et al, 1986). Epidemiological evidence also indicated that it is important for a person to engage in a program of regular physical exercise as part of a healthy life style. Adherence to a regular program of aerobic exercise involving large muscle groups can result in enhancement of the physiological systems that support activity and an improvement in the activity (Paffenbarger, et al, 1986).

It is the recommendation of the International Federation of Sports Medicine that each person should engage in a regular program of aerobic exercise consisting of three to five exercise sessions each week, and that each exercise session should have a duration of 30 to 60 minutes. The aerobic exercise may consist of such activities as walking, running, hiking, swimming, cycling, rowing, skating, or cross-country skiing. The intensity of the exercise should routinely elicit a heart rate within 50-80 percent of the individual's maximum. Regular physical exercise can contribute to an enhancement in health and can provide an individual with a more productive and enjoyable life (IFSM, 1990).

Steven N. Blair, PhD., director of epidemiology at The Cooper Institute for Aerobics Research in Dallas, said:

> Attaining basic health benefits doesn't require the hard training necessary for competitive athletics. And there are very few things you can do to add as much quality to your life. If fitness is your aim you will have to do a little more-but not much (IFSM, 1990).

To achieve heart-lung fitness the American College of Sports Medicine recommended you do three things: choose a sport that gets lots of muscles involved, big-muscle activities like fitness walking, hiking, swimming and running. These activities tax your heart and lungs more. Exercise three to five days a week, 20-60 minutes at each exercise session, and keep your heart rate above 55% of your maximum during your workouts (McAlpine, 1998).

There are several components to over-all fitness. The health-related aspects of fitness consists of aerobic endurance or cardiovascular fitness, muscle endurance, muscle strength, flexibility, and body composition or the percent of body fat. The skill-related aspects of fitness consists of agility, balance, coordination, power, rhythm, reaction time, and speed. The health-related aspects are the primary fitness components.

Aerobic activity should be the cornerstone of any fitness program. The key function of aerobic exercise is to make the cardiac (heart) muscle stronger, more effective and efficient, thus strengthening cardiorespiratory endurance. Being fit aerobically can be achieved by using the FIT formula:

F-frequency of the activity, 3-5 times a week

I-intensity of the activity, strenuous enough to raise the heart rate to the "target zone," or between 60% and 85% of your maximum heart rate

T-time of the activity, 20-60 minutes per session (Nolan Ryan Fitness Guide, 1997).

The best approach to all-around fitness is understanding heart zone training. It is not a one-size-fit-all-concept. It is individually suited to persons who are unfit to persons who are fit. Heart zone training involves an understanding of four terms and the training tree.

Heart-Your heart is a muscle; you can strengthen it.

Heart Rate-How fast your heart beats, measured in beats per minute (bpm). A resting rate for most people is about 70 bpm. A maximum heart rate is the fastest the heart can beat for one minute (varies with each individual).

Zone-A range of heart beats. Recent research has shown powerful benefits from exercising in several zones. It is expressed as a percentage of the maximum heart rate. Heart zones reflect exercise intensity and the resulting benefits.

Training-A process of exercising to achieve a goal, anything from winning a marathon to becoming more fit. Almost everyone can train to live a good, healthy life (Edwards & Privus, 1997). (Appendix E)

The American Heart Association recommends vigorous activity to condition your heart and lungs and promote cardiovascular fitness to help lower blood cholesterol, high blood pressure, and to lose body weight. Obesity is indirectly linked to coronary heart disease mainly because it influences blood pressure, blood cholesterol and triglyceride levels, and makes diabetes more likely to develop (American Heart Association, 1997).

Vigorous aerobic activities raise the oxygen consumption to more than six times the level burned by the body at rest. Some vigorous physical activities that are recommended by the American Medical Association and American College of Sports Medicine are:

Walking fast (four to five miles per hour)
Cycling fast (11-12 miles per hour)
Swimming (fast treading or front or back crawl)
Cardiovascular conditioning exercise (such as using a stair climber or cross-country ski machine)
Singles tennis or racquetball
Fishing (wading in a rushing stream)
Canoeing fast (more than four miles per hour)
Moving heavy furniture
Mowing the lawn (with a manual mower)
Aerobic dancing
Jogging (5 miles per hour)

Rope jumping (60 jumps/minute)

The Physical Activity Pyramid was used to identify the types of activities that are appropriate for building different parts of fitness and contributing to overall health and wellness. (Appendix F)

A debate in the physical education field for a number of years has been whether or not studies should concentrate on the health related aspects of fitness: muscular strength, muscular endurance, aerobic endurance, flexibility, and percentage of body fat or body composition; or should studies concentrate on the skill related aspects of fitness: agility, coordination, balance, power, speed, rhythm, and reaction time. The 1987 National Children and Youth Fitness Study II in the Report of the President's Council on Physical Fitness and Sports revealed that elementary physical education teachers in grades one through four were teaching the top five activities from their survey, including movement experiences and body mechanics (43%), soccer (32%), jumping and skipping rope (26%), gymnastics (25%), and basketball (21%). In addition, between fifteen and twenty percent of students were exposed to throwing and catching activities, calisthenics/exercise, rhythmic activities, kick ball, relay, running, and baseball/softball (Corbin, et al, 1987).

An important finding from this study was that elementary schools have not adopted a broad-based fitness program that is health-related. When the health-related aspects of fitness are taught the skill-related aspects follow; however, the reverse is NOT true. This is very significant for physical education teachers to know and to consider when constructing the goals, objectives, unit and lesson plans for their classes. Fitness norms for children under ten years of age have only been available since 1980. However, it is clear that these physical education programs were not emphasizing fitness but rather skill and motor development.

The results of a study by Strand and Reeder confirmed reports claiming that American children are not as fit as many health and physical education professionals think they should be. If physical education teachers fail to raise heart rate levels into the required intensity level for a sufficient period of time, and continue to teach the traditional activities in the manner commonly found in most physical education classes, the state of youth fitness may never improve. From this study it appeared that students engaged in a sports education curriculum, with emphasis on traditional team sports, cannot reach the American College of Sports Medicine (ACSM) standards for cardiovascular fitness development despite the fact that a cardiovascular fitness component is planned as part of a daily lesson. Traditional skill, sport development, and team sports in physical education classes generally do not develop aerobic fitness. Teachers must restructure activity units so opportunities for developing aerobic fitness are built into their unit plans. Teachers may have to even restructure curricular offerings. Traditionally, junior and senior high school programs have emphasized sports and games rather than fitness. If the development of cardiovascular fitness is a major goal, curricular changes which eliminate or modify traditional activities must be implemented (Strand & Reeder, 1993). In a subsequent study P. E. with a heartbeat Strand and Reeder concluded that HRMs can be used to improve teaching skills, enhance youth fitness, and develop positive attitudes and behaviors (Strand & Reeder, 1993).

In regard to the previously mentioned debate among physical educators concerning fitness or skill development, Quinn and Strand conducted a study to examine the effect of adding aerobic training to football skills development activities for male seventh graders. Two groups completed one or the other type of training. HRM and skill assessment data indicated that the addition of the planned fitness component did not detract from skill development. Skill development did improve even though more time was spent on fitness-type activities (Quinn & Strand, 1995).

The 1996 Surgeon General's Report on Physical Activity and Health suggested that the minimum standard, or basic goal, is for daily "mild-to-moderate" activity.

MINIMUM ACTIVITY STANDARD FOR CHILDREN

Frequency: Daily. Frequent activity sessions (3 or more) each day.

Intensity: Moderate. Alternating bouts of activity with rest periods as needed or moderate activity such as walking or riding a bike to school.

Time: A total of about 30 minutes or more of active play or moderate sustained activity that may be distributed over 3 or more sessions.

The optimal standard, or optimal goal, is for daily "moderate-to-vigorous" activity.

OPTIMAL ACTIVITY GOAL FOR CHILDREN

Frequency: Daily. Frequent activity sessions (3 or more) each day.

Intensity: Moderate to vigorous. Alternating bouts of activity with rest periods as needed or moderate activity such as walking or riding a bike to school.

Time: A total of about 60 minutes or more of active play or moderate sustained activity that may be distributed over 3 or more activity sessions (Surgeon General Report, 1996).

A good way to picture activities is the "activity pyramid" developed by Park Nicollet Medical Foundation in Minneapolis. (Appendix G)

A study published in the *American Journal of Diseases of Children* found that parents can promote fitness in children by encouraging them to play, by playing with them and by serving as good role models. Some of the specific things parents can do to develop healthy lifestyle habits in their children are:

- Be physically active yourself
- Involve your child
- Limit television and video viewing
- Support your child's fitness activities
- Work for quality physical education programs in schools
- Support your community athletic programs.

Overweight Trend

More kids are starting off on a sedentary lifestyle earlier than ever before. "The concern is that the pattern of inactivity of adults is already well established by adolescence," said Dr. Gregory Heath of the Centers for Disease Control and Prevention. Dr. Heath continues, "The trend is that the proportion of young people who are inactive continues to increase."

In the opinion of many experts American kids are in worse shape than ever before in our history. Not only do the boys and girls of today weigh more than their same-age counterparts in the past (on average, a 12 year old today weights 11.4 pounds more than a 12 year old in 1973), but they also do not measure up on tests of endurance and strength. In California, more than one-third of children participating in a pilot aerobics program could not do 10 minutes of aerobic exercise. In Florida, children scored lower on fitness test than their counterpart did a decade earlier. In Texas, half the children scored "poor to weak" in the 600-yard run. As the President's Council on Physical Fitness and Health cryptically reported, "The fitness boom never reached our children" (Piscatellea, 1997).

This situation is critical for four specific reasons:

1. It is well known that physical inactivity is a significant predictor and cause of obesity in children and teens, independent of nutritional habits.
2. Physical inactivity in children and teens is a significant predictor of coronary heart disease, cancer and other adult diseases.
3. Poor fitness produces low self-esteem, poor body image, and not enough energy to be their best.
4. Physical inactivity in childhood tends to "track" into adulthood. The sedentary child tends to become the sedentary adult (Piscatella, 1997).

Being physically active is a crucial lifestyle factor in losing weight, controlling weight, and increasing cardiovascular health. The 1996 Surgeon General's Report on Physical Activity and Health stated that, "the importance of promoting physical activity among youth is based on growing evidence that physical activity is associated with enhanced physical and psychosocial health." The report cited physical inactivity as a "major cause of overweight and obesity," a concern echoed by the U.S. Public Health Service, the American College of Sports Medicine, the American Academy of Pediatrics, the American Heart Association, and the American Medical Association.

Dr. Charles Kuntzleman, an authority on children and physical activity, said it in simple terms: "Active children rarely become overweight" (Piscatella, 1997).

The fattening of America is an EPIDEMIC. With the exception of the population of a few Pacific islands, Americans are the fattest people on earth. Charles Hennekens, M.D. ,chief of preventive medicine at Brigham and Women's Hospital in Boston, said: "The U.S. is probably the heaviest society in the history of the world." And no group of Americans is bigger than those ages 50 through 69 (men) and 50 through 59 (women), who are twice as likely to be obese as people in their 20's. In just the period from 1978 through 1995, obesity among males increased a stunning 72 percent, with a 79 percent increase among those 50 through 69. Among women it increased 58 percent overall and 21 percent in the 50 through 69 category (Fumento, 1998). (Appendix H)

As the nation heads toward a new millennium, obesity has become a major public health crisis. Obesity has increased at levels over the past decade, up from 26 percent of adults in 1980 to 34 percent today. As a result, over 58 million American adults, one third of the population, are overweight or obese. Even more alarmingly, childhood obesity rates have been rising steadily over the last three decades with 22 percent of children ages 6 to 17 now overweight. At the same time Hispanics and African Americans have obesity rates that are 10 to 20 percent higher than whites, while Native Americans and Hawaiians have a 10 to 40 percent greater prevalence of unhealthy weight (http://www.shapeup.org).

From a public health perspective this situation is nothing short of a crisis. Although the economic costs of obesity are now estimated at over $100 billion a year, this serious condition has yet to be recognized as the main nutrition and metabolic disease in this country. And the likely consequence is that obesity rates will continue to skyrocket further, since obesity is directly linked to a number of disabling and life threatening diseases, diabetes, hypertension, heart disease, some forms of cancer, gallbladder disease, and osteoarthritis. These related disease rates will also continue to rise (http://www.shapeup.org).

This is disastrous news. According to data from the Centers for Disease Control and Prevention and other organizations and researchers, excess weight kills 300,000 Americans prematurely each year by contributing to heart attacks, high blood pressure, strokes, diabetes, and many other serious diseases. More than 100 years of research, including huge ongoing studies, put the facts in the starkest terms: *The fatter you are, the sicker you will be and the earlier you will die (Fumento,1998).*

Some explanations to ponder are:

1. Our food isn't served, it's shoveled

The size of portions served in America's food establishments has grown enormously during the past couple of decades. The McDonald's original 3.7 ounce hamburger (bun included) has now grown to 9 ounces (and the chain is currently test marketing an even larger sandwich). 7-11 stores sell 64 ounce soft drinks-ten times bigger than the original Coke bottle (European Cokes are eight ounces) (Fumento, 1998).

The July/August Nutrition Action Health Letter continued this same thought. "The food industry is selling food in larger portions," says Marion Nestle, chair of the Department of Nutrition and Food Studies at New York University.

Nestle and colleague Lisa Young asked 100 college students taking a nutrition course to bring in a bagel, baked potato, muffin, or cookie that they considered "medium." Then they compared those foods to serving sizes that the U.S. Department of Agriculture advised the public on how much of what to eat-calls "medium" The results:

- a typical medium baked potato was seven ounces, instead of the USDA's four ounces.
- a typical medium bagel was four ounces, double the USDA's two ounces.
- a typical medium muffin was six ounces, triple the USDA's two ounces.

"It's a great sales technique," said Nestle. "People buy larger sizes because they perceive them as good value AND more food doesn't cost much more. It is profitable to sell giant servings because only about 20 cents of every food dollar goes to the producer of the food," explains Nestle. "The rest is for packaging, transportation, advertising, and marketing" (Liebman, 1998).

2. Fatness is "in"

Rather than fight obesity, America has declared peaceful co-existence with it. Clothing and magazines specifically targeting overweight women (in the U.S.) are rare in the rest of the world. Obesity has become such a cause celebre that "fat-acceptance" advocates curry favor with the media. In dealing with the obesity epidemic in America, we are enabling it and institutionalizing it. While many individuals clearly don't want to be overweight, American society as a whole is progressively accepting it (Fumento, 1998).

3. We're low-fat junkies

It's not fat but calories that cause weight gain, although fat is packed with calories. The problem with low-fat food is that the principle is scientifically bankrupt-most low-fat products are still high-calorie snack foods. A low-fat diet can help control your weight, but only if you also keep your calories down. Don't reduce the percentage of the calories you are eating that are coming from fat; reduce the fat in your diet to reduce the number of calories you are eating (Fumento, 1998).

4. America-The Sedentary

Americans are exercising less with each succeeding generation. One reason is an increase in TV watching, video renting, computer usage, Internet browsing, and (for kids) video-and/or computer game-playing.

Another reason is that many schools are cutting back their athletic programs. About a decade ago nearly half of all high school students were in daily physical education classes. Today, only about a quarter of them are (Fumento, 1998).

5. Our expectations are too high

Americans have always had an all-or-nothing mentality. We do not do anything slowly or halfway. When it comes to weight, we want to lose it now. Crash diets are self-defeating. The key to losing weight and keeping it off is to do it as slowly as possible. Evidence shows that the milder your calorie reduction, the milder your metabolism reduction (Fumento, 1998).

6. We deny, deny, deny

Some overweight people claim that they are being maligned unjustly. First, studies showing that fat people eat no more than thin people are based on the results on self-reported eating habits. Second, studies have shown that some people are genetically inclined to burn calories more slowly, but that hardly explains why Americans are so much fatter than their genetically related brethren around the world, why few other cultures have any such "genetic" problems or why Americans are getting fatter by the year. And third, many doctors do believe that carrying fat below the waist is less risky than carrying it above (an apple shape), but medical evidence from a 1995 study disputes this. The *Journal of the American Medical Association* reported that excess fat, regardless of location, causes the same health problems (Fumento, 1998).

Of all behaviors that lead to illness, only smoking takes more lives than obesity, and if current trends continue, says JoAnn Manson, M.D., an endocrinologist at Harvard Medical School and one of the main researchers in the Nurses' Health Study comprising more than 120,000 women ages 30-55, "it won't be very long before obesity surpasses cigarette smoking." "Being overweight kills primarily through heart disease, but also by: stroke, cancer, diabetes and further, when obesity doesn't kill, it sickens and cripples."

Body Mass Index (BMI) is a ratio between weight and height, and it is a mathematical formula that correlates with body fat. BMI is a better predictor of disease risk than body weight alone. However, there are certain people who should not use BMI as the basis for determining relative disease risk. Competitive athletes and body builders whose BMI is high due to a relatively larger amount of muscle, and women who are pregnant or lactating. Nor is it intended for use in growing children or in frail and sedentary elderly individuals (http://www.shapeup.org). (Appendix I)

BMI is important because if your BMI is high, you may have an increased risk of developing certain diseases, including:

- Hypertension
- Cardiovascular disease
- Adult-onset diabetes (type 11)
- Sleep apnea
- Osteoarthritis
- Female infertility
- Prevention of further weight gain is important and weight reduction is desirable (http://www.shapeup.org).

Americans enjoy the most abundant and varied diet in the world. Food is cheap, plentiful, and tasty. All those readily available nutrients should make us a strong, healthy people. But for an increasing share of U.S. adults, life in the land of plenty is making them plenty fat (Dortch, 1997).

The percent of adults aged 20-74 who are obese based on their body mass index increased from 24% in the 1960's to 33% in 1988-91 and to 35% by 1994. Applying that rate to the adult population yields a total of 65 million U.S. adults ages 20 or older who were overweight in 1988-94. The aging population cannot be blamed. Overweight has become more prevalent among all age groups, not just the elderly (Dortch, 1997).

Children and adolescents are following the example of their elders. The share of children aged 6-11 who are overweight increased from 11% in the late 1970's to 14% in 1994. For children ages 12 to 17, the share doubled to 12% in 1994 (Dortch, 1997).

The National Center for Health Statistics (NCHS) said that overweight and obese adults are at increased risk for numerous acute and chronic conditions. Most doctors believe that a wide range of chronic ailments can be prevented or mitigated by maintaining a reasonable body weight. Former Surgeon General C. Everett Koop recently said that if he had stayed in office longer, "I would have launched the same assault on obesity that I did on smoking" (Dortch, 1997).

In order to address the problem, former Surgeon General C. Everett Koop has launched an assault on obesity with his organization called, "Shape Up America." Dr. Koop's anti-obesity campaign, consists of the following action plan:

- Making physical activity accessible in the workplace
- Mobilizing the nation's physicians to promote physical activity
- Providing incentives for physical activity efforts
- Improving the safety of parks, sidewalks and recreational areas
- Expanding community programs that promote physical activity
- Making physical education mandatory in schools
- Rethinking school physical education and activity programs
- Advocating the passage of legislation to protest schools from litigation
- Providing childcare services in community recreation facilities
- Elevating walking as a national priority-the walking campaign was begun nationally in the spring of 1997 (http://www.shapeup.org).

The data from the National Center for Health Statistics clearly illustrated the increase in overweight is not good news. (Appendix J) (Appendix K)

An important question to be dealt with should be in the Area of Aerobic Activity-Do Physical Education Programs Provide Enough? Eileen McGing studied this question in 1989, and she asked:

> Are we, as physical educators, providing enough vigorous activity to strengthen and prolong the heart and its associated system? Are we teaching students to reduce coronary heart disease risk factor such as hypertension, obesity, and hyperlipidemia by performing aerobic exercise on a regular basis, or are we simply continuing to teach student competitive skills for playing games and sports (McGing, 1989)?

Considering the epidemic advancement of cardiovascular disease, the nation's number one killer, providing aerobic exercise and concepts to improve cardiorespiratory endurance and alleviate degenerative diseases should be a primary objective of the high school physical education curriculum.

For Eileen McGing's descriptive study a questionnaire requested information about the following components of the high school physical education curriculum:

1. methods used to determine vigorous activity participation
2. duration of vigorous activity per class
3. frequency of vigorous activity per week
4. school size and its relationship to inclusion of aerobic activity
5. unit length and weekly application of specified aerobic activities
6. endurance testing frequency and type
7. priority rating of eight listed objectives

The questionnaire was sent to 49 physical education department chairpeople in regular education high schools of a large metropolitan area in Illinois. The results of this study showed that sufficient application of aerobic activity does not occur in the secondary school of this large metropolitan area. Perhaps these results are not surprising since sport skill instruction has long been an important objective of physical education. However, research now shows that chronic degenerative diseases begin in childhood. Curricula should concentrate less on sport skill development and competition, and more on health-related fitness and aerobic activity. THE TIME FOR CHANGE HAS ARRIVED (McGing, 1989).

Indeed, the time for change has arrived. Since 1980 body weights in the United States have been inflating at an alarming rate, and the rest of the world seems to be following suit. Currently, 22.5% of the U.S. population are considered to be clinically obese compared to only 14.5% in 1980, and the end to the increase does not appear to be in sight. Also, this "obesity epidemic", as many public health experts call it, affects all demographic groups, including children (Taubes, 1998). (Appendix L)

Low levels of activity, resulting in fewer kilocalories used than consumed, contribute to the high prevalence of obesity in the United States. The number of overweight adults in the United States increased from about 25% in the 1970's to 33% in the early 1990's. These numbers do not bode well for the overall health of the nation because obesity is a key factor in chronic conditions like diabetes, coronary heart disease, and high blood pressure.

The message is simple. Physical activity helps people lose weight, and the most effective prescription of long-term weight regulation is exercise combined with a reduced energy diet. Physical activity generally promotes fat loss while it preserves or increases lean mass (Applegate, 1998).

The best evidence of an increase in body weight outside the United States comes from the United Kingdom, where data from the National Health Survey suggested that obesity rates jumped from 6% to 15% in men and from 8% to 16.5% in women between 1980 and 1994. For the rest of the world the data from national health surveys and studies of small population samples are:

In the Americas outside the United States, only Brazil and Canada have collected trend data. In Brazil, between 1976 and 1989, obesity prevalence increased from 3.1% to 5.9% in men and from 8.2% to 13.3% in women. In Canada, between 1978 and 1992, obesity prevalence went from 6.8% to 12.0% in men and 9.6% to 14.0% in women (Taubes, 1998).

In Europe, studies from Finland, the Netherlands, and Sweden indicated that the prevalence of obesity is increasing slightly in men and not at all in women. In contrast, an unpublished study in the former East Germany suggested that between 1985 and 1992, rates of obesity increased from 13.7% to 20.5% in men and 22.2% to 26.8% in women (Taubes, 1998).

In the Western Pacific region, the prevalence of obesity in Australia increased from 9.3% to11.5% in men and from 8.0% to 13.2% in women between 1980 and 1989. In China and Japan, studies indicated that obesity may be increasing slightly in men but not in women. In Western Samoa between 1978 and 1991 urban obesity rates increased from 38.8% to 58.4% in men and from 59.1% to 76.8% in women (Taubes, 1998).

In Southest Asia, the only meaningful data came from two small studies in Thailand, suggesting that between 1985 and 1991 obesity prevalence increased from 2.2% to 3.0% in men and from 3.0% to 3.8% in women (Taubes, 1998).

In Africa, the only trend data came from Mauritius, where one study stated that obesity prevalence increased from 3.2% to 5.3% in men and 10.4% to 15.2% in women between 1987 and 1992 (Taubes, 1998).

The World Health Organization (WHO) and the International Obesity Task Force (IOTF) have declared an obesity epidemic on a global scale, as can be observed from the above mentioned data. As the IOTF puts it, obesity, which increases the risk of developing such potentially fatal conditions as diabetes and heart disease, "poses one of the greatest threats to human health and well-being as the 21^{st} century approaches" (Taubes;1998).

Factors influencing the increases in body weights seem to be: smoking cessation, caloric imbalances, labor-saving devices-sedentary life-styles, passive observers at entertainment, and less physical activity. Basically the problem is too much input of food and too little output of activity. Other factors could be more and larger soft drinks, salty snack foods and sweeteners, fast-food restaurants, stress, and societal perimeters (Kuczmarski, et al, 1994).

No one has yet found a satisfactory way to achieve long-term weight reduction that works on a population-wide basis. Americans in all sociodemographic groups are using a variety of techniques to lose weight voluntarily; however, most eventually gain it back (Kuczmarski, et al, 1994). (Appendix M)

In a commentary concerning the Epidemiology of Overweight in Children: Relevance for Clinical Care, it was stated that childhood obesity is a well-recognized problem in the United States, and in some other countries (Christoffel, 1998).

In an article entitled: "Increasing Prevalence of Overweight Among US Low-income Preschool Children: The Centers for Disease Control and Prevention Pediatric Nutrition Surveillance, 1983-1995" examined data from 18 states and the District of Columbia concerning age, sex, and race or ethnicity to determine whether the prevalence of overweight in preschool children has increased among the US low-income population. The subjects were low-income children<5 years of age. In the results, the prevalence of overweight increased from 18.6% in 1983 to 21.6% in 1995 based on the 85^{th} percentile cutoff point for weight-for height, and from 8.5% to 10.2% for the same period based on the 95^{th} percentile cutoff point. Analyses by single age, sex, and race or ethnic group (non-Hispanic white, non-Hispanic black, and Hispanic) all showed increases in the prevalence of overweight, although changes are greatest for older preschool children. Thus, the conclusion was that overweight is an increasing public health problem among preschool children in the US low-income population (Mei, et al, 1998).

Heart Monitors

Since the health-related aspects of fitness are so vital, and especially cardiovascular fitness, then it is important to monitor the heart rate during activity. The individual can palpate the pulse or use a heart rate monitor during the activity to record the pulse. Either way, it is important to monitor the heart rate during activity in order that the individual may know whether or not he/she is working at a fitness level that is appropriate for him/her.

Heart rate monitors are one method of recording the pulse. The Polar Heart Rate Monitor (PHRM) uses a wireless transmitter that is encased in a water-proof chest strap that houses two electrodes. The heart rate is accurately transmitted to a watch-like heart rate monitor that continuously displays the heart rate throughout the time that the individual is wearing the chest strap. It can be programmed to signal the individual if the heart rate is either at unsafe levels or if it is not a level that produces a positive training effect. Once the exercise is completed, the heart rate monitor can be interfaced with a computer, the information can be downloaded, and a hard copy print-out showing the complete workout or testing heart rate graphically displayed and fully analyzed can be produced.

With the use of heart rate monitors it is relatively easy to determine if a student or class of students has exercised in the appropriate zone necessary to achieve a cardiovascular training effect. Fitness workouts are personalized through the use of heart rate technology. The student's own body tells him/her how hard to work.

Students vary in size, medical conditions, body fat percentages, fitness levels, and attention spans. Heart rate monitors are like personal fitness trainers that give immediate feedback to students. Everyone can benefit from working out with knowledge of his/her heart rate (Polar Electro Inc., 1997).

In order to know and to be able to calculate one's own heart rate, the subject can palpate the pulse at the carotid artery in the neck or on the radial artery on the wrist. Both manual methods obviously have drawbacks. Activity is interrupted while the pulse is taken, accuracy of the pulse is often difficult to count unless the subject is quite skilled in the procedure, complete concentration is necessary for the counting and most children, and youths and adults for that matter, have difficulty with the process. Since the activity is interrupted in order to manually count the pulse, there is a decrease in the intensity of the activity which decreases the heart rate that the subject is attempting to count. Heart rates during exercise and recovery from exercise are perhaps the single most important criteria in exercise prescription, whether the individual is in a cardiac rehabilitation program or training at the elite endurance level. Heart rate monitoring offers the most convenient index of exercise intensity, a key component in endurance training or in rehabilitation (Seward, Sleamaker, McAuliffe, & Clapp, 1990).

In 1988, Karvonen and Vuorimaa studied heart rate and exercise intensity during sports activities. Heart rate monitoring is probably the most widely used method for exercise prescription of healthy adults and athletes. The variations in heart rate correlate with the variations in exercise intensity. By recording the heart rate during a training session or a segment of training, and calculating the average of the heart rate and comparing this average to the maximum heart rate of the individual and at rest, the relative heart rate to the intensity of the workload (% HR max) can be calculated. These results are useful in planning optimal training intensities for both the healthy and rehabilitating athlete. Currently the heart rate measurements are almost the only common methods for estimation of the exercise intensity (Karvonen & Vuorimaa, 1998).

In 1988, Leger and Thivierge compared the validity of thirteen commercially available HRMs. They were assessed by simultaneously comparing ECG readings on the subjects. The results indicated excellent correlations between readings obtained by ECG and HRMs using conventional chest electrodes to measure electrical activity of the heart. It is important to note that this research showing the positive benefits of the HRM was one of the first. The Polar HRM was excellent in two of their categories; validity and stability. It was the first choice in functionality. Thus, the reason the Polar HRM was selected for this study.

In 1991 a study approved by the Institutional Review Board of the University of Texas at Galveston monitored the heart rates of three-, four-, and five-year-old children. In this study the daily heart rate patterns of a large sample of young Anglo-, African-, and Mexican-American children were reported. With the exception of the longest duration of heart rates sustained about 120 beats per minute during the morning hours, there were no ethnic or gender differences in the children's heart rate patterns. Heart rates did not vary significantly by day of the week or season of the year (Durant, et al, 1992). The above authors did another study with the HRM with children in 1992. The children were five to seven years old. There were 131 Anglo-, African-, and Mexican-American children monitored over twelve waking hours with an HRM. This article illustrated the reliability and variability of indicators of heart rate monitoring in children (Durant, et al, 1993).

Another study using preschoolers was conducted to test the "Validity and Social Acceptability of the Polar Vantage XL for Measuring Heart Rate in Preschoolers." There were 23 children between the ages of 3-5 years old recruited from three day-care centers in Hamilton, Ontario. The study compared the Polar XL readings of each child's activity against that of each child's ECG readings. The study did in fact prove the Polar Vantage XL to be a valid tool for assessing heart rate in children as young as 3 years old involved in various activities (Bar-Or, et al, 1996).

Based on adult standards a target heart rate of at least sixty percent of the maximum heart rate for a duration of thirty minutes is needed to promote cardiovascular fitness (Karvonen, Kentala, & Mustala, 1957). So, if these same standards can be applied to children the target heart rate would need to be at least 150 beats per minute. The present data provided evidence that the voluntary activity patterns of children studies may not be adequate, in terms of duration and intensity, to promote cardiovascular fitness (Gilliam, Freedson, Geenen, & Shahraray, 1981).

The validity of an HRM has been investigated during laboratory tests at the Johnson Space Center in Houston, Texas, and on the Space Shuttle. The work was supported by the National Aeronautics and Space Administration. The results of this study revealed that the HRM provided accurate HR data during work tests in the laboratory and on the Space Shuttle. The researchers' computations confirmed the consistencies between ECG and HRM HR readings. Given the accuracy of the results, the

HRM should provide a useful tool in the assessment of work activities. In conclusion, the HRM provided accurate information regarding the HR response to cycle exercise both on the ground and during space flight. It is currently being used to obtain data from the pre- and in-flight exercise sessions of astronauts participating in exercise investigations (Moore, Lee, Greenisen, & Bishop, 1997).

On November 7, 1998, Senator and astronaut John Glenn (77years old) and the six other crew in the "Discovery" splashed down to earth after nine days in orbit. Along with many other experiments that John Glenn performed was one of wearing a heart monitor. As part of a series of cardiovascular tests Glenn wore a Holter monitor that measured any irregularities in his heartbeat. He kept a log to see if changes in his heart rhythm correspond to certain activities. Older people tend to have more heart fluctuation; scientists want to see if these are worse in zero gravity (Bai, 1998).

The "Accuracy of Radio Telemetry Heart Rate Monitoring During Exercise" study in 1991 found that with regard to research the Polar Electro monitor can be useful in studies assessing habitual physical activity, especially those employing oxygen uptake-heart rate curves for individuals (Wajciechowski, et al, 1991).

The "Polar Vantage XL Heart Rate Monitor: An Analysis of its Internal Consistency and Computer Interface" study clearly showed that the device is very consistent. Monitors are receiving essentially the same data over 97% of the time, and the computer and monitor files are exact duplicates. This confirms that the hardware and software components of this module have been engineered to a very high standard (Carroll, Godsen, & Tangeman, 1991).

College females (18-25 years old) at the University of Delaware, Newark, volunteered to participate in a study of the "Accuracy of Self-Reported Heart Rate At Assessing Exercise Heart Rate During Aerobic Dance." The results indicated no significant difference between the self-HR count on the radial artery and the HRM for the 6-second pulse count; however, a significant difference did result in HR count on the radial artery and the HRM for the 10 and 15-second pulse counts. The Polar HRMs were used in the study, and it was concluded that the HRM can provide a significant degree of accuracy in recording all exercise intensity of an aerobic dance class (Bryant, et al, 1996).

In another study, "How Well Does the Polar Vantage XL Heart Rate Monitor Estimate Actual Heart Rate", the above same researchers concluded that the monitors give an excellent estimate of heart rate as compared to an ECG electrocardiogram. The researchers said:

> We conclude that these monitors give an excellent estimate of heart rate as they yielded exercise values which were within + or – 6 beats per minute about 95% of the time. The devices are quite susceptible to rapid changes in heart rate; however, most of the errors observed could be attributed to arrhythmias, anticipatory heart rate rises, and rapid adaptation to or recovery from exercise. Researchers must be alert to such events, and interpret their data accordingly (Godsen, Carrol, & Stone, 1991).

Best & Steinhardt studied the accuracy of children's counting of exercise heart rates. The children were 3rd, 4th, and 5th graders. They were from three elementary schools in Austin, TX. Each child wore a heart monitor to report their exercise heart rate, and they reported their own exercise heart rate for 5 and 10 seconds during the aerobic fitness portion of the class. Each child's reported values were then compared to the heart watch values. Conclusion: children in 5th grade can accurately count and report their heart rate during exercise. However, at one school all grades were accurate in the counting and reporting of exercise heart rate. Teacher effectiveness could have played a role at that school (Best & Steinhardt, 1991).

Since physical activity lessons provide a means by which children can regularly exercise for cardio-respiratory fitness, assessing exercise intensity during physical activity lessons would provide valuable information on the cardio-respiratory loads during the lessons. A study in heart rate telemetry of school children during physical activity was conducted by H. M. Al-Hazzaa in the city of Riyadh in Saudi-Arabia in 1992. There were 36 school boys from grades 2, 4, and 6 as subjects in the study. The findings of this study indicated that school boys are engaged in activity that raises heart rate above 160 beats per minute for only 28.4% of the time, or 11.4 minutes. If this is the only cardio-respiratory stimulus they get during the week, it would be less than enough for developing appropriate cardio-respiratory fitness. It is concluded from the findings of this study that, in general, the amount of time a student spends in activity that raises heart rate to above 160 beat per minute, is less than optimal. This intensity is believed to be necessary for enhancing cardio-respiratory fitness (Al-Hazzaa, 1992).

Physical fitness is, and always has been, the primary justification for physical education in our schools. Louis W. Sullivan, Secretary of Health and Human Services, appears to support this contention. He stated that physical education has three goals: (a) to produce physically fit youth, (b) to teach the relationship between physical activity, physical fitness, and health, and (c) to promote the skills, knowledge, and attributes to help children lead active, healthy, and productive lives as adults (Strand & Reeder, 1993).

Recently two studies examining fitness activities in physical education have been conducted. Lacy and LaMaster's 1990 study reported that junior high school students were involved in fitness activities for less than 5 minutes of their class periods, and McGing's 1989 survey revealed that high school physical education classes did not provide sufficient aerobic activity. It would seem that if American youth are not as fit as desired, researchers should investigate the level of intensity obtained during physical education activities (Strand & Reeder, 1993).

Thus, Brad Strand and Steve Reeder investigated "Using Heart Rate Monitors in Research of Fitness Levels of Children in Physical Education" at Mt. Logan Middle School, Logan, UT. Fifty-five middle school students aged 12 and 13 served as the subjects. The study was conducted throughout an entire school year, and included the sports of soccer, football, speedball, indoor football, dodgeball, basketball, swimming, volleyball, and wrestling. The Polar Vantage XL wireless heart rate monitors were worn during the class periods. Results from this study tend to support McGing's (1989) contention that most students receive insufficient aerobic activity in physical education classes; however, the results did indicate that in all nine activities the subjects were able to attain heart rate levels necessary to develop cardiovascular fitness. In eight of the nine activities (speedball was the exception) heart rate levels were below recommended training zones a majority of the class time. This study indicated that researchers interested in fitness achievements of school-age children will find that the use of HRM in research settings has great potential. It is hoped that field-based research with HRM begins a new field of study for physical education researchers (Strand & Reeder, (1993).

A study to assess the merit of whole-day heart rate monitoring as a quantitative measure of children's unrestricted physical activity was conducted in 1992 in the public schools in Muscatine, Iowa. The Muscatine Study, as it is called, found that in regard to heart rate monitoring between total activity and aerobic activity indicated that the children who were generally active were the same children involved in intense physical activity. With regard to levels of physical activity children, especially more mature children, were engaged primarily in low intensity or sedentary activities even when not restricted by school activities or winter weather. Only 5 of the 76 children monitored engaged in activity for a duration of 20 or more continuous minutes (Janz, 1992).

Their conclusion was that children are for the most part inactive. In contrast, studies which found high levels of physical activity in children and adolescents are almost exclusively European studies. With regard to physical activity and gender, they found no gender-related activity differences in school-aged children (Janz, 1992).

An increase in the activity level of girls, found in this study, could be due in part to the findings in *The Wilson Report: Moms, Dads, Daughters and Sports June 7, 1988* .

- Eighty-seven percent 87% of today's moms and dads generally accept the idea that sports are equally important for boys and girls. Parents show very little concern that sports may be "unladylike," and nearly all agree (97%) that sports and fitness activities provide important benefits to girls who participate.
- Eight out of ten girls (82%) currently participate in sports and fitness activities, and 89% plan to make sports a part of their adult lives.
- Eighty seven percent (87%) of 7-10 year old girls and 84% of 11-14 year old girls are involved in sports, but this number drops to 75% of 15-18 year olds.
- Parents' own behavior influences their daughter's, since parents who play tend to have daughters who play-70% of daughters who currently participate have parents who also engage in sports or fitness activities.
- Black and white girls are equally likely to be involved in sports and for the same reasons.
- Eighty-two (82%) of girls are currently involved in some form of sports or fitness activity and the vast majority find it a pleasurable and beneficial experience (Women's Sports Foundation, 1988).

The Muscatine Study showed that with regard to physical activity and cardiorespiratory fitness, gender differences in peak VO2 values did exist; males had higher mean peak VO2 values than females. And, in regard to physical activity, age, and maturation, puberty may be the transitional period from an active to an inactive way of life. For example, the study found that prepubescent children spent approximately 26 minutes of daily aerobic activity whereas pubescent and post pubescent children spent only 7 minutes. If a carryover of activity patterns does exist from the developmental years to adulthood, the level of activity for the adolescents within this study indicated that low levels of activity can be expected during their adult years. This trend should be of concern because a sedentary adult lifestyle clearly has been associated with all-cause mortality and particularly with death as a result of coronary artery disease (Janz, 1992).

The above mentioned activity patterns did exist in the Allied Dunbar National Fitness Survey which was conducted in England in 1990. The carryover of activity pattern did exist for men and women alike (Allied Dunbar, 1992).

A study of peak oxygen uptake and physical activity in 11-to 16-year-olds was conducted by Neil Armstrong in 1990. In the study, 111 girls and 85 boys wore heart monitors. No significant relationship was detected between peak VO2 and heart rate indicators of habitual physical activity. This study suggested that few children have periods of physical activity of sufficient intensity and duration to stress the cardiopulmonary system. Increases in cardiopulmonary fitness are therefore unlikely to be stimulated through habitual physical activity, and structured exercise training programs are necessary for the improvement of peak VO2 (Armstrong, et al, 1990).

An article in Young Children (September, 1996) is most revealing and should be of extreme concern to physical educators. Whereas most people think that young children are constantly on the move and have boundless energy, actual research data indicated the opposite (Werner, Timms, & Almond, 1996). Data such as this is particularly alarming in view of the fact that only two percent of adults who were inactive as children become active as adults, according to the national fitness survey conducted in England (Allied Dunbar, 1992).

Cardiovascular disease is the number one killer in America. Lack of exercise is considered to be one of the major risk factors for heart disease. Research showed that there is a 90% failure rate for appropriate exercise throughout the adult years if during the teenage years and before, students failed to engage in appropriate exercise (Polar Electro Inc., 1997).

Appendix N reveals the highest heart-disease mortality states and the lowest heart-disease mortality states from the Center of Disease Control.

Much of the rate variation between states is easily explained, according to Julie Buring, Sc.D., an epidemiologist and medical researcher at Harvard Medical School and Brigham and Women's Hospital, in Boston. Consider age: Nearly one quarter of Florida residents are sixty or older, whereas in Alaska only 6.34 percent of the population is sixty-plus.

According to the Center for Disease Control the top mortality states have a higher-than-average percentage of overweight people (in Missouri and West Virginia, more than 30 percent of adults are very overweight) or a lower-than-average ranking for exercising. About a third or more of the citizens of New York, Missouri, Arkansas, Oklahoma and West Virginia are completely inactive or both.

In contrast, people living in the low-mortality states are thinner (Colorado, Hawaii and New Mexico are among the nation's slimmest) and more active (only about one fifth of residents are couch potatoes). Age, weight and inactivity all contribute to heart disease (Amodio, 1998).

Recent research in the United States and other international studies provide evidence that coronary heart disease may have its origins in childhood, indicating that heart disease can begin at a young age. Early on, many children may already possess one or more clinical risk factors, such as hypertension, obesity, or adverse lipoproteins. While genetic factors, such as gender and race, cannot be altered, it is believed that educating children and parents about the factors that can be controlled, such as diet and exercise, may be an important step in producing health benefits for a lifetime.

The Bogalusa Heart Study, celebrating its 20th anniversary in 1994, is a long-term epidemiologic study centered in a rural community in Louisiana, which for the past 20 years has investigated the critical questions of the early natural history of atherosclerotic heart disease and hypertension in our society. This study has clearly demonstrated that atherosclerosis begins very early in childhood, and that the degree of atherosclerosis in these young children is correlated with identifiable risk factors, as such as blood lipid concentrations. It is remarkable that in a time when it is first becoming widely recognized that studies of cardiovascular disease must include analyses of sex and racial differences, that the Bogalusa Heart Study has focused on sex and racial differences in the origins of cardiovascular disease for over 20 years. The Bogalusa Heart Study represents research on a well-defined biracial (black-white) population. It has been a unique opportunity to conduct a long-term epidemiologic study of infants, children, adolescents, and young adults destined to develop heart disease (SSCI, 1995).

The value of a long-term epidemiologic study increases as it continues because it can demonstrate both secular trends occurring in the community and provide longitudinal data surrounding the evolution of cardiovascular disease. The emergence of clinical morbidity in young adults reinforces the importance of studying risk factors at an earlier age. The development of abnormal levels of serum lipids and lipoproteins, elevated blood-pressure, and the onset of diabetes mellitus are evident links to the adult epidemiologic studies, such as Framingham. These observations, supported by autopsy studies and other anatomic findings, confirm that target organ changes have already begun in childhood as part of the early onset of adult cardiovascular disease (SSCI, 1995).

The Bogalusa Heart Study documents adverse life-styles, including poor eating behavior, early onset of smoking, and increasing obesity, providing direction to develop models of prevention. Intervention for high-risk individuals through family health promotion and a public health or population program through health education of school children are beginning to show promise for changing the natural course of premature heart disease (SSCI, 1995).

In the article, "The Benefits of Physical Activity in Childhood" taken from the Bogaluas Heart Study, David W. Harsha, PhD. stated:

> Current studies indicate that today's children are probably less fit than children 20 years ago. Children are heavier and tend to be more overweight and sedentary than earlier. The relationships between fitness and cardiovascular risk factors in children are very similar to those in adults. Because cardiovascular risk factors, including obesity, tend to track from childhood to adulthood, programs to increase

regular physical activity in youths hold promise in reducing adult cardiovascular disease. Positive long-term lifestyle changes need to be established early (Harsha, 1995).

The habitual physical activity of adults is well documented. The literature concerned with children's physical activity patterns is currently being researched at an ever-expanding rate. This is due in part to the Surgeon General's Report on the state of the health and activity of the American people as well as other international research concerning the state of the health and activity of the citizens of other countries.

International Fitness

In a study conducted by Neil Armstrong in 1989, "The Physical Activity Patterns of 10 and 13 year old Children," were monitored for three days, using a heart monitor. This British study included 97 secondary schoolchildren and 40 primary schoolchildren. The results showed that the secondary boys spent a significantly greater percentage of their time with their heart rates above 139 beats per min. than the secondary girls. There was no significant difference between the percentage of time the primary boys and girls spent with heart rates above 139 beats per min. but the primary boys and girls spent a significantly higher percentage of their time with heart rates above 139 beats per min. than their secondary school counterparts.

Conclusion of the study: in the light of the United Kingdom's unenviable record of deaths from cardiovascular heart disease, the current level and pattern of British children's habitual physical activity is a cause for grave concern. Physical educators at all levels of education must collaborate in partnership with the community and the home to meet this challenge. The future health of our children depends upon it (Armstrong, et al, 1990).

In a study designed to test the feasibility of collecting coronary risk factor data from British children, 107 children were studied. The results from the children in the study indicated that the British children had a relatively high serum cholesterol level and they exhibited low levels of physical activity. Fourteen percent of the children were classified as 'overweight' (Armstrong, et al, 1990).

In another British study, the patterns of physical activity among 266 children (163 girls, 103 boys) ages 11 to 16 years old were examined. The objective was to assess whether the children experience the intensity and duration of physical activity that are believed to stress the cardiopulmonary system appropriately. In conclusion, the British children have surprisingly low levels of habitual physical activity, and many children seldom experience the intensity and duration of physical activity that are believed to stress the cardiopulmonary system appropriately (Armstrong, et al, 1990).

Besides the concern for the health of children and persons in England, there is the same concern in Australia. Too few people exercise regularly and many are overweight or obese (Australian Medical Association, 1995).

Japan is experiencing a new prevalence of diseases. Reduced physical activity, a diet with increased fat rich foods, and heightened psycho-social stress have made age-related diseases the leading causes of death, replacing infectious diseases. Since 1980, cardiovascular diseases, which are the second highest cause of death in Japan, mainly include coronary artery disease, heart failure, valvular heart disease, and rheumatic heart disease. The number of those suffering from hypercholesterolemia, obesity, diabetes or physical inactivity has also been increasing. These conditions are well-known predictors of cardiovascular diseases. On the other hand, because the awareness of health development has risen various kinds of sport activity have been encouraged. The exercise most recommended for the purpose of health benefits are aerobic which promote cardiovascular fitness (Fujieda, et al, 1992).

The Singapore Youth Coronary Risk and Physical Activity Study examined coronary risk factors and physical activity patterns of primary and secondary school children in Singapore. The study included 730 boys and 849 girls, ages 6-18. Results indicated physical activity was significantly correlated with total cholesterol and triglycerides for boys and between physical activity with body fat and body mass index (BMI) for girls. Height, weight, BMI, percent body fat, and blood pressure were greater for each age to 14 yr. after which there was less recorded body fat for boys. Girls' body fat remained about the same after 14 yr. Comparing by gender and age significant differences were found between physical activity groups and total cholesterol and body fat. Although few children were at risk for heart disease, this study provided baseline coronary risk and physical activity data for further longitudinal analysis in the population (Schmidt, Walkuski, & Stensel, 1998).

In China, the "Fitness For All Program"(FAP) is an important national policy initiative for the promotion of physical fitness for China. The program was issued in June 1995 to focus on promoting physical fitness for the Chinese population. The program underscores the importance of improving the health status of all Chinese people, especially children and adolescents, in order to respond effectively to the health challenges of the 21st century. It is intended to make significant positive changes in the lives and exercise habits of the average Chinese. As a means of establishing a database of current fitness practices and attitudes, the authors conducted a survey of 724 (393 male, 331 female) residents of Jiangsu Province, China. Only 39% of those surveyed exercised regularly, and there was no significant difference between men and women. The main reasons expressed that kept both men and women from exercising were: no time, lack of access of sports facilities, and not belonging to a sports organization. The major obstacles to implement this policy are the lack of importance placed on fitness in modern life, limitations on the usage of sports facilities, and lack of knowledge of scientific exercise methods. Only if the people themselves realize the importance of fitness will they actively participate in fitness programs. Then they will develop and choose suitable scientific, safe, and effective exercise methods for themselves, in order to achieve the national health and improvement goals of the "Fitness For All Program" (Yang, et al, 1998).

The Allied Dunbar National Fitness Survey (England) is one the most significant pieces of research undertaken in the broad fields of physical activity and fitness. The results heighten concern about the low levels of activity and fitness among certain sections of the population, but also provides a measure of optimism that at least among the younger generation there is a greater awareness of the value of physical activity which in years to come may be carried forward. The inescapable conclusion to be drawn from the Survey is that the population of England needs to engage in more physical activity (Allied Dunbar, 1992).

The Survey focused on the adult population aged 16 years and over in England. It was spread across 30 parliamentary constituencies covering all 14 Health Regions. A structured interview about physical activity, health and lifestyle was undertaken in people's homes by interviewers. The goal was 6,000 interviews while 4,316 interviews were actually achieved. Physical appraisal to measure people's fitness was undertaken by specially recruited and trained teams working in mobile laboratories in the 30 selected areas. This survey was conducted February to November of 1990. The results showed that activity levels are less than optimal in many adolescents, particularly girls. This is clear from the differences in aerobic capacity found between active and inactive children and the low levels of activity reported in studies of secondary school children. The time spent on physical activity further diminishes when children leave school. Children who have not established a routine of regular activity are likely to settle for inactivity in adulthood which will bring with it health hazards (Allied Dunbar, 1992).

Other results from the study showed the although most men and women occasionally undertook activities that had energy costs defined as moderate or vigorous, very few did so at a frequency and with a regularity that was likely to confer benefit. It also showed that there was a definite decline in activity with increasing age. If people are not involved in activity by or in their teenage years only 2% of adults become active (Allied Dunbar, 1992). This should be an alarming fact.

The activity results of the Survey sample are similar to findings of studies carried out in other developed countries. In a presentation to the International Conference on Physical Activity, Fitness and Health, Toronto, May 1992, a paper entitled 'The Demography of Physical Activity', concluded: 'Recent surveys in Australia, Canada, Finland and the United States indicated that only about 10% of adults engage in genuinely vigorous activities at least three time weekly for 20 minutes or more at a time. Another third are active at a lower level-practicing leisure-time activities that are less vigorous or less frequent, while a third are sedentary in their leisure-time activity (Allied Dunbar, 1992).

The data in Appendix O was given at the 1992 International Conference held in Toronto. The English figures have been added at the foot of the table. An important point to note, not included in the list, is that unlike the other surveys the data from the English Survey were not confined to leisure time activity (Allied Dunbar, 1992).

Consistent activity patterns, over time, was another interesting result of the Allied Dunbar Survey. The more active a person was in early life, the more frequently they continued with or returned to sport and active recreation later. Another influence on lifetime participation is the extent to which people can engage in activities for which the intensity level relative to their own capacity can be reduced as they get older, rather than stop and find a lower energy cost alternative. Participation in sport and recreation declined as age increased; the drop out rate was high soon after people left school when many faced the competing pressures of work, moving and running a home, or marriage and raising a family (Allied Dunbar, 1992).

Three conclusions of the Allied Dunbar Survey that are appropriate for this study are:

- Activity Levels-Only 14% of men and 4% of women were 'vigorously' active three times a week for at least 20 minutes on each occasion, commonly accepted as the level that provides maximum protection against the risks of coronary heart disease. (this combined 18% of men and women consisted of 777 of the 4,316 participants in the Survey). The levels of physical activity declined with increasing age from both men and women (Allied Dunbar, 1992).
- Fitness levels-Aerobic fitness levels were low (Allied Dunbar, 1992).
- Overweight and obesity-The survey results showed increasing numbers of overweight men and women (Allied Dunbar, 1992).

At an ACSM news briefing in 1994, leading researchers—including Dr. Pate, president of ACSM, and Dr. Blair, epidemiologist for the Cooper Institute for Aerobics Research—made a clear link between exercise and coronary heart disease. According to Dr. Blair, "A sedentary lifestyle is as much of a risk factor for disease as high blood pressure, obesity, and smoking" (Blair, 1992). Dr. Pate added that, "scientific evidence shows that even moderate physical activity can produce substantial health benefits." Others noted that schools are the most likely place to change physical activity patterns, and physical education curricula should provide movement experiences that are enjoyable, provide significant amounts of physical activity and promote lifelong participation in physical activity.

The message is clear. As physical educators we must more carefully examine the role of exercise in the lives of children and the role of exercise frequency, intensity and duration must be elevated. Establishing early patterns of healthy lifestyles is important to enhancing physical and psychological well-being for a lifetime. And sadly, as the international and United States studies have indicated, the minority of the citizens are fit.

In conclusion, the use of the HRM for accurately assessing and evaluating exercise intensity looks promising. Additional longitudinal research is necessary to further substantiate these early studies and to track youth into adulthood. Since physical inactivity is a risk factor for cardiovascular disease in adults, and since physical activity behaviors may track from adolescence into adulthood, it is desirable to explore the relationship between physical activity and aerobic fitness in children, youth, and adolescents (Morrow & Freedson, 1994).

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to examine the accuracy of the palpate method—using the fingers for monitoring the heart rate as compared to the accuracy of the heart rate monitor—using the chest strap and the watch for monitoring the heart rate.

Subjects

The subjects of this study were sixty seventh grade females who were volunteers. They attended Simmons Middle School in Birmingham, Alabama. Simmons Middle School was selected as it had an adequate supply of Polar Heart Rate Monitors, however, Polar Electro, Inc., supplied fifteen more monitors for the study.

The subjects participated in 50 minutes of daily physical education activity, the school was fitness oriented (high intensity activities were offered) and it emphasized the health-related aspects of fitness. Lastly, it was selected as there were no such schools of this description in Oklahoma. The high intensity activities used in this study were part of the existing physical education curriculum for the fall of 1998.

The coordinator and physical education teacher, Carol Chesnutt, suggested that the seventh grade girls participate in the study due to their enthusiasm and energy for activity. Secondly, the seventh graders were selected as they had not ever used the palpate method or the heart monitor in a physical education class. Carol Chesnutt and the four other physical education teachers involved in the study collected and kept the data.

Each of the sixty subjects recorded her own data twice a week on Tuesdays and Thursdays.

The subjects' parents had access to the information on demand.

The sample size was representative of most junior high seventh grade girls.

The sixty subjects were randomly selected from a homogenous group of subjects.

The subjects participated in a variety of high intensity activities such as: cardiovascular conditioning exercises and games, aerobic dancing, basketball, jogging, rope jumping, volleyball, track events, brisk walking (3-5 mph), and the mile run.

Procedure

All subjects wore the chest strap and watch to record their pulse from the heart rate monitor and palpated their own pulse. The six-second pulse count was used to record the pulse after rest, five, ten, and fifteen minutes of activity. The heart rate monitors were operational; however, they were periodically checked to make sure they were in proper working order by the teachers aide. The subjects received the same instructions concerning the use and function of the heart monitor from their respective teachers. The subjects' heart rates were compared using both the heart rate monitor and the palpate method.

The data collection occurred over a nine-week period and was recorded twice a week on Tuesdays and Thursdays. The five physical education teachers supervised, collected, and kept the data of each individual subject's heart rate, from the heart rate monitor and the palpate method. The information was kept in a safe place at the school in the normal fashion for research.

Parents signed a consent form to enable the subjects to participate in the study. The sixty subjects remained anonymous as the interest is only in the aggregate data. For nine weeks the subjects participated in the same type high intensity aerobic fitness activities even though the subjects were divided among five teachers. All teachers treated the subjects the same in regard to the amount and intensity of the activity. The subjects attempted to work within their target heart rate zone in each high intensity activity for a sustained 20 minutes (as often as possible due to periodic school constraints).

The researcher visited Simmons Middle School five times for the purpose of observing the study. During the first visit, introductions were made and an explanation of the study and how the heart rate monitors work was accomplished. During the second visit the subjects participated in dance. During the third visit, the subjects were engaged in volleyball. During the fourth visit, the subjects were doing track runs. During the fifth visit the subjects were completing the track unit.

The Oklahoma State University Institutional Review Board approved the study.

Instruments

Heart Rate Monitor Method: the Polar Heart Rate Monitor (Polar Electro Inc., 1997) uses a wireless transmitter that is encased in a waterproof chest strap that houses two electrodes. The heart rate is accurately transmitted to a watch-like heart rate monitor that continuously displays the heart rate throughout the time that the individual is wearing the chest strap.

Palpate Method: the subject can palpate the pulse using the fingers at the carotid artery in the neck or on the radial artery in the wrist.

Design

The design selected for this study is a correlation design and it will test the hypotheses—there will be no significant difference in the measurement of heart rates between the palpate method and the heart monitor.

Analysis of Data

The analysis of the data has been completed by the researcher. Using the statistical program described in the Statistical Package for the Social Sciences (SPSS), the data were subjected to t-tests for paired samples and the correlation design.

A correlation study is feasible for this type of research as the study allowed the researcher to focus on two variables (heart rate monitor and the palpate method) for measuring the heart rate involving one group of subjects after the study was completed. The scores for both measurements; heart monitor and palpate method were put into a data matrix, calculated, summarized, and the relationship between the two measures were evaluated. The researcher was involved only after the subjects had completed the nine-week study.

The relationships between the scores on both measures were arranged in a joint distribution, meaning they were a bivariate distribution. The scatter grams are in Appendix P.

The correlation study involved the measurements of the mean, the standard deviation, the standard error of the mean, and the correlation coefficient.

CHAPTER IV

RESULTS AND DISCUSSION

A total of 46 female seventh grade subjects from Simmons Middle School, Birmingham, Alabama, participated in this study to determine the accuracy of the palpate method as compared to the heart monitor. The subjects were divided among five physical education teachers. Sixty subjects were originally included in the study. Seven subjects moved away from the school, three dropped out of the study, and four subjects suffered injuries that required termination from the study.

Descriptive Data

The 46 subjects were seventh grade females. The correlation, mean, standard deviation, and standard error of the mean are shown in Tables I – IV by t-tests for paired samples.

Results

There were eighteen days of data collection in this study. Each day, a subject collected data (heart rate) eight different times, four by the palpate method and four by the PHRM method. This data collected was at "resting", "five minutes", "ten minutes", and "fifteen minutes" of physical activity using the six-second count. That data was then put in pairs. Each subject had four observations of paired data. This paired data is shown in Appendix P in 72 different scatter grams (eighteen days of four paired observations).

After the eighteenth day of collecting data, the following statistics for the paired data were computed using SPSS. For each day a correlation coefficient was computed. Also, for each day a mean difference in the palpate heart rate and the PHRM heart rate was computed for "resting", "five minutes", "ten minutes", and "fifteen minutes".

A sample t statistic for paired data was computed for each difference. Both of these computed statistics summaries are shown in Tables V and VI.

In Table V, every correlation coefficient computed was statistically significant at the 0.01 level of significance. The smallest correlation was on day one at the "five-minute" time. It was r = 0.480. All but four correlations (that is 95.5%) were greater than 0.650. The greatest correlation was on day fifteen at the "resting" time (r = 0.976).

Table VI, shows that in only 7 of 72 observations (or less than 10% of the time) was the mean difference of the two heart rate measurements statistically significant at the 0.05 level of significance (day seven and day fifteen, resting; day two and day three at five minutes; and day three, day six, and day seven at fifteen minutes). There was no statistical difference at the 0.05 level of significance in the collection of data by the palpate method and the PHRM method at least 90% of the time (65 of 72 observations).

In addition to these two summary tables, the summary statistics for each day, one through eighteen and each time, "resting", "five minutes", "ten minutes", and "fifteen minutes" are also included in this results section. The mean and standard deviation of both methods are shown along with the statistics shown in Tables V and VI. To assist the reader, Tables I – VI follow with its separate face page.

Discussion

The purpose of this study was to examine the accuracy of the palpate method when compared to the PHRM method of obtaining a heart rate. Using both the correlation coefficients and the t-test for mean differences in paired data, the palpate method was shown to be as accurate as the PHRM method. There was statistically significant correlation of the two variables, and at least 90% of the time there was not statistically significant differences in the means of the two variables.

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t-tests for Paired Samples

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST01 Palpate Resting Day 1				94.1707	14.212	2.220
	41	.729	.000			
WREST01 Watch Rest Day 1				94.8780	14.079	2.199

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-.7073	10.424	1.628	-.43	40	.666
95% CI (-3.998, 2.583)					

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST02 palpate resting day 02				95.2632	17.429	2.827
	38	.549	.000			
WREST02 watch resting day 02				94.7632	16.599	2.693

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
.5000	16.173	2.624	.19	37	.850
95% CI (-4.816, 5.816)					

Variable	Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST03 palpate resting day 3				95.8649	14.144	2.325
	37	.656	.000			
WREST03 watch resting day 03				96.1622	14.953	2.458

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-.2973	12.087	1.987	-.15	36	.882
95% CI (-4.327, 3.733)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST04	palpate resting day 4				97.8333	14.105	2.351
		36	.887	.000			
WREST04	watch resting day 4				99.0278	11.953	1.992

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.1944	6.528	1.088	-1.10	35	.280
95% CI (-3.403, 1.014)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST05	palpate resting day 5				97.2703	15.707	2.582
		37	.837	.000			
WREST05	watch resting day 5				98.9189	18.724	3.078

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.6486	10.245	1.684	-.98	36	.334
95% CI (-5.064, 1.767)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST06	palpate resting day 6				94.6486	20.784	3.417
		37	.880	.000			
WREST06	watch resting day 6				97.4595	18.931	3.112

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.8108	9.885	1.625	-1.73	36	.092
95% CI (-6.107, .485)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST07	palpate resting day 7				96.2973	15.590	2.563
		37	.858	.000			
WREST07	watch resting day 7				99.3243	15.556	2.557

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-3.0270	8.295	1.364	-2.22	36	.033
95% CI (-5.793, -.261)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST08	palpate resting day 8				99.6316	18.321	2.972
		38	.646	.000			
WREST08	watch resting day 8				99.8947	17.785	2.885

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-.2632	15.192	2.464	-.11	37	.916
95% CI (-5.257, 4.730)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST09	palpate resting day 9				95.8500	17.317	2.738
		40	.907	.000			
WREST09	watch resting day 9				98.0500	18.102	2.862

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.2000	7.673	1.213	-1.81	39	.077
95% CI (-4.654, .254)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST10	palpate resting day 10				95.5789	16.940	2.748
		38	.940	.000			
WREST10	watch resting day 10				96.7368	16.668	2.704

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.1579	5.833	.946	-1.22	37	.229
95% CI (-3.075, .759)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST11	palpate resting day11				94.5122	20.757	3.242
		41	.865	.000			
WREST11	watch resting day11				97.1707	22.328	3.487

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.6585	11.315	1.767	-1.50	40	.140
95% CI (-6.230, .913)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST12	palpate resting day 12				95.2821	16.106	2.579
		39	.827	.000			
WREST12	watch resting day 12				96.2821	17.288	2.768

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.0000	9.881	1.582	-.63	38	.531
95% CI (-4.203, 2.203)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST13	palpate resting day 13				99.2250	22.713	3.591
		40	.749	.000			
WREST13	watch resting day 13				102.0500	25.572	4.043

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.8250	17.314	2.738	-1.03	39	.308
95% CI (-8.362, 2.712)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST14	palpate resting day 14				94.3750	18.031	2.851
		40	.927	.000			
WREST14	watch resting day 14				96.0750	17.467	2.762

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.7000	6.798	1.075	-1.58	39	.122
95% CI (-3.874, .474)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST15	palpate resting day 15				94.1892	20.553	3.379
		37	.976	.000			
WREST15	watch resting day 15				95.8919	20.735	3.409

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.7027	4.545	.747	-2.28	36	.029
95% CI (-3.218, -.187)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST16	palpate resting 16				97.9487	15.441	2.473
		39	.891	.000			
WREST16	watch resting day 16				99.0513	17.209	2.756

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.1026	7.830	1.254	-.88	38	.385
95% CI (-3.641, 1.436)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST17	palpate resting day 17				97.5128	25.029	4.008
		39	.953	.000			
WREST17	watch resting day 17				98.5385	25.372	4.063

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.0256	7.720	1.236	-.83	38	.412
95% CI (-3.528, 1.477)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PREST18	palpate resting day 18				100.5854	23.456	3.663
		41	.915	.000			
WREST18	watch resting day 18				102.6829	22.567	3.524

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.0976	9.523	1.487	-1.41	40	.166
95% CI (-5.103, .908)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE01	Palpate Five Day 1				124.0000	19.310	2.879
		45	.480	.001			
WFIVE01	Watch Rest Day 1				125.9556	23.522	3.506

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.9556	22.132	3.299	-.59	44	.556
95% CI (-8.605, 4.694)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE02	palpate five 02				130.5778	31.954	4.763
		45	.703	.000			
WFIVE02	watch five day 02				138.0222	24.541	3.658

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-7.4444	22.832	3.404	-2.19	44	.034
95% CI (-14.304, -.585)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE03	palpate five day 3				130.5000	23.698	3.494
		46	.670	.000			
WFIVE03	watch five day 3				141.6957	21.893	3.228

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-11.1957	18.592	2.741	-4.08	45	.000
95% CI (-16.717, -5.674)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE04	palpate five day 4				138.8478	25.278	3.727
		46	.722	.000			
WFIVE04	watch five day 4				140.2391	20.670	3.048

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.3913	17.648	2.602	-.53	45	.595
95% CI (-6.632, 3.849)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE05	palpate five day 5				142.8913	27.624	4.073
		46	.601	.000			
WFIVE05	watch five day 5				142.4565	26.366	3.888

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
.4348	24.156	3.562	.12	45	.903
95% CI (-6.739, 7.608)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE06	palpate five day 6				138.0652	28.471	4.198
		46	.806	.000			
WFIVE06	watch five day 6				134.7826	24.125	3.557

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
3.2826	16.874	2.488	1.32	45	.194
95% CI (-1.728, 8.294)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE07	palpate five day 7				137.5870	24.449	3.605
		46	.843	.000			
WFIVE07	watch five day 7				136.6957	24.090	3.552

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
.8913	13.591	2.004	.44	45	.659
95% CI (-3.145, 4.927)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE08	palpate five day 8				140.4565	27.819	4.102
		46	.848	.000			
WFIVE08	watch five day 8				139.2826	23.375	3.446

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.1739	14.728	2.171	.54	45	.591
95% CI (-3.200, 5.547)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE09	palpate five day 9				134.5556	21.652	3.228
		45	.501	.000			
WFIVE09	watch five day 9				136.7556	25.072	3.737

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.2000	23.537	3.509	-.63	44	.534
95% CI (-9.271, 4.871)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE10	palpate five day 10				132.9783	28.638	4.222
		46	.795	.000			
WFIVE10	watch five day 10				135.2391	28.124	4.147

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.2609	18.164	2.678	-.84	45	.403
95% CI (-7.655, 3.133)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE11	palpate five day 11				149.3043	28.597	4.216
		46	.906	.000			
WFIVE11	watch five day 11				147.5435	29.970	4.419

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.7609	12.751	1.880	.94	45	.354
95% CI (-2.026, 5.547)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE12	palpate five day 12				151.1818	27.419	4.134
		44	.884	.000			
WFIVE12	watch five day 12				151.5909	26.600	4.010

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-.4091	13.060	1.969	-.21	43	.836
95% CI (-4.380, 3.562)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE13	palpate five day 13				148.0667	24.410	3.639
		45	.729	.000			
WFIVE13	watch five day 13				151.4000	26.162	3.900

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-3.3333	18.696	2.787	-1.20	44	.238
95% CI (-8.950, 2.284)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE14	palpate five day 14				150.5909	29.142	4.393
		44	.952	.000			
WFIVE14	watch five day 14				152.0909	27.508	4.147

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.5000	8.896	1.341	-1.12	43	.270
95% CI (-4.205, 1.205)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE15	palpate five day 15				150.4667	30.961	4.615
		45	.908	.000			
WFIVE15	watch five day 15				152.9556	30.953	4.614

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.4889	13.295	1.982	-1.26	44	.216
95% CI (-6.483, 1.505)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE16	palpate five day 16				147.2826	30.859	4.550
		46	.798	.000			
WFIVE16	watch five day 16				152.8261	27.923	4.117

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-5.5435	18.886	2.785	-1.99	45	.053
95% CI (-11.152, .065)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE17	palpate five day 17				142.4348	27.479	4.052
		46	.790	.000			
WFIVE17	watch five day 17				141.3043	27.941	4.120

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.1304	17.969	2.649	.43	45	.672
95% CI (-4.206, 6.466)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIVE18	palpate five day 18				143.1304	26.471	3.903
		46	.771	.000			
WFIVE18	watch five day 18				140.6957	27.818	4.101

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
2.4348	18.413	2.715	.90	45	.375
95% CI (-3.033, 7.903)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN01	Palpate Ten Day 1				139.3261	25.661	3.784
		46	.627	.000			
WTEN01	Watch Ten Day 1				143.9130	23.987	3.537

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-4.5870	21.497	3.170	-1.45	45	.155
95% CI (-10.971, 1.797)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN02	palpate ten day 02				130.1739	29.619	4.367
		46	.638	.000			
WTEN02	watch ten day 02				134.8913	25.182	3.713

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-4.7174	23.663	3.489	-1.35	45	.183
95% CI (-11.744, 2.310)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN03	palpate ten day 3				143.9348	24.589	3.626
		46	.820	.000			
WTEN03	watch ten day 3				143.9783	23.742	3.501

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-.0435	14.519	2.141	-.02	45	.984
95% CI (-4.355, 4.268)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN04	palpate ten day 4				146.1087	24.513	3.614
		46	.784	.000			
WTEN04	watch ten day 4				145.1087	22.862	3.371

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.0000	15.646	2.307	.43	45	.667
95% CI (-3.646, 5.646)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN05	palpate ten day 5				144.1739	26.299	3.878
		46	.805	.000			
WTEN05	watch ten day 5				146.0870	24.729	3.646

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.9130	16.009	2.360	-.81	45	.422
95% CI (-6.667, 2.841)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN06	palpate ten day 6				145.5870	23.896	3.523
		46	.647	.000			
WTEN06	watch ten day 6				139.9783	21.271	3.136

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
5.6087	19.117	2.819	1.99	45	.053
95% CI (-.068, 11.286)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN07	palpate ten day 7				147.8222	22.477	3.351
		45	.894	.000			
WTEN07	watch ten day 7				147.2889	20.932	3.120

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
.5333	10.114	1.508	.35	44	.725
95% CI (-2.505, 3.572)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN08	palpate ten day 8				144.1522	21.532	3.175
		46	.855	.000			
WTEN08	watch ten day 8				146.2826	18.730	2.762

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.1304	11.159	1.645	-1.29	45	.202
95% CI (-5.444, 1.183)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN09	palpate ten day 9				140.0870	24.345	3.589
		46	.739	.000			
WTEN09	watch ten day 9				142.0217	24.647	3.634

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.9348	17.714	2.612	-.74	45	.463
95% CI (-7.195, 3.326)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN10	palpate ten day 10				146.1111	22.920	3.417
		45	.639	.000			
WTEN10	watch ten day 10				147.5778	22.679	3.381

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.4667	19.370	2.888	-.51	44	.614
95% CI (-7.286, 4.353)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN11	palpate ten day 11				158.2609	25.402	3.745
		46	.775	.000			
WTEN11	watch ten day 11				157.4348	24.693	3.641

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
.8261	16.813	2.479	.33	45	.741
95% CI (-4.167, 5.819)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN12	palpate ten day 12				165.9091	18.209	2.745
		44	.724	.000			
WTEN12	watch ten day 12				164.2727	20.046	3.022

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.6364	14.320	2.159	.76	43	.453
95% CI (-2.717, 5.990)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN13	palpate ten day 13				157.1739	28.616	4.219
		46	.806	.000			
WTEN13	watch ten day 13				155.4130	28.242	4.164

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.7609	17.693	2.609	.68	45	.503
95% CI (-3.493, 7.015)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN14	palpate ten day 14				156.4773	21.390	3.225
		44	.804	.000			
WTEN14	watch ten day 14				153.2727	24.671	3.719

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
3.2045	14.739	2.222	1.44	43	.156
95% CI (-1.277, 7.686)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN15	palpate ten day 15				150.2222	24.366	3.632
		45	.838	.000			
WTEN15	watch ten day 15				154.4222	24.651	3.675

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-4.2000	13.962	2.081	-2.02	44	.050
95% CI (-8.395, -.005)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN16	palpate ten day 16				155.8696	25.056	3.694
		46	.874	.000			
WTEN16	watch ten day 16				155.3913	28.437	4.193

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
.4783	13.806	2.036	.23	45	.815
95% CI (-3.622, 4.578)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN17	palpate ten day 17				149.2609	25.031	3.691
		46	.895	.000			
WTEN17	watch ten day 17				150.3913	22.859	3.370

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.1304	11.177	1.648	-.69	45	.496
95% CI (-4.449, 2.189)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PTEN18	palpate ten day 18				149.0652	23.187	3.419
		46	.859	.000			
WTEN18	watch ten day 18				151.1522	20.088	2.962

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.0870	11.862	1.749	-1.19	45	.239
95% CI (-5.609, 1.436)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF01	Palpate Fifteen Day 1				152.7826	22.805	3.362
		46	.653	.000			
WFIF01	Watch Fifteen Day 1				150.9783	23.000	3.391

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.8043	19.069	2.812	.64	45	.524
95% CI (-3.858, 7.467)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF02	palpate fifteen day 02				149.6087	32.482	4.789
		46	.782	.000			
WFIF02	watch fifteen day 02				152.6522	24.798	3.656

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-3.0435	20.250	2.986	-1.02	45	.313
95% CI (-9.057, 2.970)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF03	palpate fifteen day 3				147.0652	27.174	4.007
		46	.753	.000			
WFIF03	watch fifteen day 3				152.7174	23.358	3.444

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-5.6522	18.101	2.669	-2.12	45	.040
95% CI (-11.028, -.277)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF04	palpate fifteen day 4				148.4130	26.419	3.895
		46	.841	.000			
WFIF04	watch fifteen day 4				149.5652	24.353	3.591

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.1522	14.459	2.132	-.54	45	.592
95% CI (-5.446, 3.142)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF05	palpate fifteen day 5				148.6957	28.770	4.242
		46	.723	.000			
WFIF05	watch fifteen day 5				150.3043	25.406	3.746

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.6087	20.390	3.006	-.54	45	.595
95% CI (-7.664, 4.446)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF06	palpate fifteen day 6				149.9268	20.934	3.269
		41	.734	.000			
WFIF06	watch fifteen day 6				144.4390	19.807	3.093

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
5.4878	14.900	2.327	2.36	40	.023
95% CI (.785, 10.191)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF07	palpate fifteen day 7				164.6364	29.509	4.449
		44	.704	.000			
WFIF07	watch fifteen day 7				155.1818	35.036	5.282

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
9.4545	25.357	3.823	2.47	43	.017
95% CI (1.745, 17.164)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF08	palpate fifteen day 8				142.3556	26.493	3.949
		45	.826	.000			
WFIF08	watch fifteen day 8				144.2889	23.993	3.577

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.9333	15.090	2.249	-.86	44	.395
95% CI (-6.467, 2.600)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF09	palpate fifteen day 9				146.4651	30.140	4.596
		43	.860	.000			
WFIF09	watch fifteen day 9				144.6744	28.182	4.298

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.7907	15.528	2.368	.76	42	.454
95% CI (-2.988, 6.570)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF10	palpate fifteen day 10				153.5333	28.107	4.190
		45	.865	.000			
WFIF10	watch fifteen day 10				152.3333	28.071	4.185

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.2000	14.614	2.179	.55	44	.585
95% CI (-3.191, 5.591)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF11	palpate fifteen day 11				159.3256	26.213	3.997
		43	.837	.000			
WFIF11	watch fifteen day 11				157.3721	27.700	4.224

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.9535	15.455	2.357	.83	42	.412
95% CI (-2.803, 6.710)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF12	palpate fifteen day 12				169.7619	20.941	3.231
		42	.696	.000			
WFIF12	watch fifteen day 12				168.9048	22.072	3.406

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
.8571	16.791	2.591	.33	41	.742
95% CI (-4.375, 6.090)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF13	palpate fifteen day 13				164.2727	21.317	3.214
		44	.910	.000			
WFIF13	watch fifteen day 13				164.8409	21.392	3.225

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-.5682	9.085	1.370	-.41	43	.680
95% CI (-3.330, 2.194)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF14	palpate fifteen day 14				158.6364	21.014	3.168
		44	.851	.000			
WFIF14	watch fifteen day 14				160.5682	19.999	3.015

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.9318	11.236	1.694	-1.14	43	.260
95% CI (-5.348, 1.484)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF15	palpate fifteen day 15				158.6364	21.568	3.251
		44	.760	.000			
WFIF15	watch fifteen day 15				160.6818	20.637	3.111

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.0455	14.640	2.207	-.93	43	.359
95% CI (-6.496, 2.405)					

t-tests for Paired Samples

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF16	palpate fifteen day 16				157.3261	22.531	3.322
		46	.693	.000			
WFIF16	watch fifteen day 16				159.7826	24.185	3.566

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-2.4565	18.371	2.709	-.91	45	.369
95% CI (-7.912, 2.999)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF17	palpate fifteen day 17				157.3913	22.349	3.295
		46	.813	.000			
WFIF17	watch fifteen day 17				156.2826	23.327	3.439

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
1.1087	13.994	2.063	.54	45	.594
95% CI (-3.047, 5.264)					

Variable		Number of pairs	Corr	2-tail Sig	Mean	SD	SE of Mean
PFIF18	palpate fifteen day 18				160.4130	23.773	3.505
		46	.801	.000			
WFIF18	watch fifteen day 18				161.5652	21.469	3.165

Paired Differences Mean	SD	SE of Mean	t-value	df	2-tail Sig
-1.1522	14.454	2.131	-.54	45	.591
95% CI (-5.445, 3.140)					

DAY	RESTING sample size	RESTING corr coeff	RESTING 2-tail signif	5 MINUTES sample size	5 MINUTES corr coeff	5 MINUTES 2-tail signif	10 MINUTES sample size	10 MINUTES corr coeff	10 MINUTES 2-tail signif	15 MINUTES sample size	15 MINUTES corr coeff	15 MINUTES 2-tail signif
1	41	0.729	0.000	45	0.480	0.001	46	0.627	0.000	46	0.653	0.000
2	37	0.549	0.000	46	0.703	0.000	46	0.638	0.000	46	0.782	0.000
3	38	0.656	0.000	46	0.670	0.000	46	0.820	0.000	46	0.753	0.000
4	36	0.887	0.000	46	0.722	0.000	46	0.784	0.000	46	0.841	0.000
5	37	0.837	0.000	46	0.601	0.000	46	0.805	0.000	46	0.723	0.000
6	37	0.880	0.000	46	0.806	0.000	46	0.647	0.000	41	0.734	0.000
7	37	0.858	0.000	46	0.843	0.000	45	0.894	0.000	44	0.704	0.000
8	38	0.646	0.000	46	0.848	0.000	46	0.855	0.000	45	0.826	0.000
9	40	0.907	0.000	45	0.501	0.000	46	0.739	0.000	43	0.860	0.000
10	38	0.940	0.000	46	0.795	0.000	45	0.639	0.000	45	0.865	0.000
11	41	0.865	0.000	46	0.906	0.000	46	0.775	0.000	43	0.837	0.000
12	39	0.827	0.000	44	0.844	0.000	44	0.724	0.000	42	0.696	0.000
13	40	0.749	0.000	45	0.729	0.000	46	0.806	0.000	44	0.910	0.000
14	40	0.927	0.000	44	0.952	0.000	44	0.804	0.000	44	0.851	0.000
15	37	0.976	0.000	45	0.908	0.000	45	0.838	0.000	44	0.760	0.000
16	39	0.891	0.000	46	0.798	0.000	46	0.874	0.000	46	0.693	0.000
17	39	0.953	0.000	46	0.790	0.000	46	0.895	0.000	46	0.813	0.000
18	41	0.915	0.000	46	0.771	0.000	46	0.859	0.000	46	0.801	0.000

TABLE 5
Sample size, correlation coefficients, and p-values of the paired heart rate data

			RESTING				5 MINUTES				10 MINUTES		
	sample	mean	sample	2-tail	sample	mean	sample	2-tail	sample	mean	sample	2-tail	sample
DAY	size	diffrnc	t	signif	size	diffrnc	t	signif	size	diffrnc	t	signif	size
1	41	-0.707	-4.30	0.666	45	-1.96	-0.59	0.556	46	-4.59	-1.45	0.155	46
2	37	0.5	0.19	0.850	46	-7.44	-2.19	0.034	46	-4.72	-1.35	0.183	46
3	38	-0.29	-0.15	0.882	46	-11.19	-4.08	0.000	46	-0.04	-0.020	0.984	46
4	36	-1.19	-1.10	0.280	46	-1.39	-0.53	0.595	46	1.00	0.43	0.667	46
5	37	-1.65	-0.98	0.334	46	0.43	0.12	0.903	46	-1.91	-0.81	0.422	46
6	37	-2.81	-1.73	0.092	46	3.28	1.32	0.194	46	5.61	1.99	0.053	41
7	37	-3.01	-2.22	0.033	46	0.89	0.44	0.659	45	0.533	0.35	0.725	44
8	38	-0.26	-0.11	0.916	46	1.17	0.54	0.591	46	-2.13	-1.29	0.202	45
9	40	-2.2	-1.81	0.077	45	-2.20	-0.63	0.534	46	-1.93	-0.74	0.463	43
10	38	-1.16	-1.22	0.229	46	-2.26	-0.84	0.403	45	-1.47	-0.51	0.614	45
11	41	-2.66	-1.50	0.140	46	1.76	0.94	0.354	46	0.83	0.33	0.741	43
12	39	-1	-0.63	0.531	44	-0.41	-0.21	0.836	44	1.64	0.76	0.453	42
13	40	-2.82	-1.03	0.308	45	-3.33	-1.20	0.238	46	1.76	0.68	0.503	44
14	40	-1.7	-1.58	0.122	44	-1.50	-1.12	0.270	44	3.20	1.44	0.156	44
15	37	-1.7	-2.28	0.029	45	-2.49	-1.26	0.216	45	4.20	-2.02	0.050	44
16	39	-1.1	-0.88	0.385	46	-5.54	-1.99	0.053	46	0.48	0.23	0.815	46
17	39	-1.03	-0.83	0.412	46	1.13	0.43	0.672	46	-1.13	-0.69	0.496	46
18	41	-2.1	-1.41	0.166	46	2.43	0.90	0.375	46	-2.09	-1.19	0.239	46

TABLE 6
Sample size, mean difference, sample t, and p-values of the paired heart rate data

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Summary

The purpose of this study was to examine the accuracy of the palpate method—using the fingers for monitoring the heart rate as compared to the accuracy of the heart rate monitor—using the chest strap and the watch for monitoring the heart rate.

Each subject (46 females) had four observations of paired data recorded at rest, after five, ten, and fifteen minutes of activity. The paired data was compared in 72 scattergrams and t-tests for paired samples were conducted.

The major findings indicate that every correlation coefficient computed on the SPSS program was statistically significant at the 0.01 level of significance. Less than 10% of the time the mean difference of the two heart rate measurements were statistically significant at the 0.05 level of significance. At least 90% of the time there was no statistical difference at the 0.05 level of significance when examining the accuracy of the palpate method as compared to the accuracy of the heart rate monitor.

Conclusions

The majority of negative mean differences (palpate method) were a little lower on the recorded heart rates. Of the 72 recorded heart rates, 48 were negative on the palpate method or 70% of the time the palpate method was lower that the mean of the heart rates recorded by the PHRM. The negative palpate method recordings could indicate the subject's lack of concern or ability for heart rate accuracy.

This study indicated that at least 90% of the time there was no statistical difference between the two measurements at the 0.05 level of significance. However, due to the fact that 70% of the time the palpate method was lower than the PHRM, one could assume that the PHRM is a better indicator of a positive measurement, which is what a person would desire when wanting to remain or become physically fit.

Recommendations

The following recommendations for future research are proposed:

1. Subjects should use both methods of measurements (palpate and PHRM) when doing this type of a research study for the first time. It is a good learning situation for the subjects as all subjects have an equal reference point in regard to the two methods of heart measurement.
2. A study of this type should be conducted under the supervision of one or two teachers if they team-teach. More control over the activities would be accomplished and the enthusiasm for accuracy in recording the heart rate of the activity would probably improve. The high intensity activities would be the same for each subject each day.
3. Due to the high number of subjects that were terminated from this study it would be recommended that more subjects be selected for a heart rate study.
4. A study of this type should be conducted over a longer period of time such as a semester or a whole school year. As indicated in this dissertation, more longitudinal studies like the Harvard Alumni Study, Framingham Heart Study and The Bogalusa Study are needed in researching the use of the HRM. Strand and Reeder did their longitudinal study in a middle school in Utah for one year. More longitudinal studies that track students using HRM's and the palpate method for four – five years (elementary to junior high) would be worthwhile. It should indicate an improvement in the students' resting heart rate, the ability to have a good sustained heart rate for 20 minutes or longer and an improved level of fitness. It would be hoped that through a four – five year study students, parents, and the school system would realize and appreciate the value of daily, vigorous physical activity, in school as well as its value for a life-style of fitness.

The value of the longitudinal study increases and continues to show trends in the community and in the levels of cardiovascular fitness as well as the pattern of cardiovascular disease, still the number one killer in the United. States. More studies of the habitual activity of children are warranted, even though this area of research has increased in recent years.

5. As stated in the dissertation, junior high school students were involved in fitness activities for less than five minutes of their class periods in one study and in McGing's survey it was revealed that high school physical education classes did not provide sufficient time for aerobic activity. Thus, further study needs to be conducted on the frequency, time, and duration (FIT) of fitness activities in school.

   It is vital to implement proper frequency, intensity and duration of activity in order for the student to become more physically fit. As previously stated in the review of the literature, the health-related aspects of fitness need to be emphasized and the skill-related aspects of fitness will develop however, the reverse is not true.

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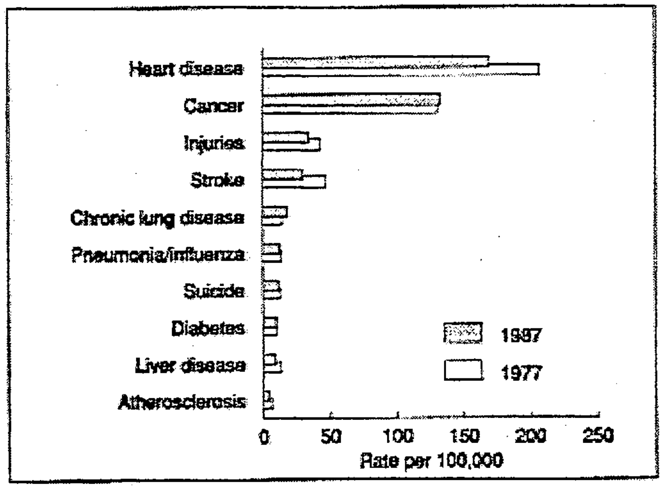
APPENDIXES

APPENDIX A

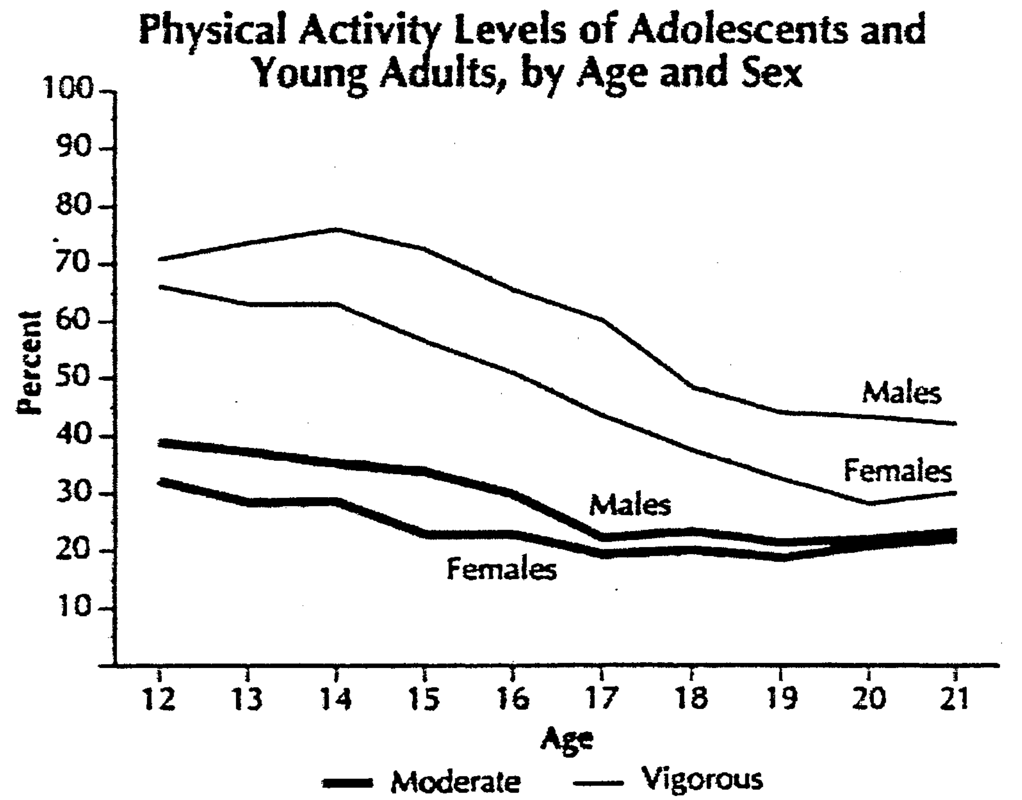
LEADING CAUSES OF DEATH

U.S. POPULATION



(Healthy people 2000, 1992)

APPENDIX B
PHYSICAL ACTIVITY LEVELS OF ADOLESCENTS AND YOUNG ADULTS, BY AGE AND SEX



Source: CDC 1992 National Health Interview Survey/Youth Risk Behavior Survey

APPENDIX C

FORMULA AND EXAMPLE FOR

CALCULATING TARGET HEART RATES

Formula and Example for Calculating Target Heart Rates Using the Percentage of Maximal Heart Rate Procedure. (Example is for a twenty-two-year-old person.)

Formula for Calculating Maximal Heart Rate	Example
220 – Age (in years) = Maximal Heart Rate (beats per minute)	220 – 22 = 198
Formula for Threshold Heart Rate	**Example**
Maximal Heart Rate × 60% Threshold of Training Heart Rate	198 × .60 = 118.8 (119)
Formula for Upper Limit Heart Rate	**Example**
Maximal Heart Rate × 90% Upper Limit for Target Heart Rate Zone	198 × .90 = 178.2 (178)
The target zone for this person is 119 – 178 bpm.	

(Corbin & Lindsey, 1997)

APPENDIX D

KARVONEN HEART RATE FORMULA

KARVONEN HEART RATE FORMULA

Karvonen, a Finnish researcher, found that in order to improve cardiorespiratory fitness, the exercising heart rate must be raised by approximately 60-90 percent of the difference between the resting heart rate and the maximum heart rate. This difference is called "heart rate reserve." The American College of Sports Medicine has recently revised the percentage to 50-85 percent.

The Karvonen formula is a way of determining your safe and effective exercise benefit zone based on your age and resting heart rate.

VO$_2$ Max: the maximal oxygen uptake effort, also called aerobic power

Karvonen Heart Rate Formula

1. Determine your maximum heart rate according to your age.
   220–Age = #1 ____________

2. Subtract your resting heart rate (RHR) from the above – ____________
   = #2 ____________

2. Determine the lower limit of your exercise benefit zone by multiplying #2 above by 60%, which is minimum intensity for improvement. × .60 ____________
   #3 ____________

3. Add your resting heart rate (see #2). + #4 ____________

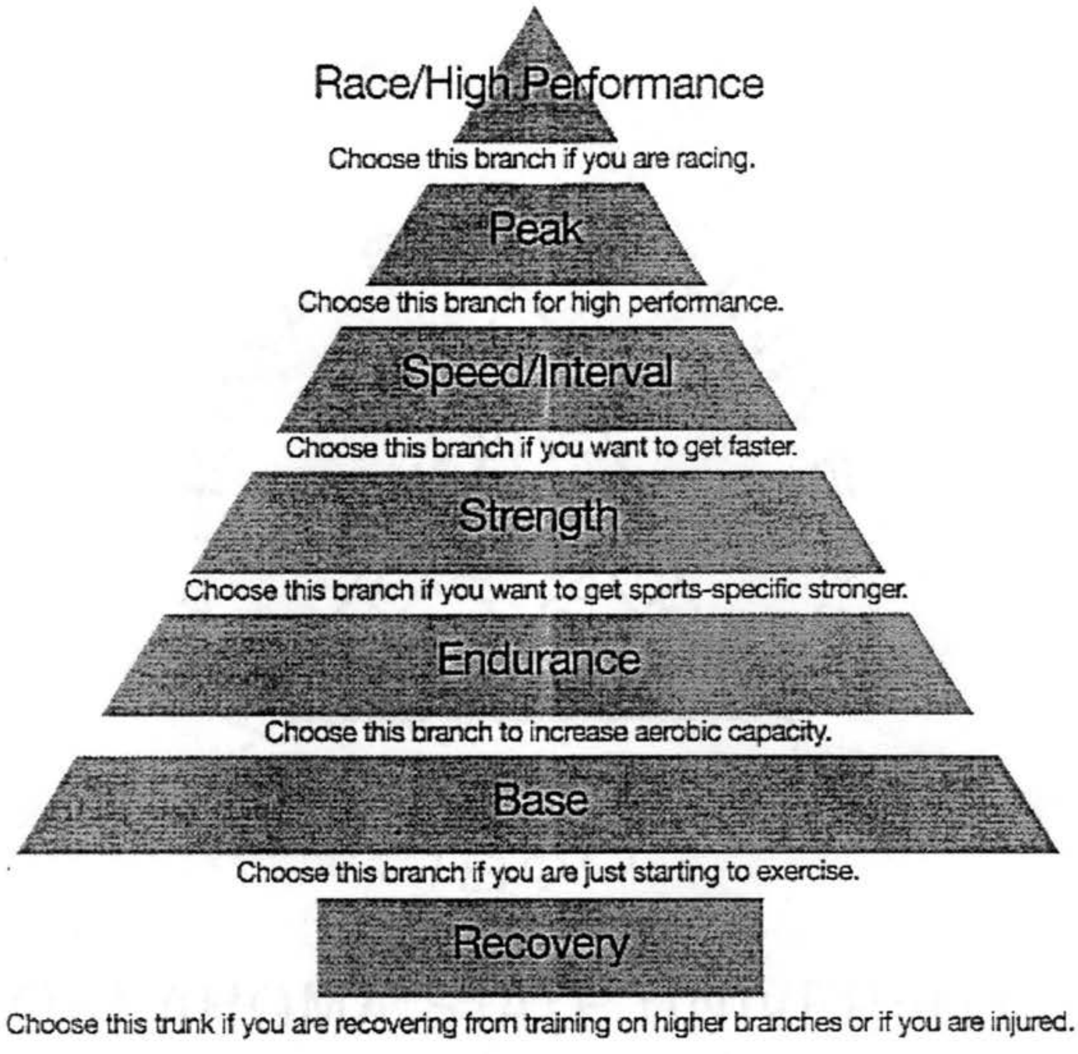
4. This is the lower limit of your exercise benefit zone. = #5 ____________

[Use the same procedure to determine the upper limit of your exercise benefit zone by substituting 85% (.85) in #3.]

5. Upper limit of your exercise benefit zone. = #6 ____________

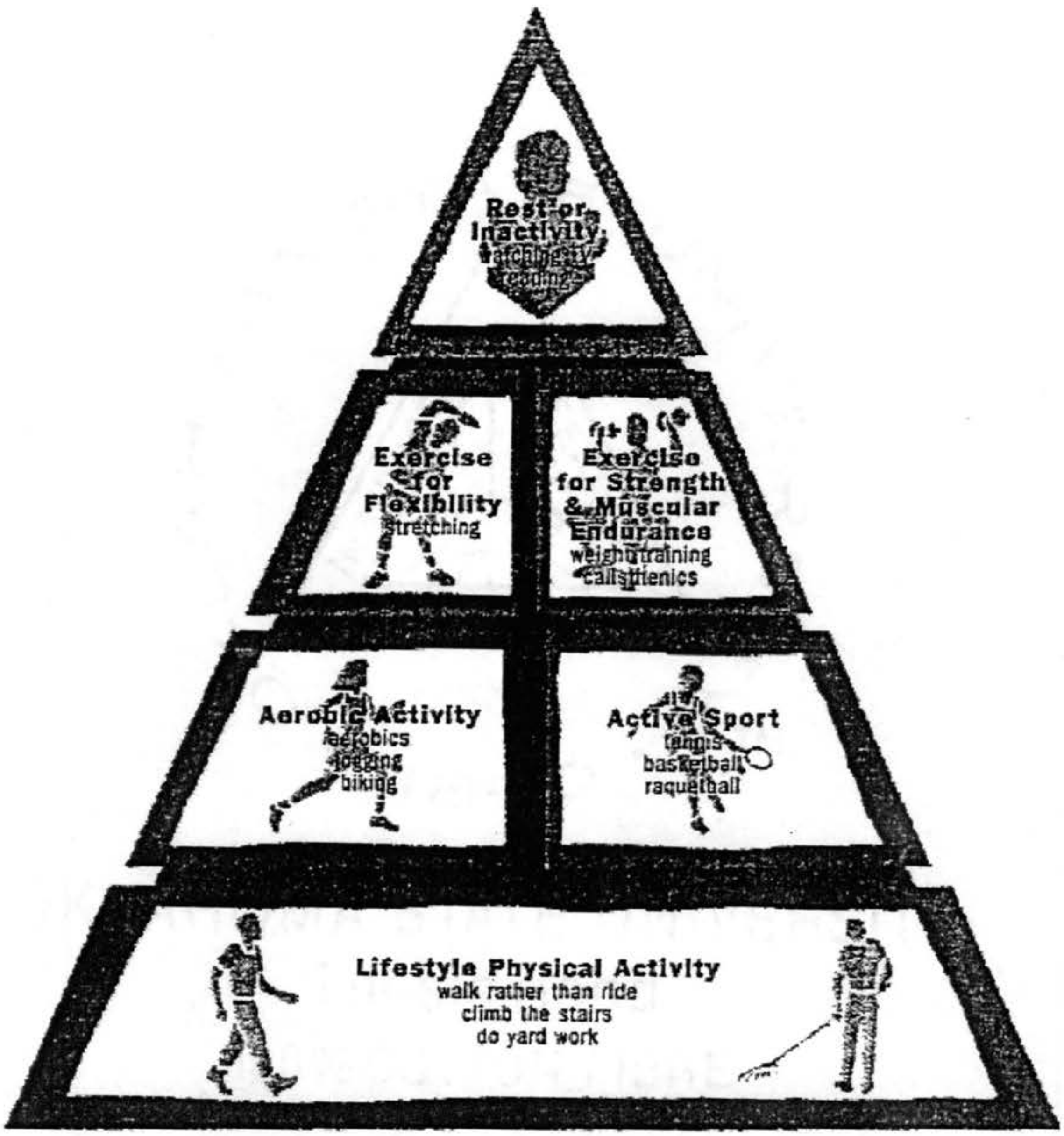
My exercise benefit zone is (#5) _______ to (#6) _______. As your fitness improves, work the formula again, using your lowered resting heart rate. (Tally, 1995)

APPENDIX E
PERFORMANCE TREE



(Edwards & Privus, 1997)

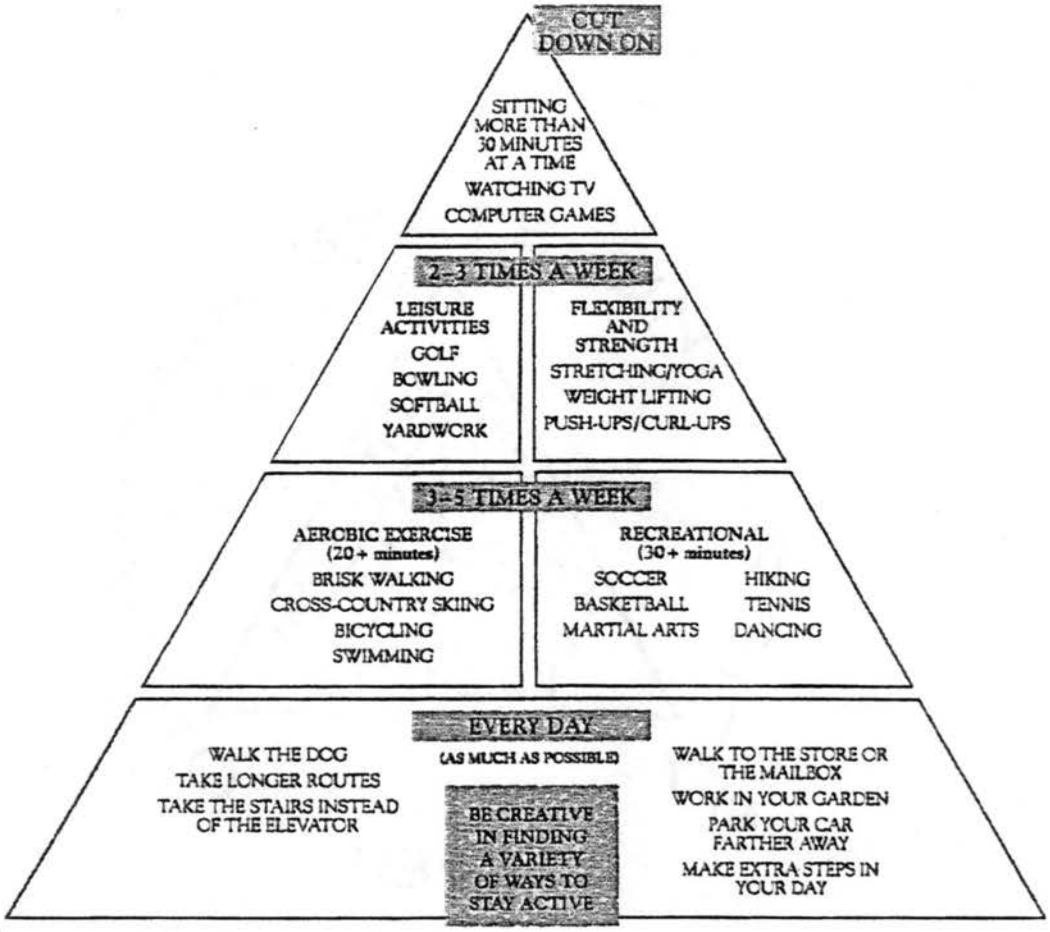
APPENDIX F
PHYSICAL ACTIVITY PYRAMID



(Corbin & Lindsay, 1997)

APPENDIX G

ACTIVITY PYRAMID



(Piscatella, 1997)

APPENDIX H

GIRTH OF A NATION

GIRTH OF A NATION

The average weight of men and women, in pounds, based on an assumed height of 5'4".

UNITED STATES
160

SOUTHERN EUROPE
152

EASTERN EUROPE
151

WESTERN AND CENTRAL EUROPE
145

NORTHERN EUROPE
145

SOUTH AND CENTRAL AMERICA
141

AFRICA
136

ASIA
123

Note: These figures go back to the late 1980s. The disparity between the U.S. and other regions is probably far wider today.

Source: Based on INTERSALT data published in Obesity (J.B. Lippincott, 1992), edited by Per Pjörntorp and ernard N. Brodoff.

(Fumento, 1998)

APPENDIX I

BODY MASS INDEX CHART

BMI Chart

Wolght	100	105	110	115	120	125	130	135	140	145	150	155	100	105	170	175	100	105	100	105	200	205	210	215	220	225
Holght																										
5'3"	20	21	21	22	23	24	25	20	27	28	20	30	31	32	33	34	35	30	37	38	30	40	41	42	43	44
5'1"	10	20	21	22	23	24	25	20	28	27	28	20	30	31	32	33	34	35	30	37	38	30	40	41	42	43
5'2"	18	10	20	21	22	23	24	25	28	27	27	28	29	30	31	32	33	34	35	30	37	37	38	30	40	41
5'3"	18	10	10	20	21	22	23	24	25	26	27	27	28	20	30	31	32	33	34	35	35	38	37	38	30	40
5'4"	17	18	10	20	21	21	22	23	24	25	28	27	27	28	20	30	31	32	33	33	34	35	30	37	38	30
5'6"	17	17	18	10	20	21	22	22	23	24	25	20	27	27	28	20	30	31	32	32	33	34	35	30	37	37
5'0"	10	17	18	10	10	20	21	22	23	23	24	25	20	27	27	28	29	30	31	31	32	33	34	35	30	30
5'7"	10	18	17	18	10	20	20	21	22	23	23	24	26	20	27	27	28	20	30	31	31	32	33	34	34	35
5'0"	15	10	17	17	18	18	20	21	21	22	23	24	24	25	28	27	27	28	20	30	30	31	32	33	33	34
5'0"	15	18	10	17	18	18	10	20	21	21	22	23	24	24	25	20	27	27	28	20	30	30	31	32	32	33
5'10"	14	15	10	17	17	18	10	19	20	21	22	22	23	24	24	25	28	27	27	28	20	20	30	31	32	32
5'11"	14	15	15	10	17	17	18	19	20	20	21	22	22	23	24	24	25	20	20	27	28	20	20	30	31	31
0'0"	14	14	15	10	18	17	18	18	10	20	20	21	22	22	23	24	24	25	20	20	27	28	28	20	30	31
0'1"	13	14	15	15	10	10	17	10	18	10	20	20	21	22	22	23	24	24	25	20	20	27	28	28	20	30
0'2"	13	13	14	18	15	10	17	17	18	10	10	20	21	21	22	22	23	24	24	25	20	20	27	28	28	20
0'3"	12	13	14	14	15	10	10	17	17	18	10	10	20	21	21	22	22	23	24	24	25	20	20	27	27	28
0'4"	12	13	13	14	15	15	10	10	17	10	18	10	10	20	21	21	22	23	23	24	24	26	20	20	27	27

(http://shapeup.org)

APPENDIX J
OVERWEIGHT CITIES

OVERWEIGHT CITIES

(of the 33 largest U.S. metros, top 20 with the highest rates of obesity for adults aged 20 to 74, 1990 and 1993*)

rank	metro	percent obese
1	New Orleans, La	37.6%
2	Norfolk, VA	33.9
3	San Antonio, TX	33.0
4	Kansas City, MO	31.7
5	Cleveland, OH	31.5
6	Detroit, MI	31.0
7	Columbus, OH	30.8
8	Cincinnati, OH	30.7
9	Pittsburgh, PA	30.0
10	Houston, TX	29.2
11.	Philadelphia, PA	29.1
12	Milwaukee, WI	28.8
13	Buffalo, NY	28.4
14	Sacramento, CA	28.2
15	Dallas-Fort Worth, TX	27.5
16	Portland, OR	27.2
17	Chicago, IL	27.1
18	New York, NY	27.1
19	Miami, FL	27.0
20	Baltimore, MD	26.4
Average for 33 largest metros		28.8

*Cases for these two years were combined.
Note: Data are based on self-reported weight and height as reported in the National Health Interview Survey, conducted by the National Center for Health Statistics.

Source: Coalition for Excess Weight Risk Education, Washington, DC

(Fumento, 1998)

APPENDIX K

OVERWEIGHT PERSONS

Overweight persons 20 years of age and over, according to sex, age, race, and Hispanic origin: United States, 1960-62 and 1988-91

[Data are based on physical examinations of a sample of the civilian noninstitutionalized population]

Sex, age, race, and Hispanic origin[1]	1960-62	1988-91
20-74 years, age adjusted	**Percent of population**	
Both sexes	24.4	33.0
Male	22.9	31.9
Female[3]	25.6	34.1
White male	23.1	32.3
White female[3]	23.5	32.6
Black male	22.2	32.9
Black female[3]	41.7	49.6
White, non-Hispanic male	---	32.4
White, non-Hispanic female[3]	---	31.0
Black, non-Hispanic male	---	32.9
Black, non-Hispanic female[3]	---	49.8
Mexican-American male	---	39.9
Mexican-American female[3]	---	48.2
20-74 years, crude		
Both sexes	25.5	33.3
Male	23.4	31.9
Female[3]	27.4	34.6
White male	23.7	32.6
White female[3]	25.4	33.3
Black male	22.5	32.4
Black female[3]	43.0	48.6
White, non-Hispanic male	---	32.9
White, non-Hispanic female[3]	---	31.8
Black, non-Hispanic male	---	32.4
Black, non-Hispanic female[3]	---	49.0
Mexican-American male	---	35.4
Mexican-American female[3]	---	47.3
Male		
20-34 years	19.6	22.8
35-44 years	22.8	35.7
45-54 years	28.1	35.5
55-64 years	26.9	40.5
65-74 years	21.8	42.2
75 years and over	---	26.0

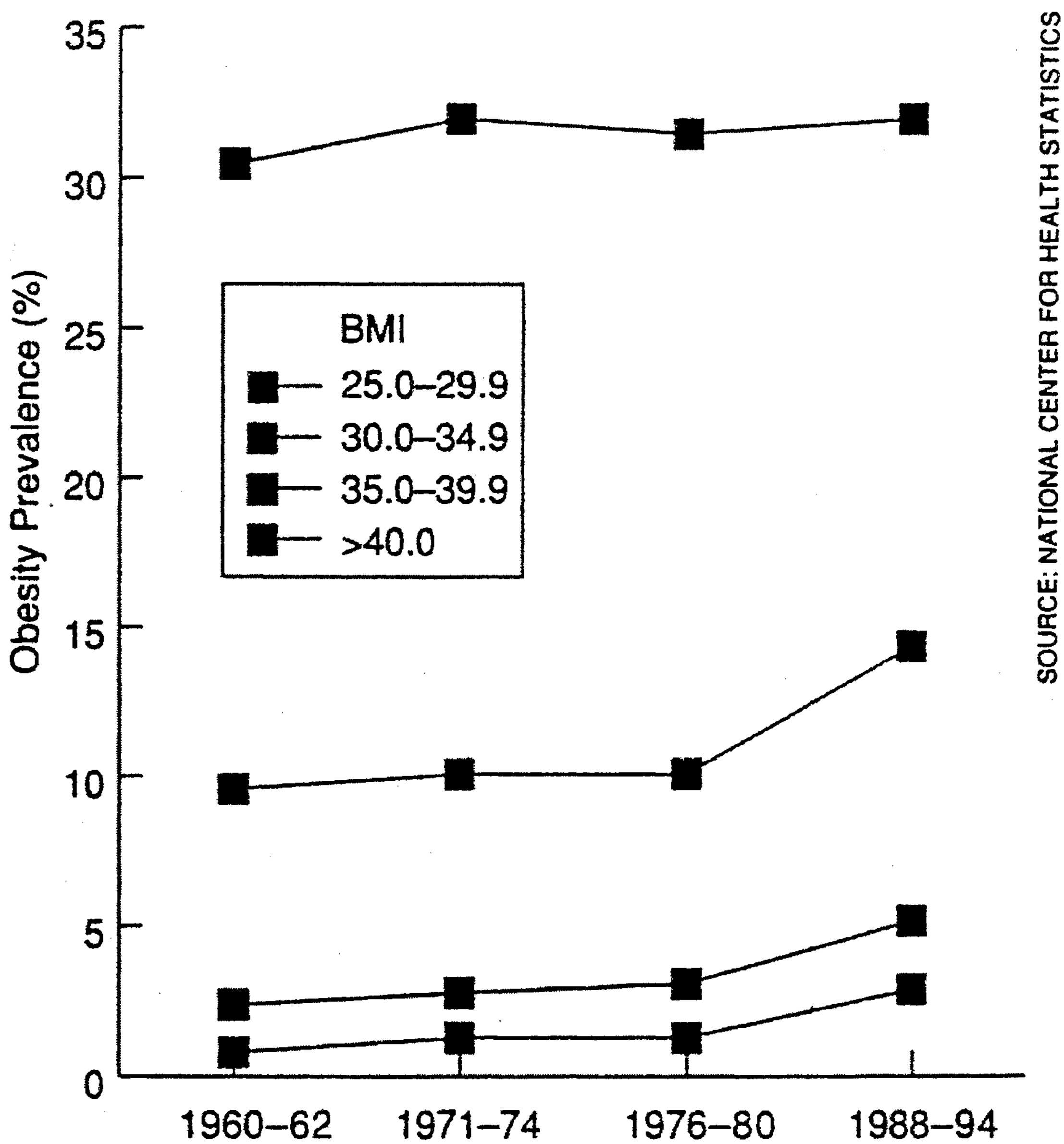
Female[3]		
20-34 years	13.2	24.5
35-44 years	24.1	35.1
45-54 years	30.7	39.8
55-64 years	43.2	48.7
65-74 years	42.9	39.7
75 years and over	---	31.5

---Data not available.
[1]The race groups, white and black, include persons of Hispanic of non-Hispanic origin. Conversely, persons of Hispanic origin may be of any race.
[3]Excludes pregnant women.

Notes: Overweight is defined for men as body mass index greater than or equal to 27.8 kilograms/meter^2, and for women as body mass index greatyer than or equal to 27.3 kilograms/meter^2. These cut points were used because they represent the sex-specific 85th percentiles for persons 20-29 years of age in the 1976-80 National Health and Nutrition Examination Survey. Height was measured without shoes; 2 pounds are deducted from data for 1960-62 to allow for weight of clothing. Some data have been revised and differ from previous editions of Health, United States.

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, Division of health Examination Statistics. Unpublished data.

APPENDIX L
OBESITY PREVALENCE



Going up. With the possible exception of preobesity (BMIs from 25.0 to 29.9), the prevalence of all classes of obesity seems to have ticked upward during the 1980s.

(Taubes, 1998)

APPENDIX M

HOW DOES YOUR CHILD'S

SCHOOL MEASURE UP?

How Does Your Child's School Measure Up?

Points Low – High				
1	2	3	1.	Does the school provide at least one period per day of vigorous exercise that lasts at least 20 minutes?
1	2	3	2.	Does the school offer at least 75% of physical education instruction in lifetime activities such as walking, running, swimming, bicycling, aerobics, tennis, badminton, skiing, weight training, stretching and the how and why of fitness?
1	2	3	3.	Does the school provide tests to determine which children might lack flexibility, strength and cardiovascular endurance?
1	2	3	4.	Does the school provide physical activity opportunities for the obese, unfit and unskilled?
1	2	3	5.	Does the school provide physical education programs for the mentally and physically handicapped?
1	2	3	6.	Does the school have a prescribed source of study for physical education that the teachers are required to follow? Is P.E. teaching monitored?
1	2	3	7.	Does the school's physical education program emphasize fun, participation and relevance (fitness and motor skills) rather than sports skill development and competition?
1	2	3	8.	Does the school put physical education first and athletics second?
1	2	3	9.	Do the physical education teachers look fit and participate in personal fitness programs?
1	2	3	10.	Do your children enjoy, speak highly of and look forward to physical education classes?
1	2	3	11.	Does the school not threaten to cut physical education when budget cuts are considered?
1	2	3	12.	Does the school integrate physical education concepts with classroom concepts? (Piscatella, 1997)

APPENDIX N
HIGHEST AND LOWEST
HEART-DISEASE MORTALITY STATES

The chart below reveals the highest heart-disease mortality states and the lowest heart-disease mortality states.

Highest heart-disease mortality states

Women	*Men*
New York 276.53	Florida 268.13
Rhode Island 242.49	Arkansas 258.97
Missouri 239.93	New York 252.72
Pennsylvania 226.44	Oklahoma 252.24
Florida 226.21	West Virginia 247.90

Lowest heart-disease mortality states

Women	*Men*
Alaska 37.31	Alaska 62.9
Utah 73.94	Utah 100.31
New Mexico 81.28	New Mexico 102.23
Hawaii 85.4	Colorado 119.11
Colorado 96.49	Hawaii 124.29

(http://cdc.org)

APPENDIX O

PERCENTAGE OF NATIONAL POPULATIONS
WHO ARE 'AEROBICALLY ACTIVE'
OR 'MODERATELY ACTIVE'
IN THEIR LEISURE TIME

Percentage of national populations who are 'aerobically active' or 'moderately active' in their leisure time

Country (date)	Age group	Aerobically active MEN %	Aerobically active WOMEN %	Moderately active MEN %	Moderately active WOMEN %
Australia (1989)	20-69	6	4	33	29
Australia (1990/1)	18-78	16	14	32	26
Canada (1988)	10+	14	8	37	38
USA (1990)	18+	9	9	32	32
ENGLAND (1990)	16-74	14	4	35	37

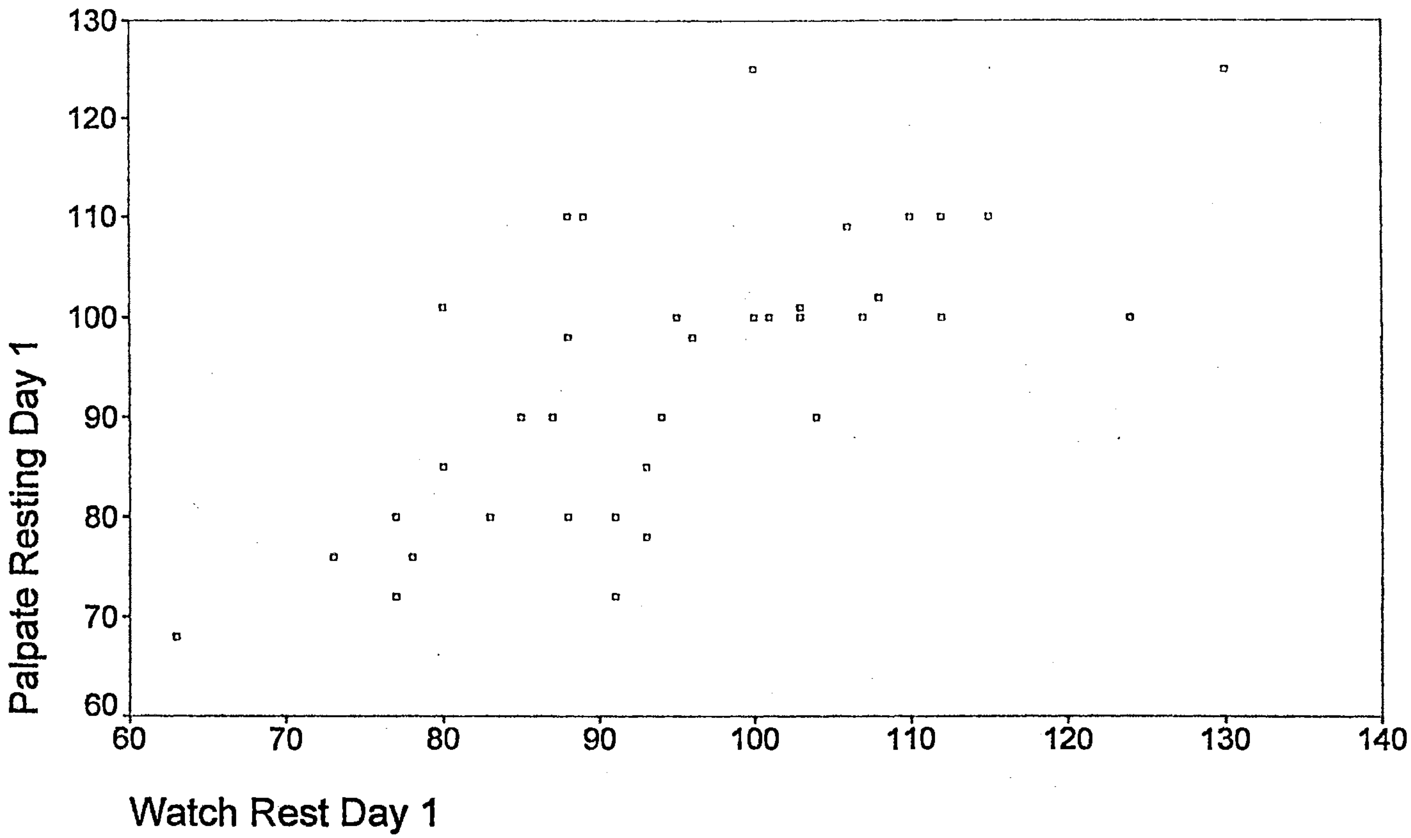
Definitions used for 'aerobically active' and moderately active'

Country (date)	Aerobically active	Moderately active
Australia (1989)	Vigorous (breathing hard/puffing/panting); 20+ min, 3+ times/wk	Less vigorous no puffing or panting
Australia (1990/1)	2 week total energy expenditure in selected vigorous activities (equivalent to above)	Vigorous activity less than three times per week
Canada (1988)	Activity with energy cost greater than 60% age-specific capacity; 30+ min, 3+ times/wk	Low-intensity; 30+ min, three times per week
USA (1990)	Activity with energy cost greater than 60% age- and sex- specific capacity, 30+ min, 3+ times/wk	Regular, not vigorous activity
ENGLAND (1990)	Vigorous activity (energy cost 7.5+ kcal/min); 20+ min, 12+ times in past 4 weeks	Moderate activity (energy cost 5.0+ kcal/min) or mixed vig/mod; 20+ min, 12+ times/4 weeks

(Allied Dunbar, 1992)

APPENDIX P

SCATTERGRAMS


Palpate Resting Day 1
Watch Rest Day 1
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120
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90
80
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60
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80
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100
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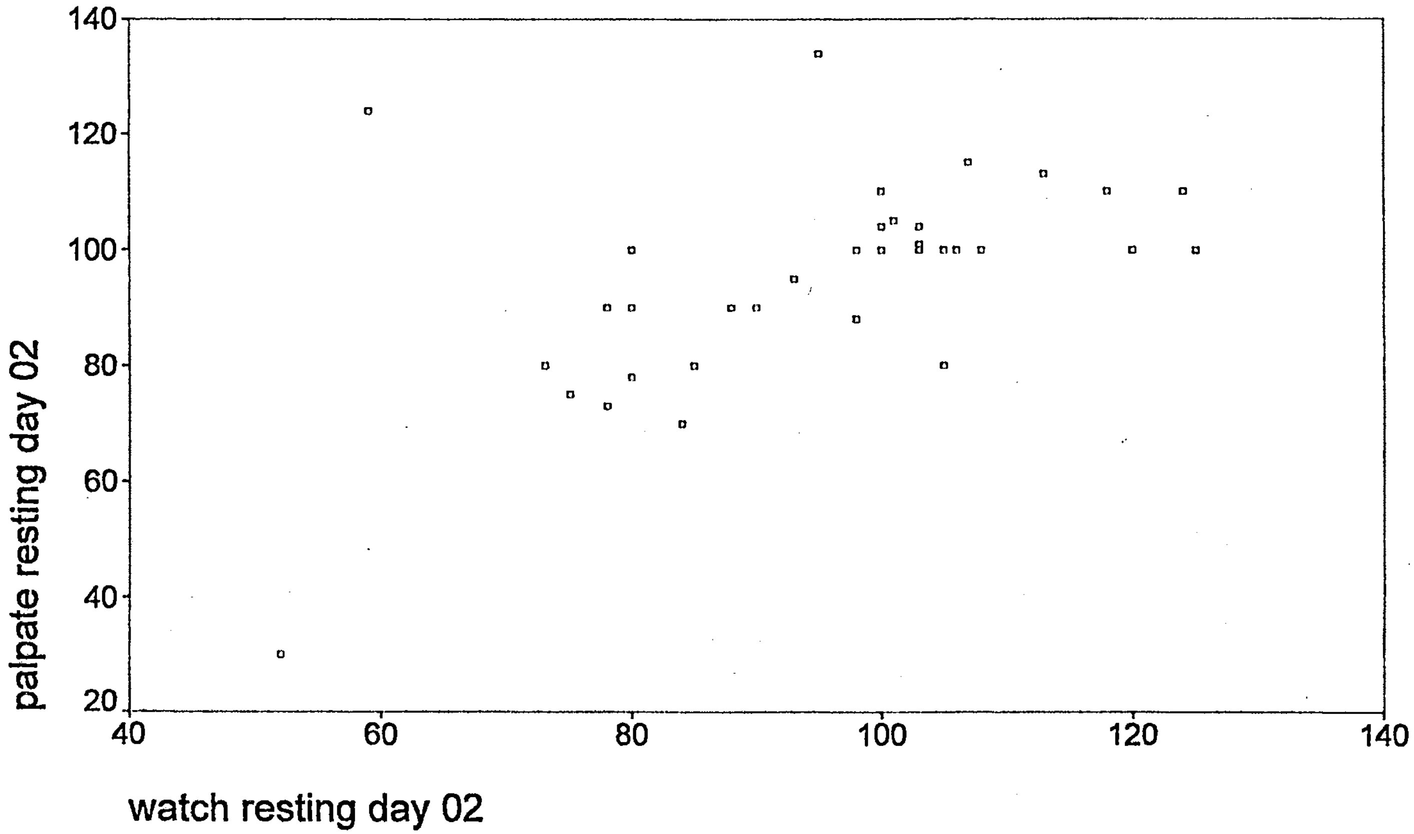
120
130
140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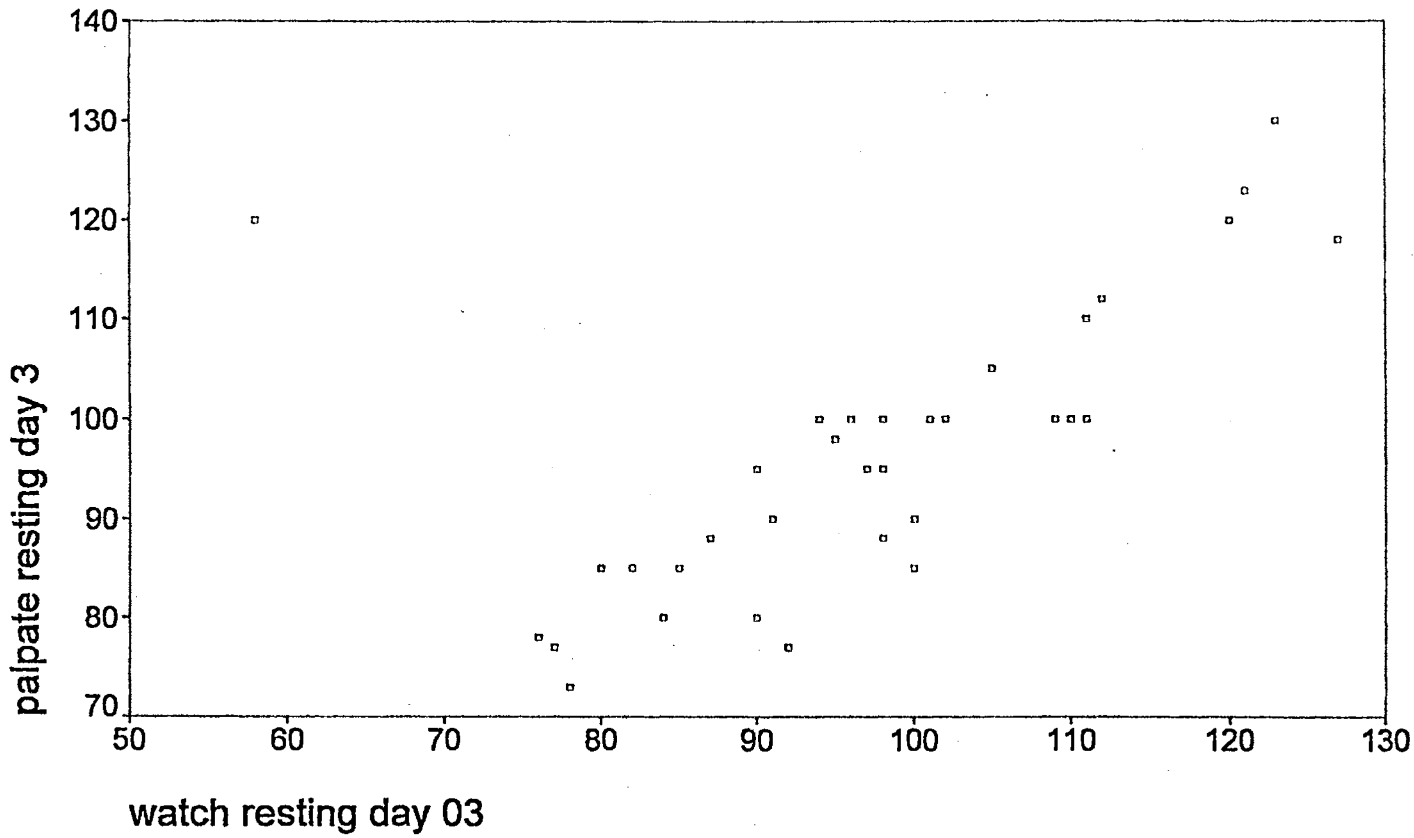
palpate resting day 02
watch resting day 02


palpate resting day 3
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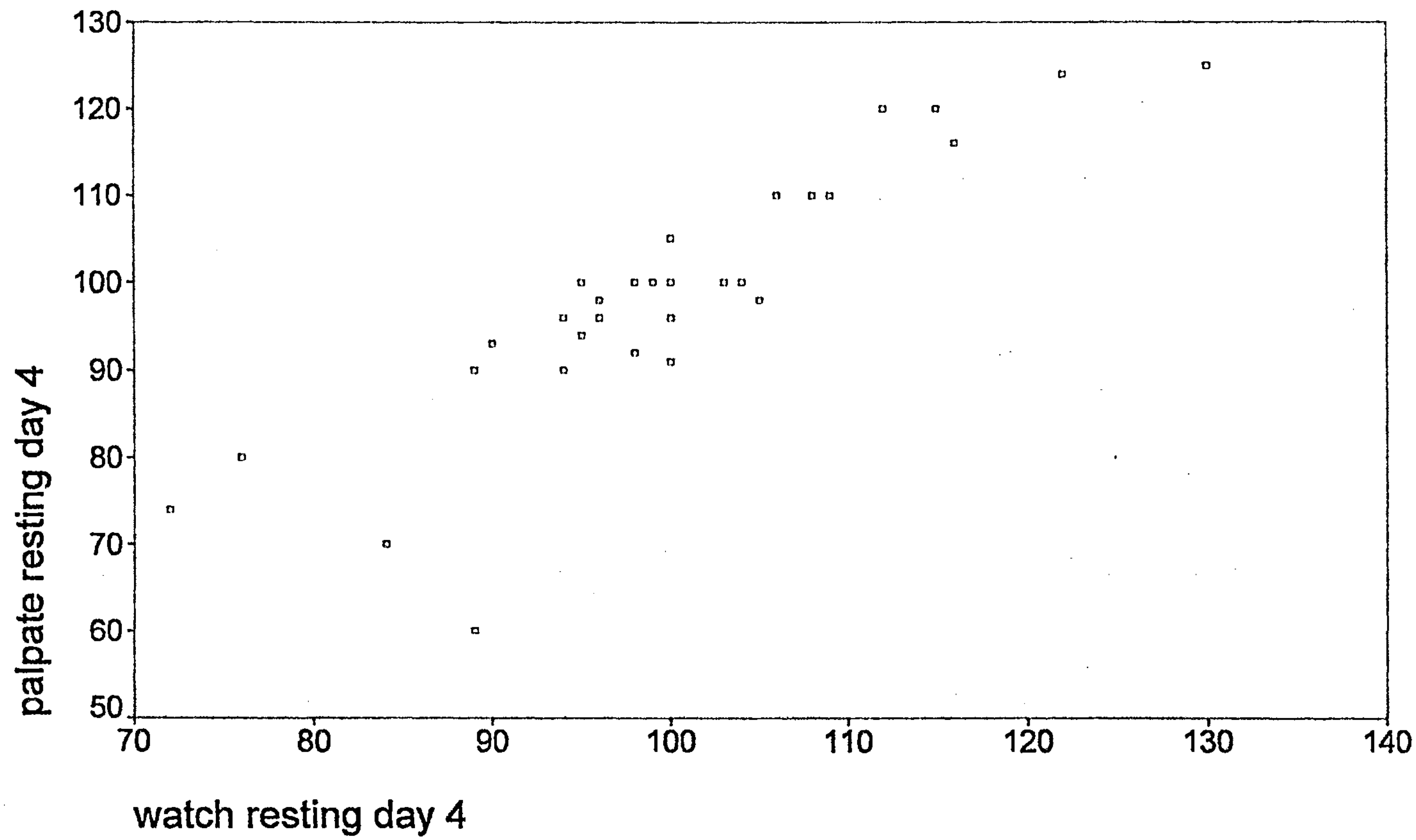
watch resting day 03


palpate resting day 4
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130
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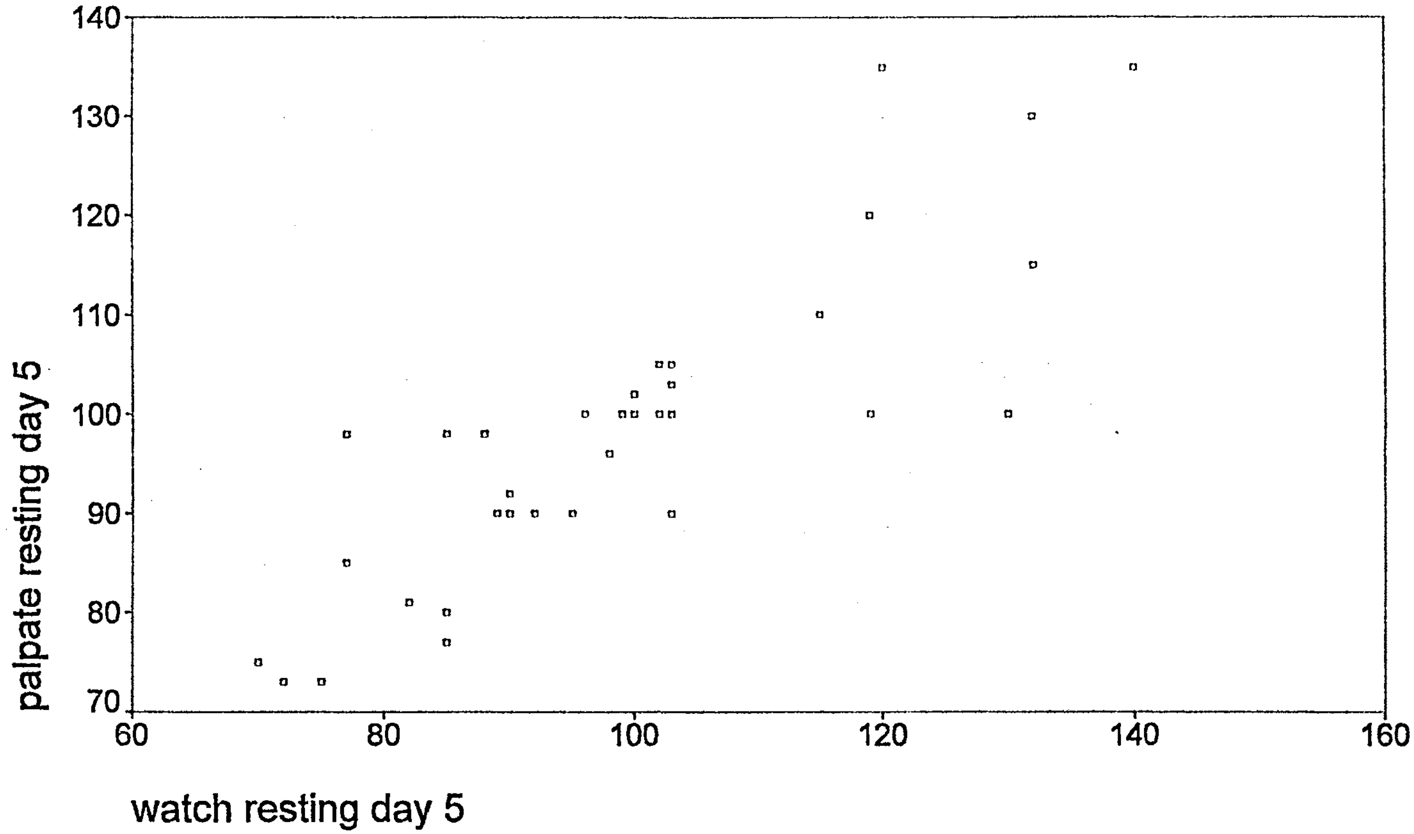
watch resting day 4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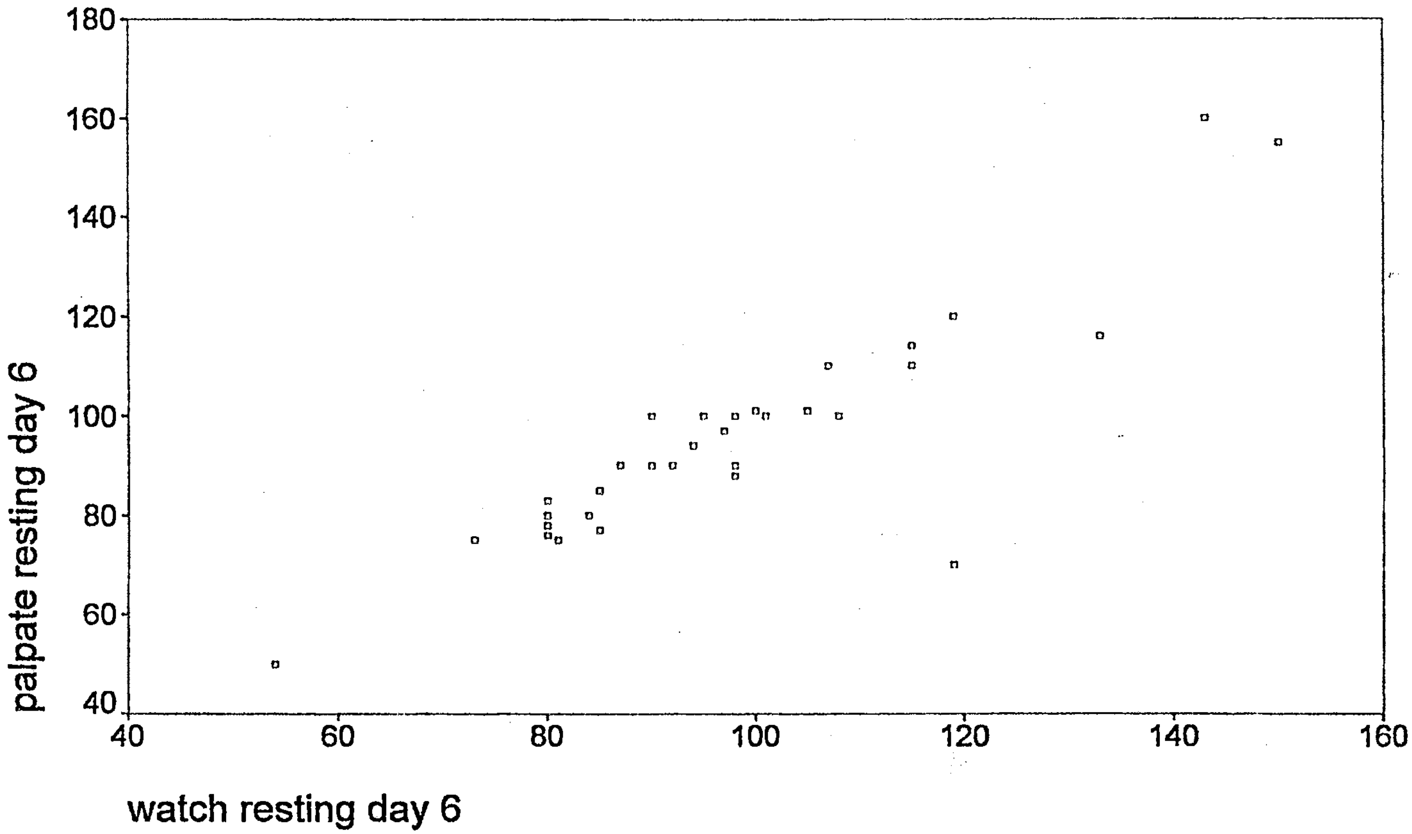
120
140
160
watch resting day 5



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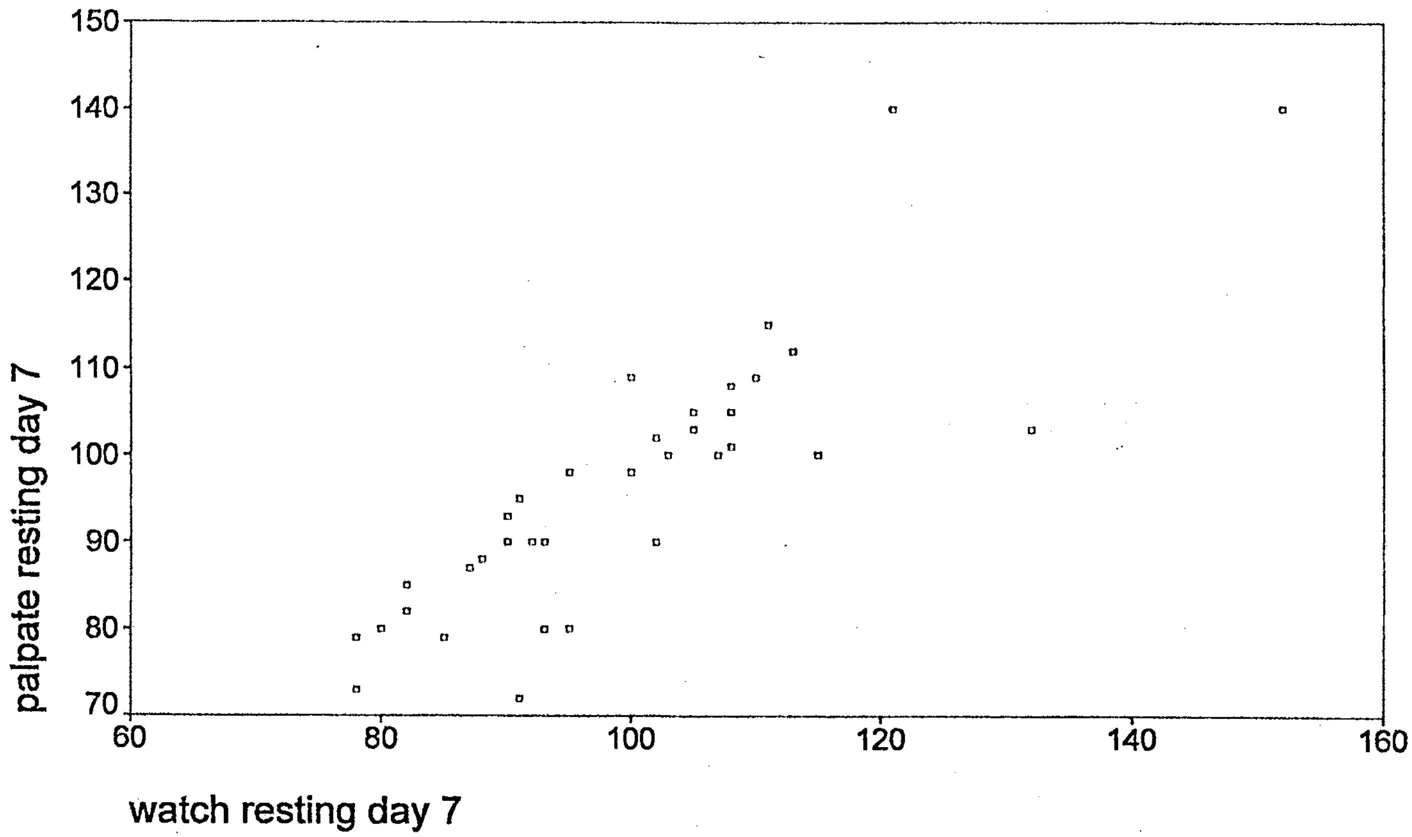
140
160
palpate resting day 6
watch resting day 6



150
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palpate resting day 7
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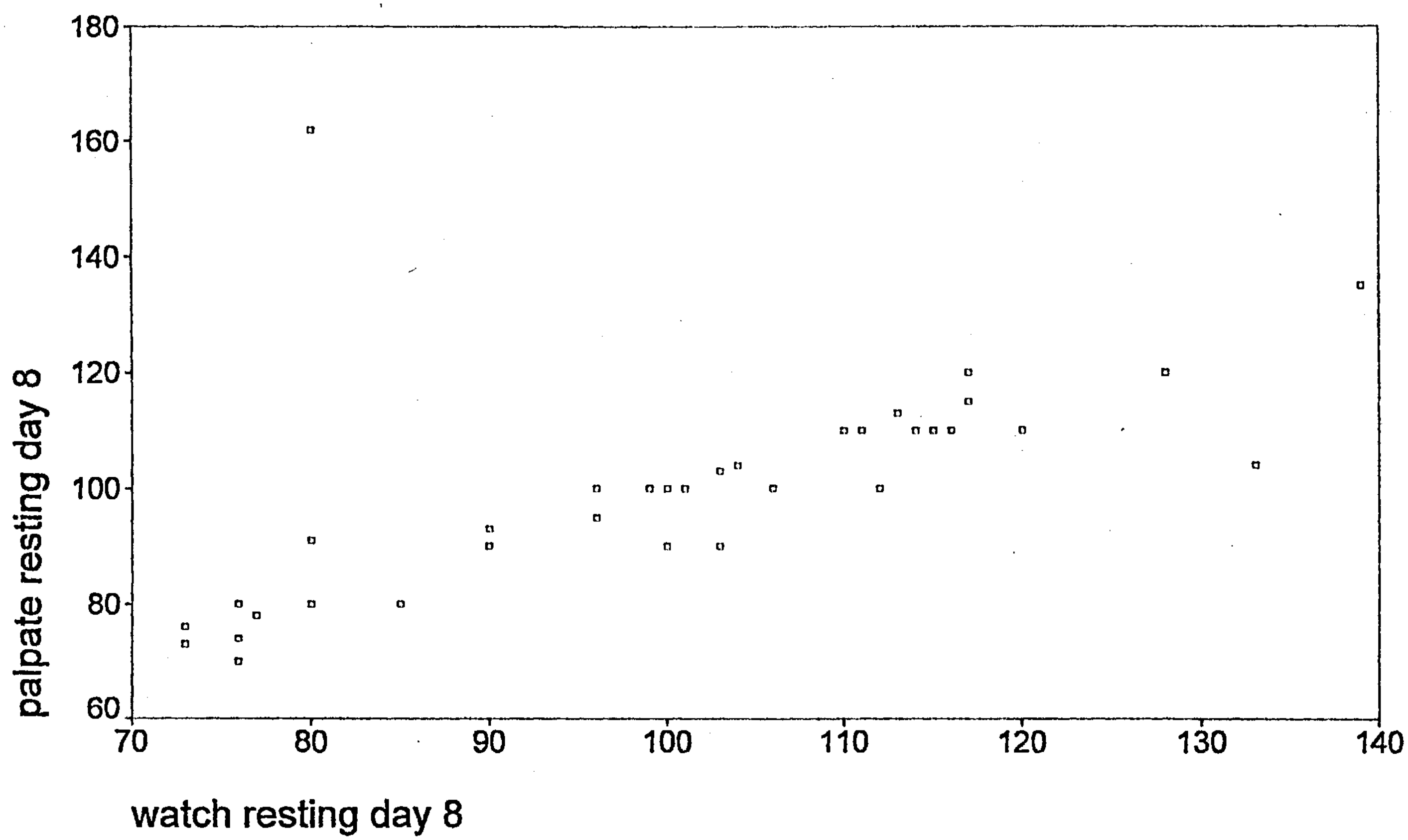
160
watch resting day 7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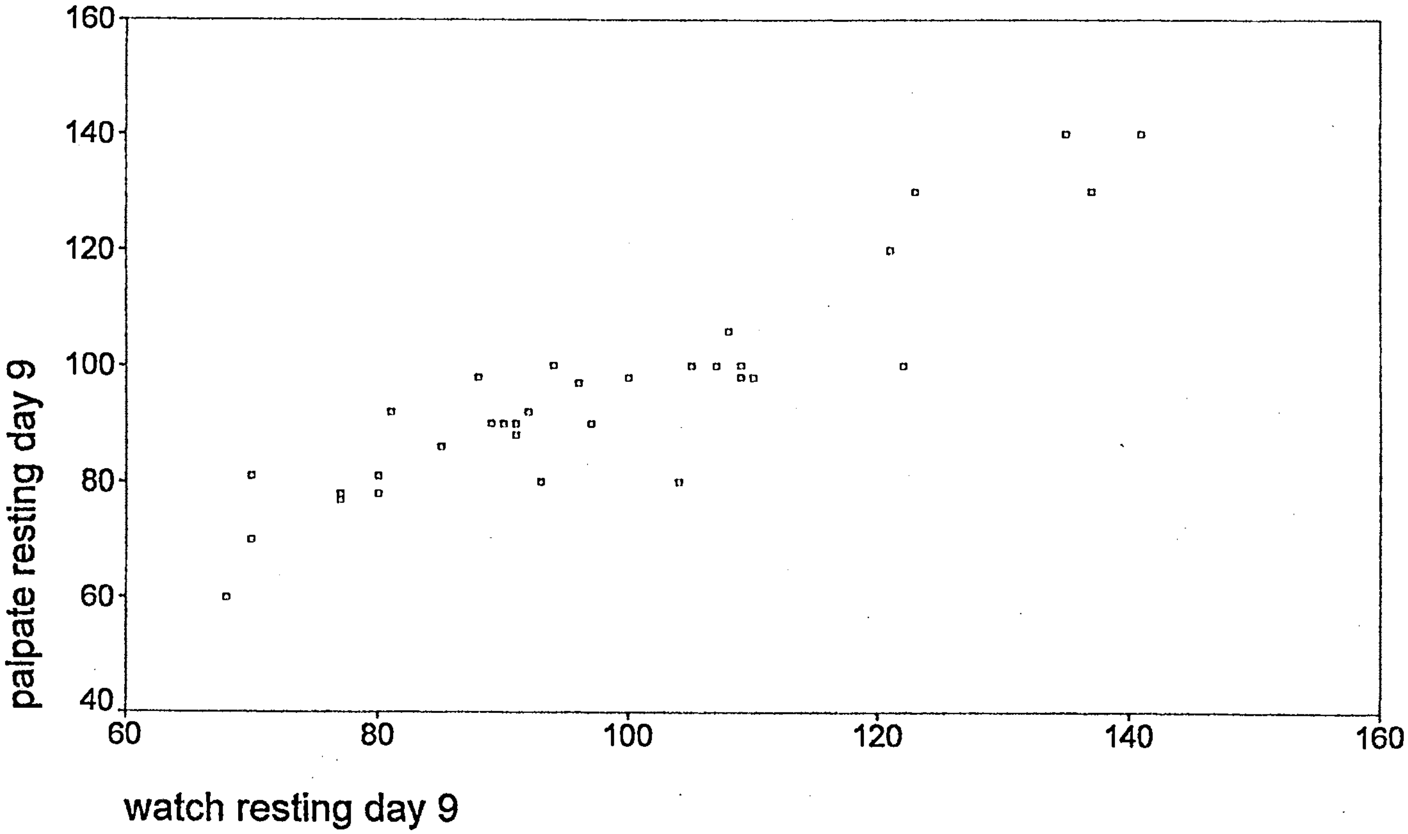
140
palpate resting day 8
watch resting day 8


palpate resting day 9
watch resting day 9
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140
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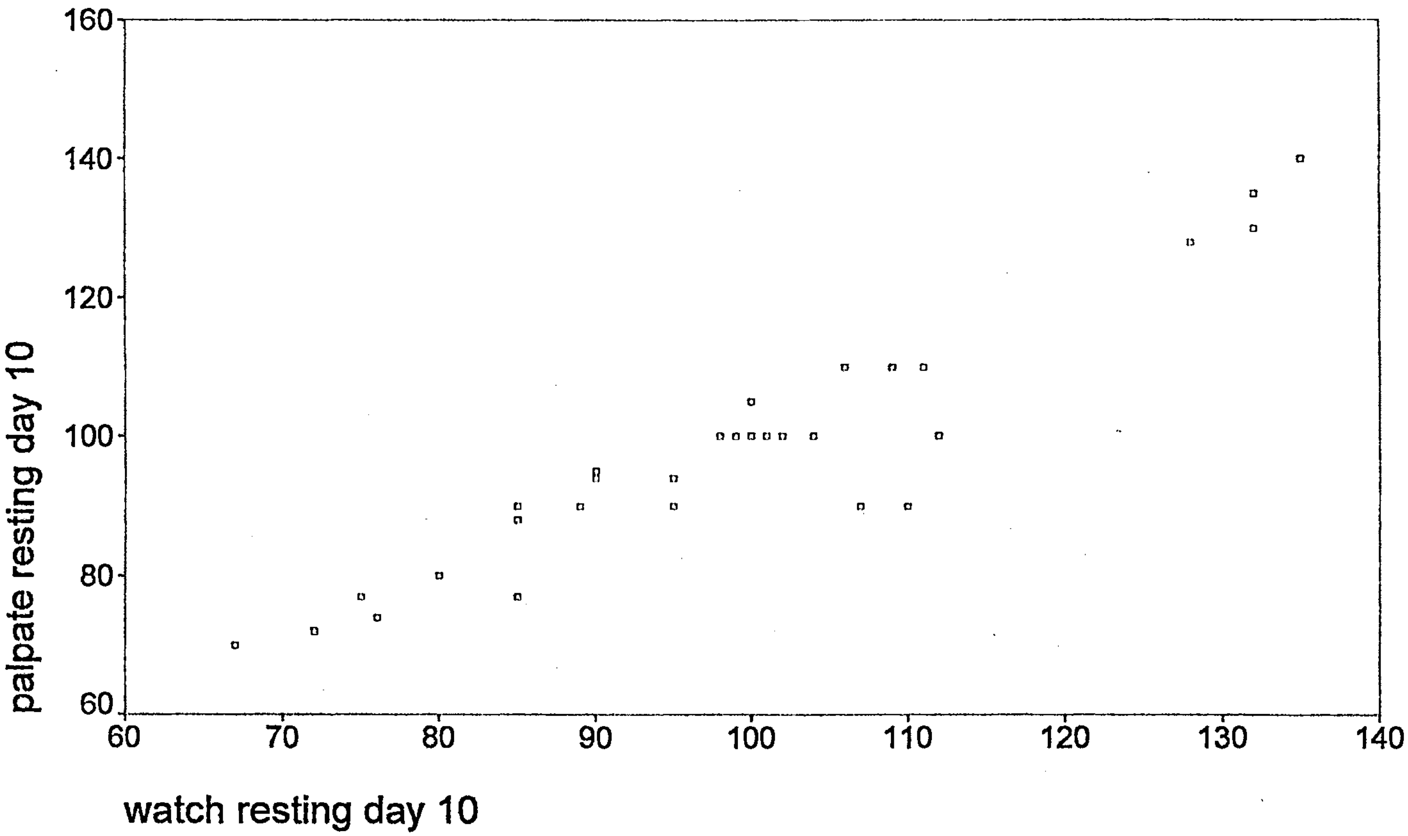
160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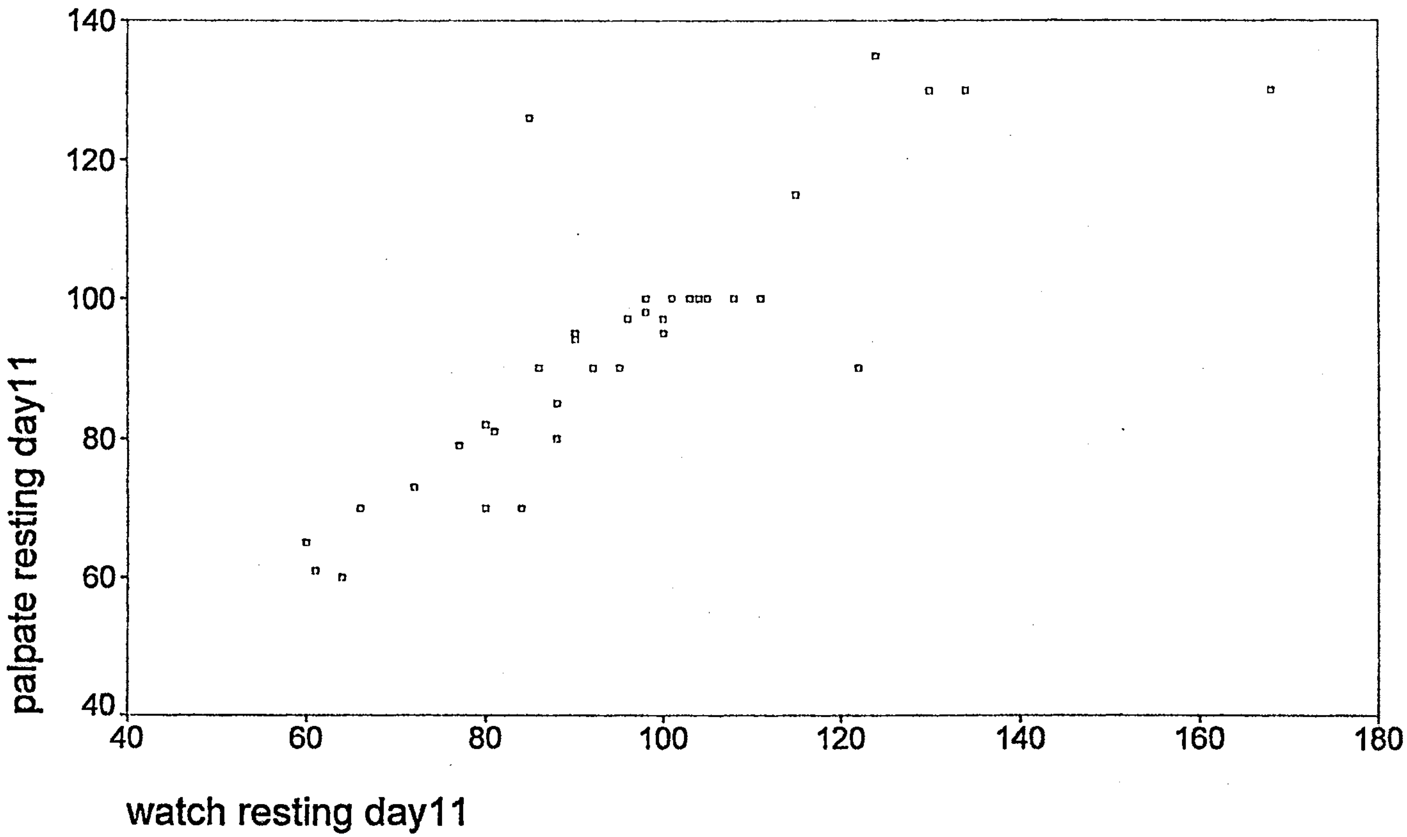
palpate resting day 10
60
70
80
90
100
110
120
130
140
watch resting day 10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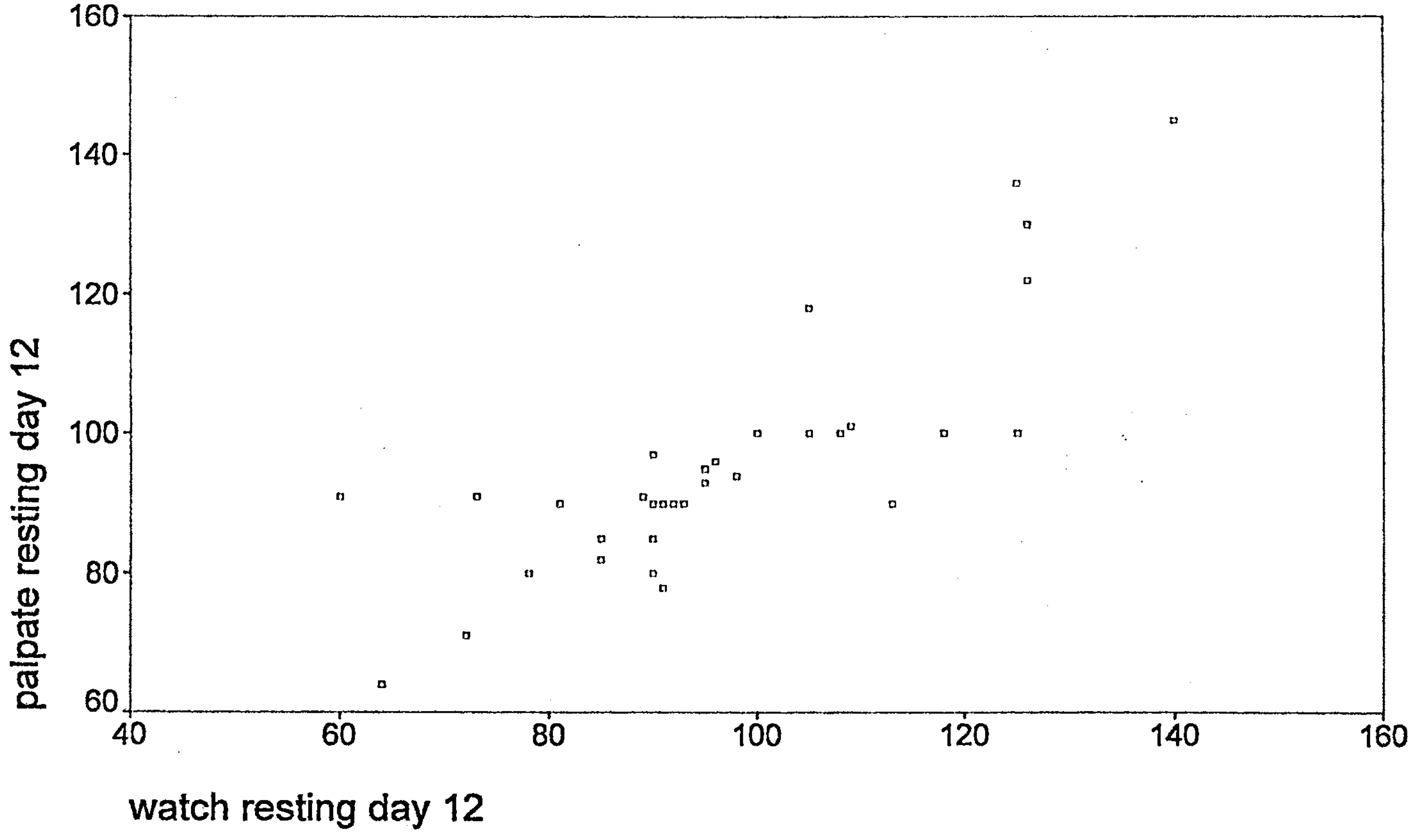

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palpate resting day 12
watch resting day 12

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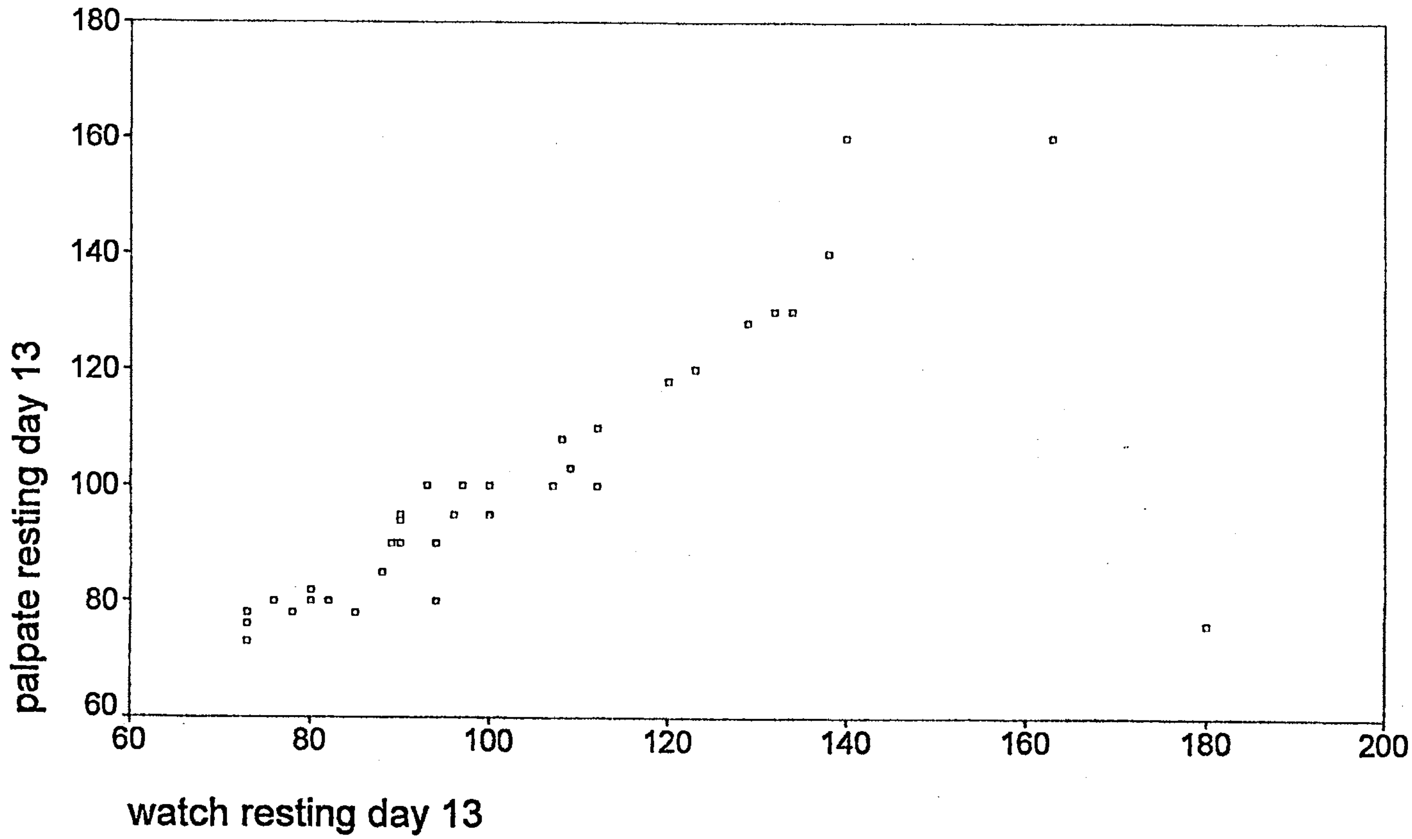
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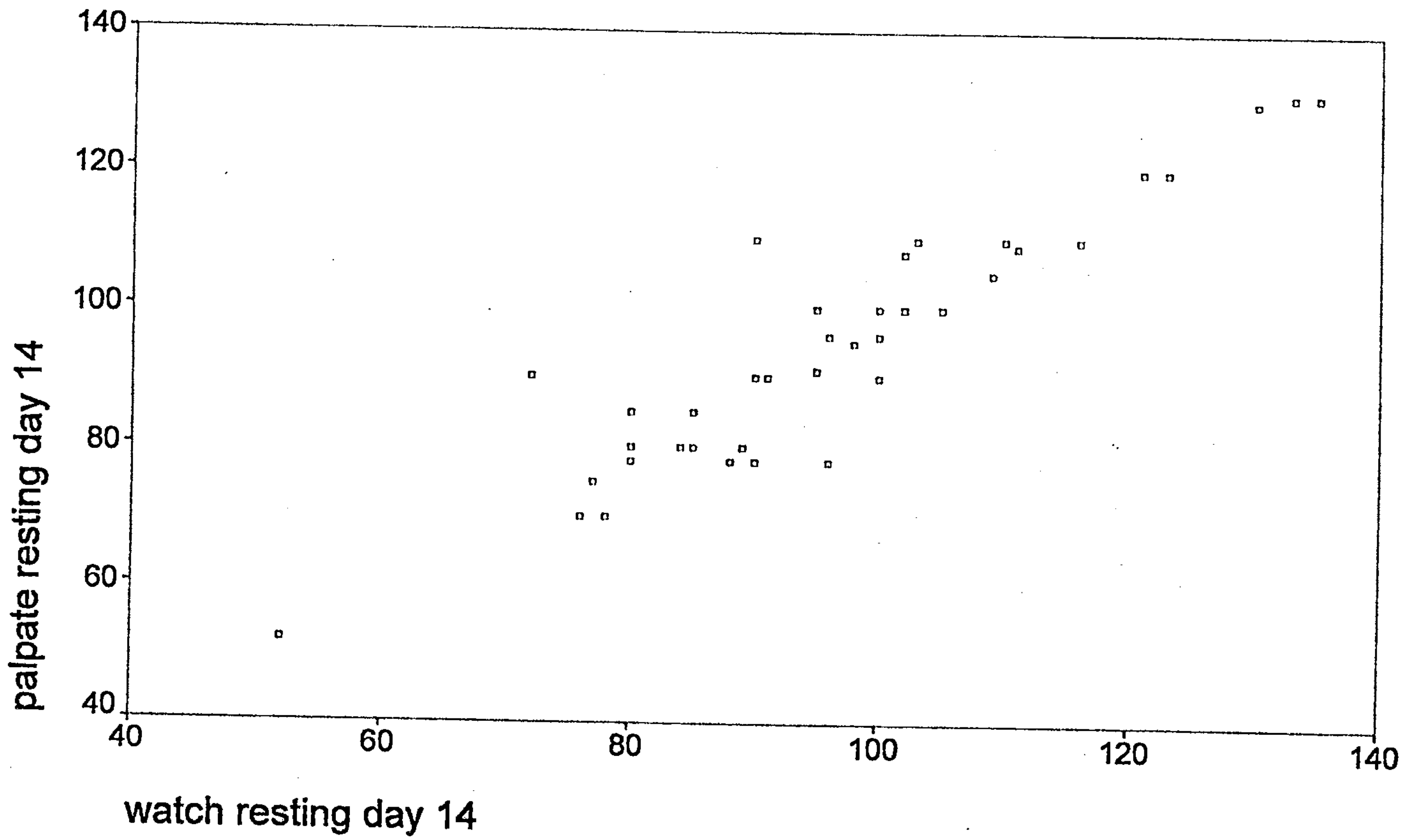
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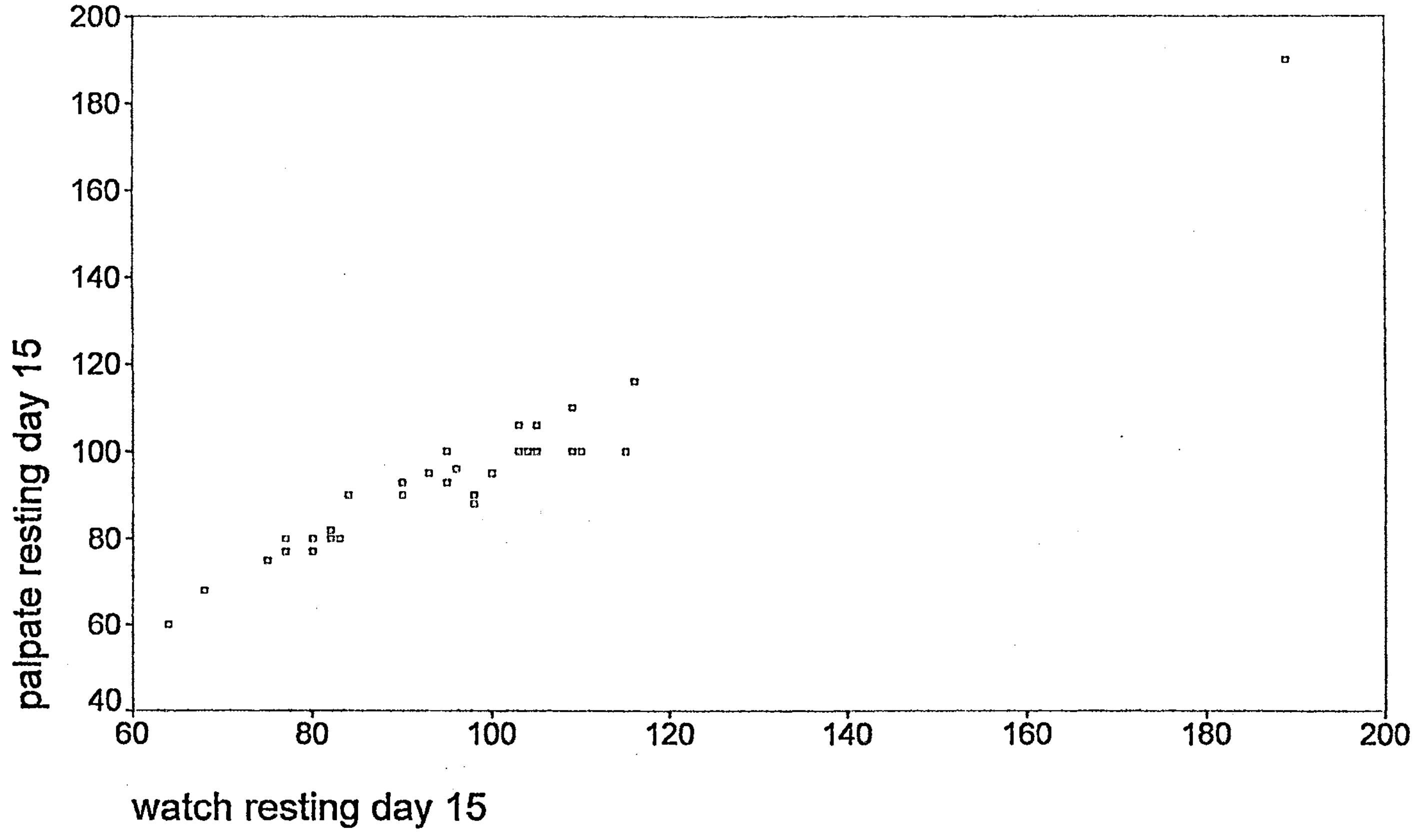
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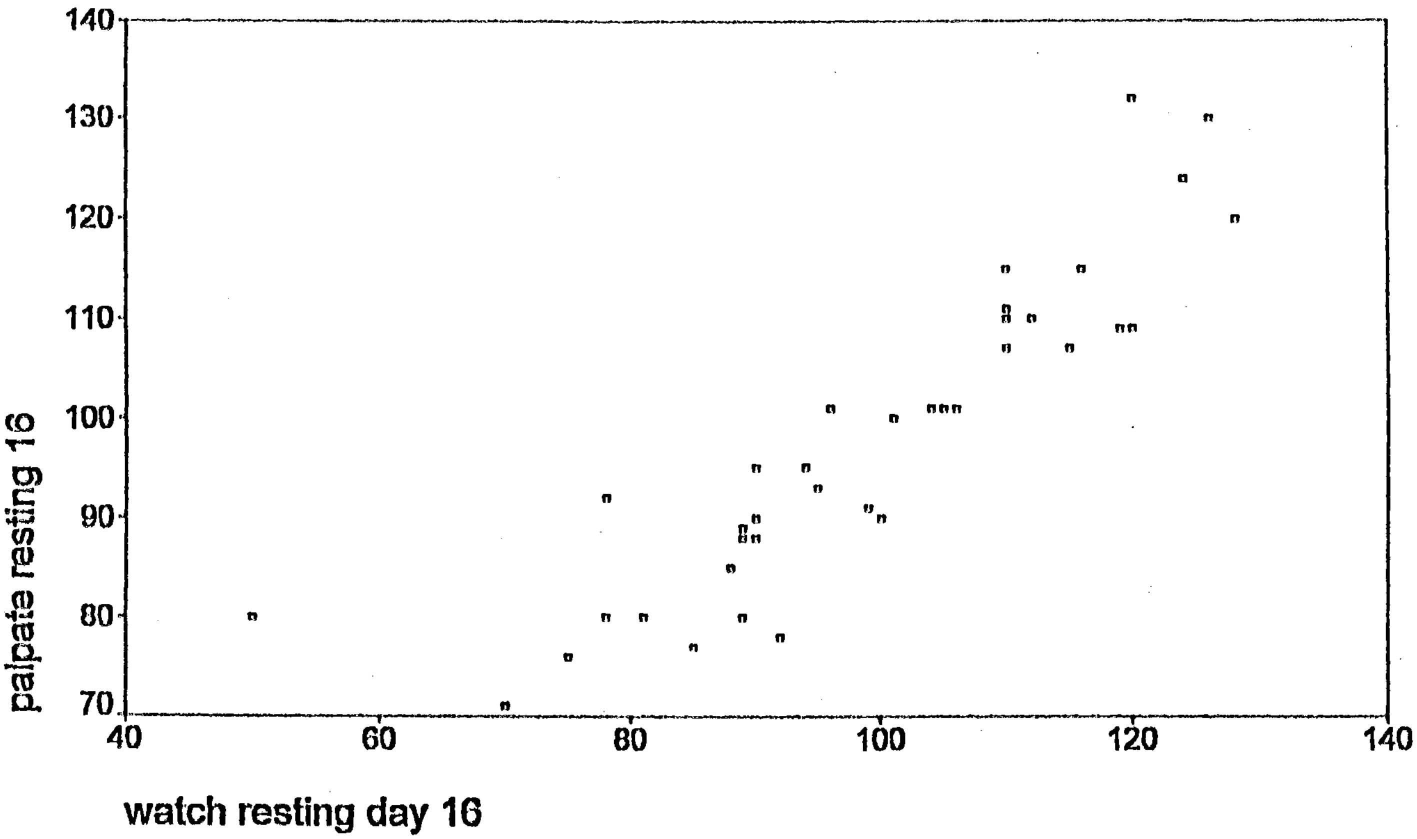
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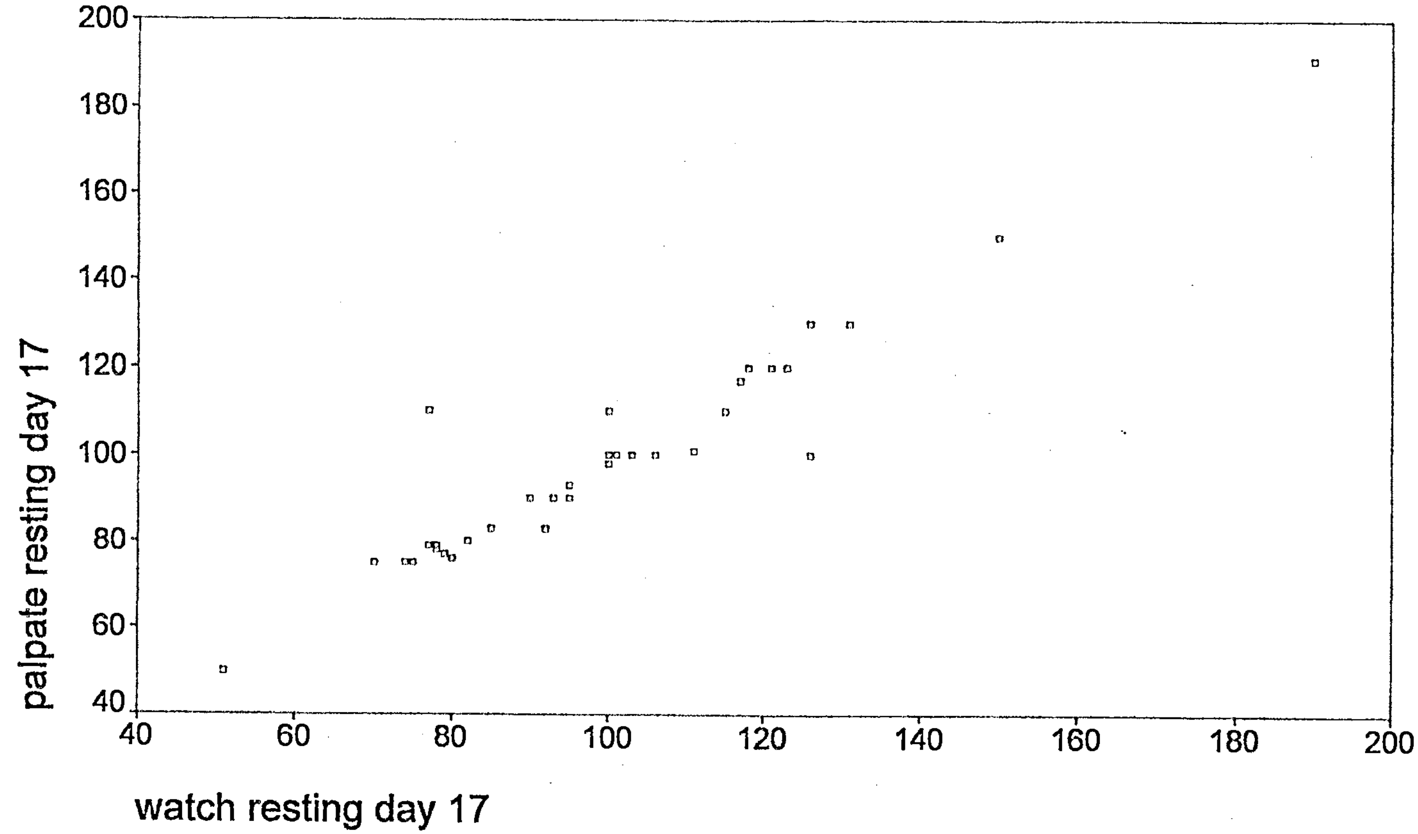
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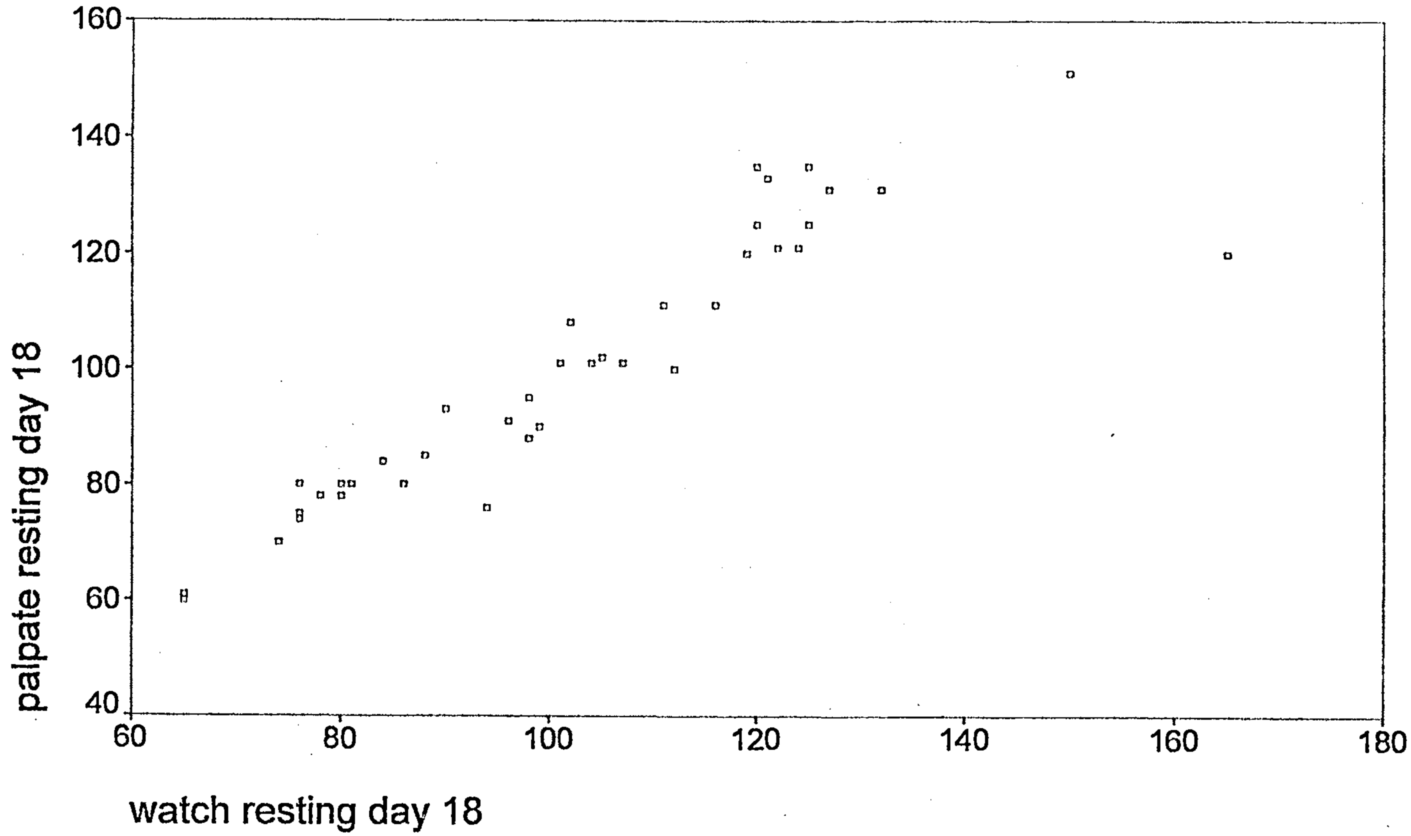
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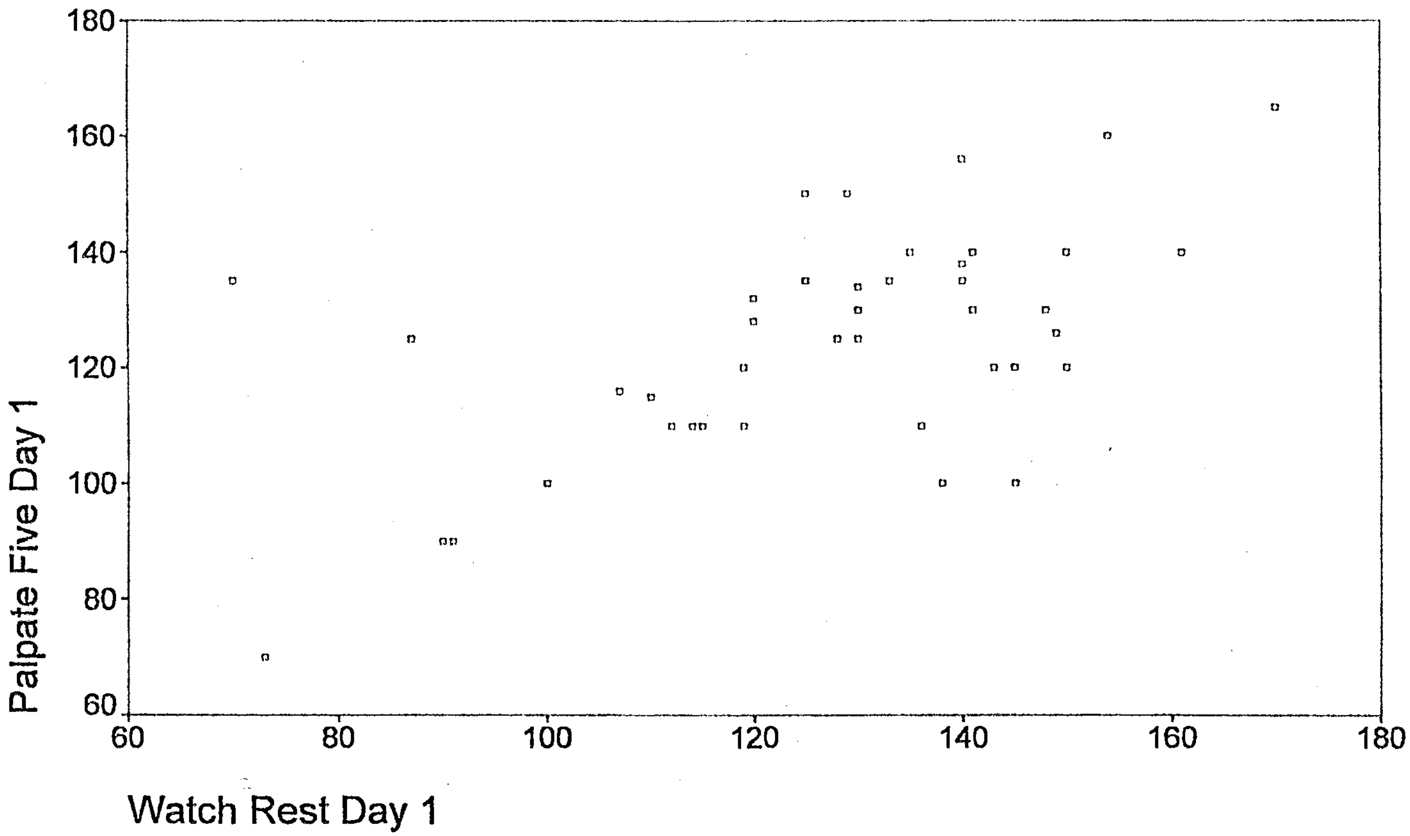
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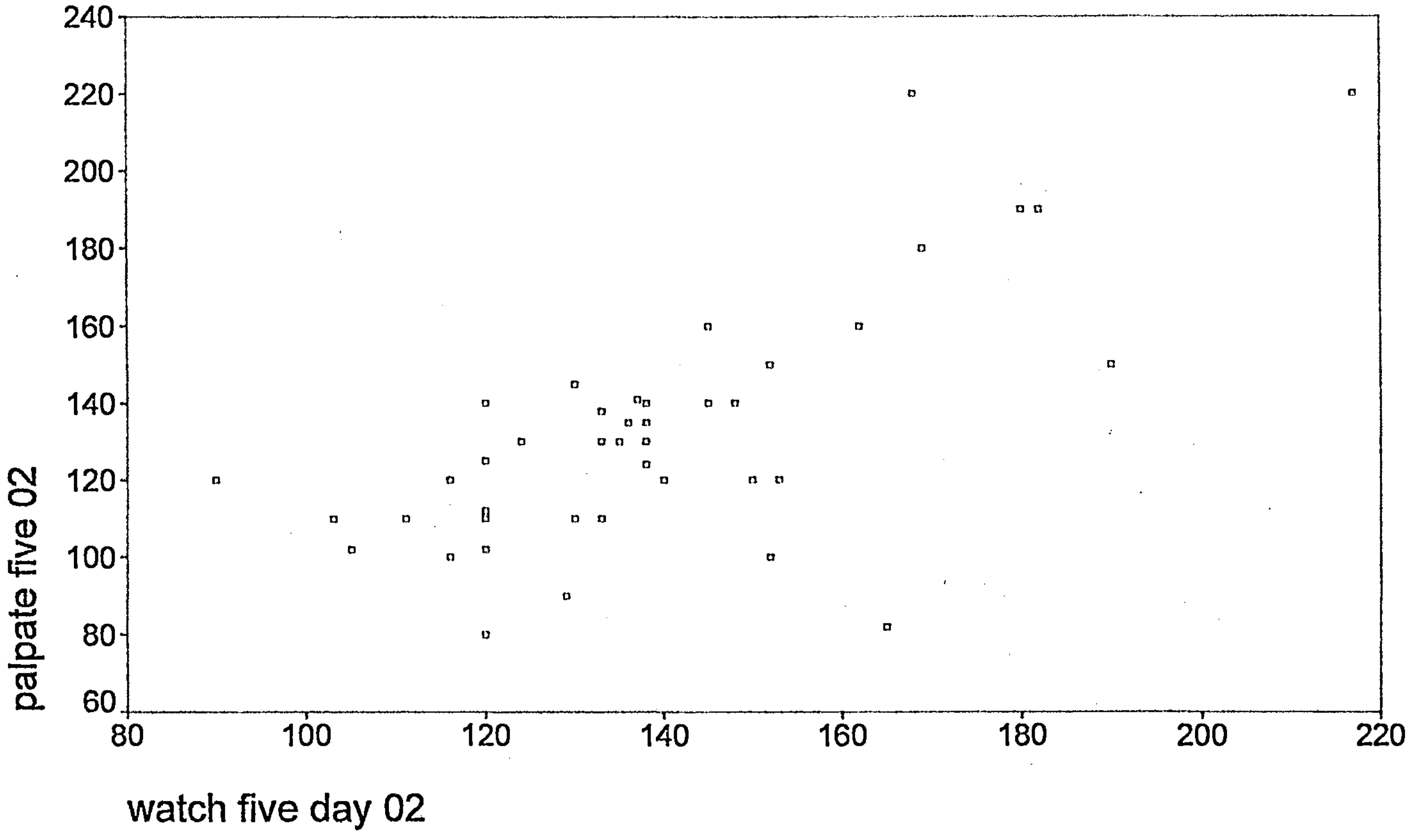
Palpate Five Day 1
Watch Rest Day 1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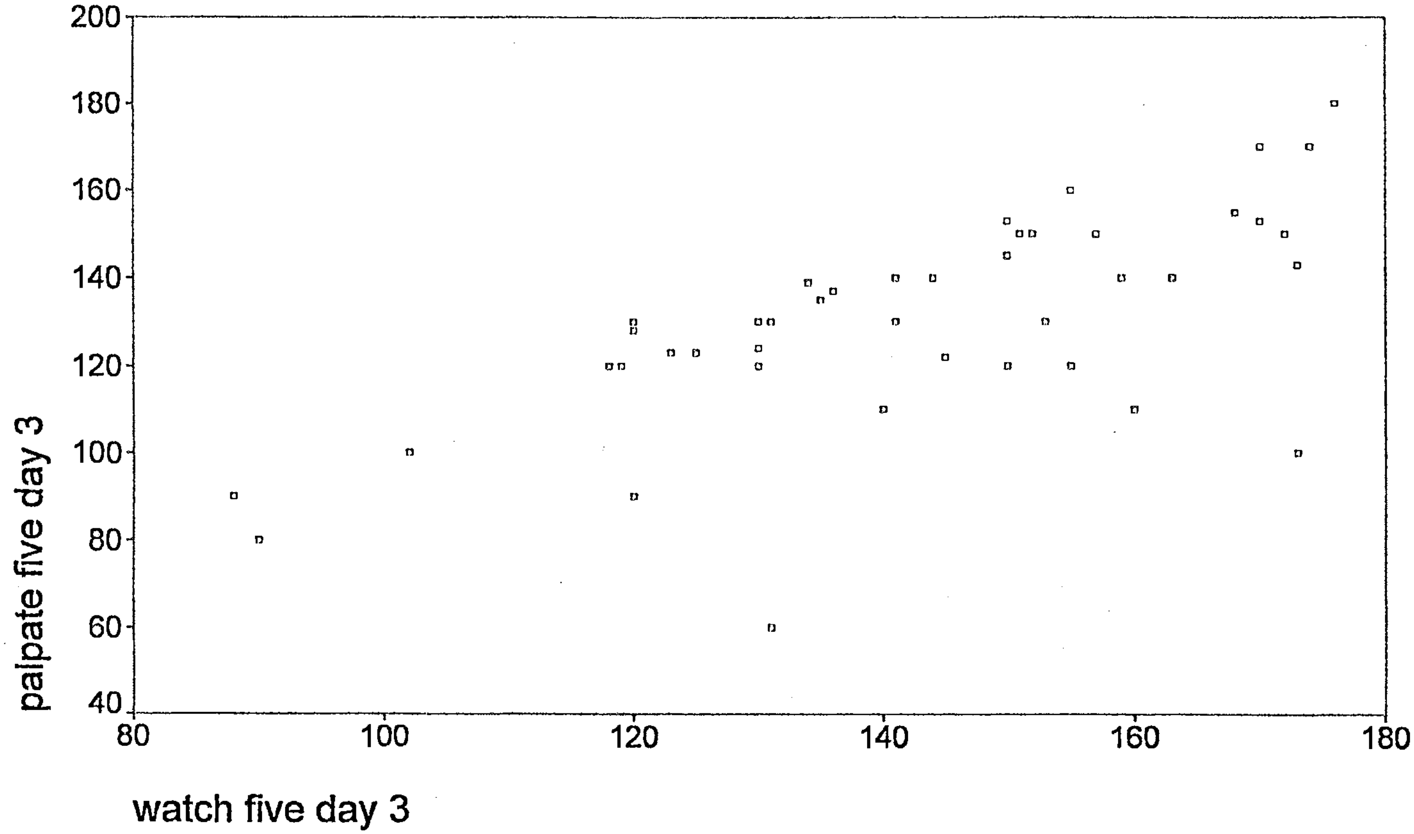
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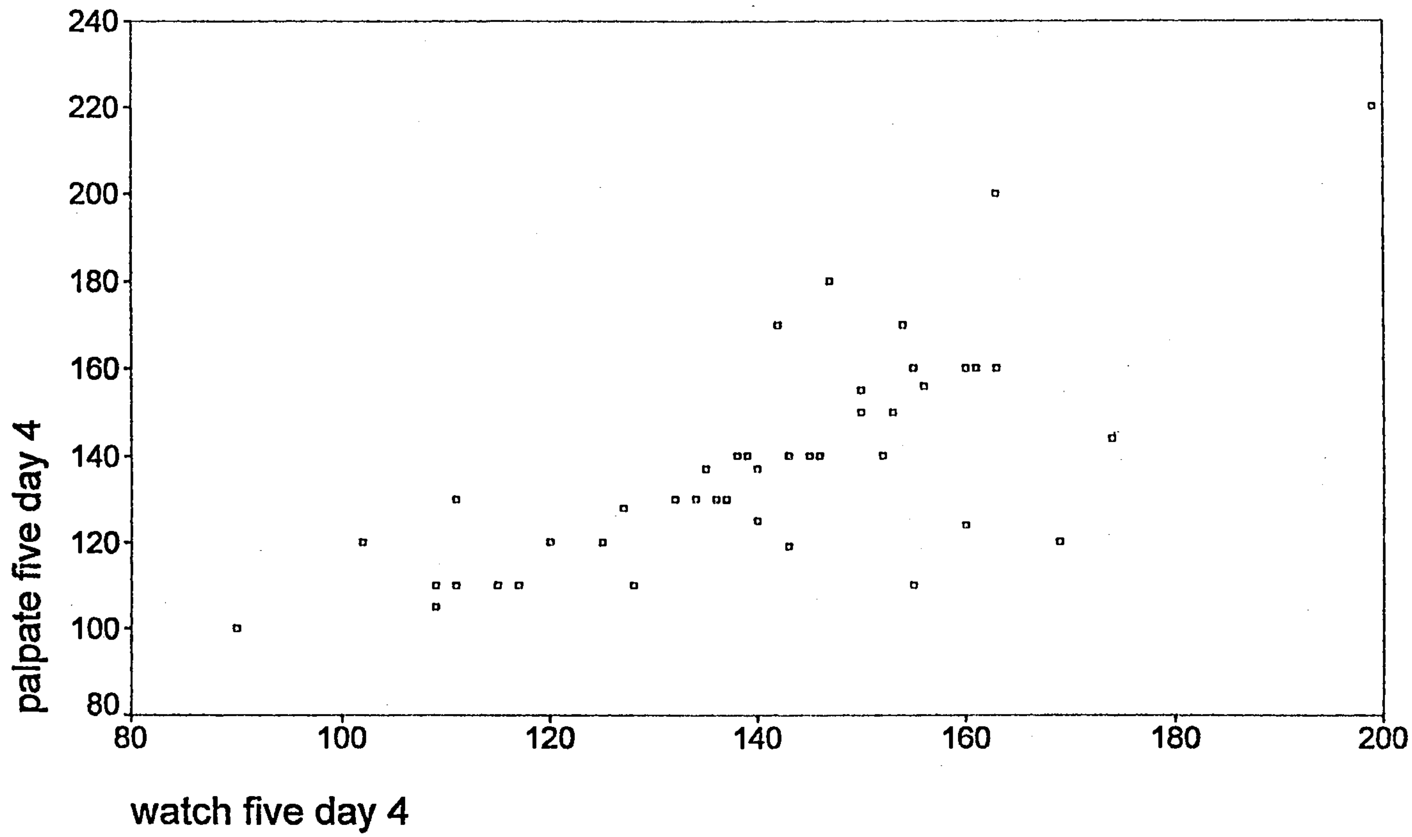
watch five day 3



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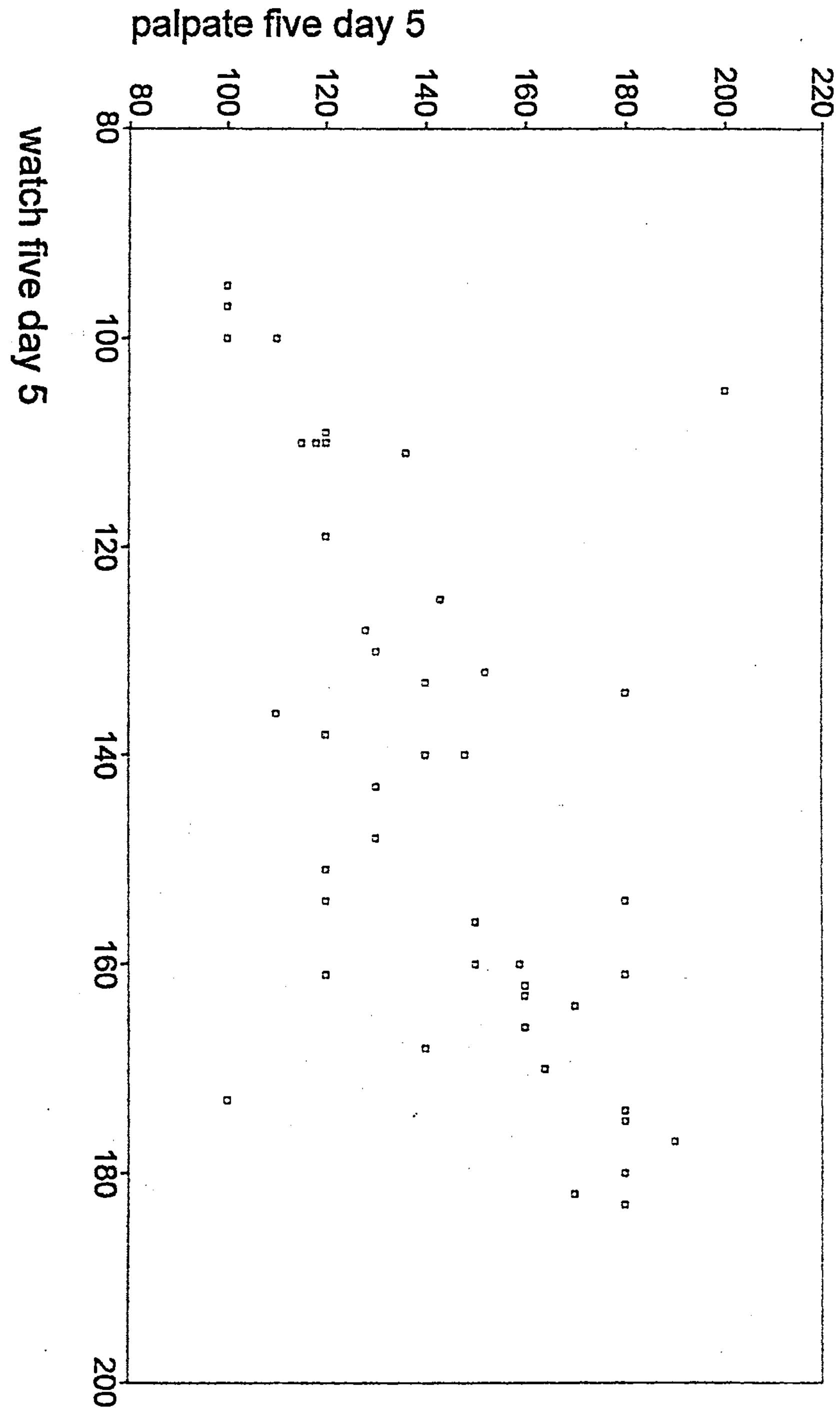
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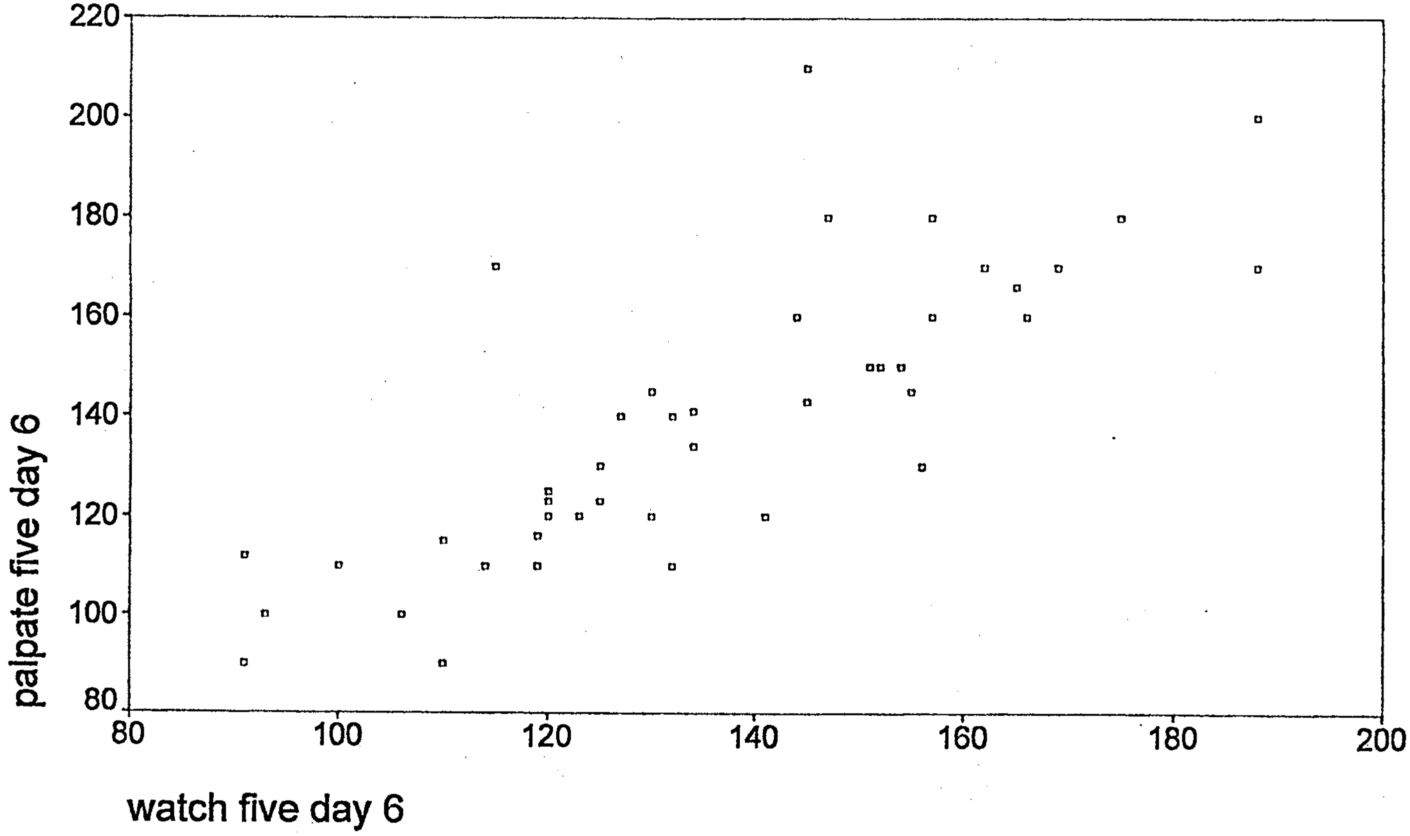
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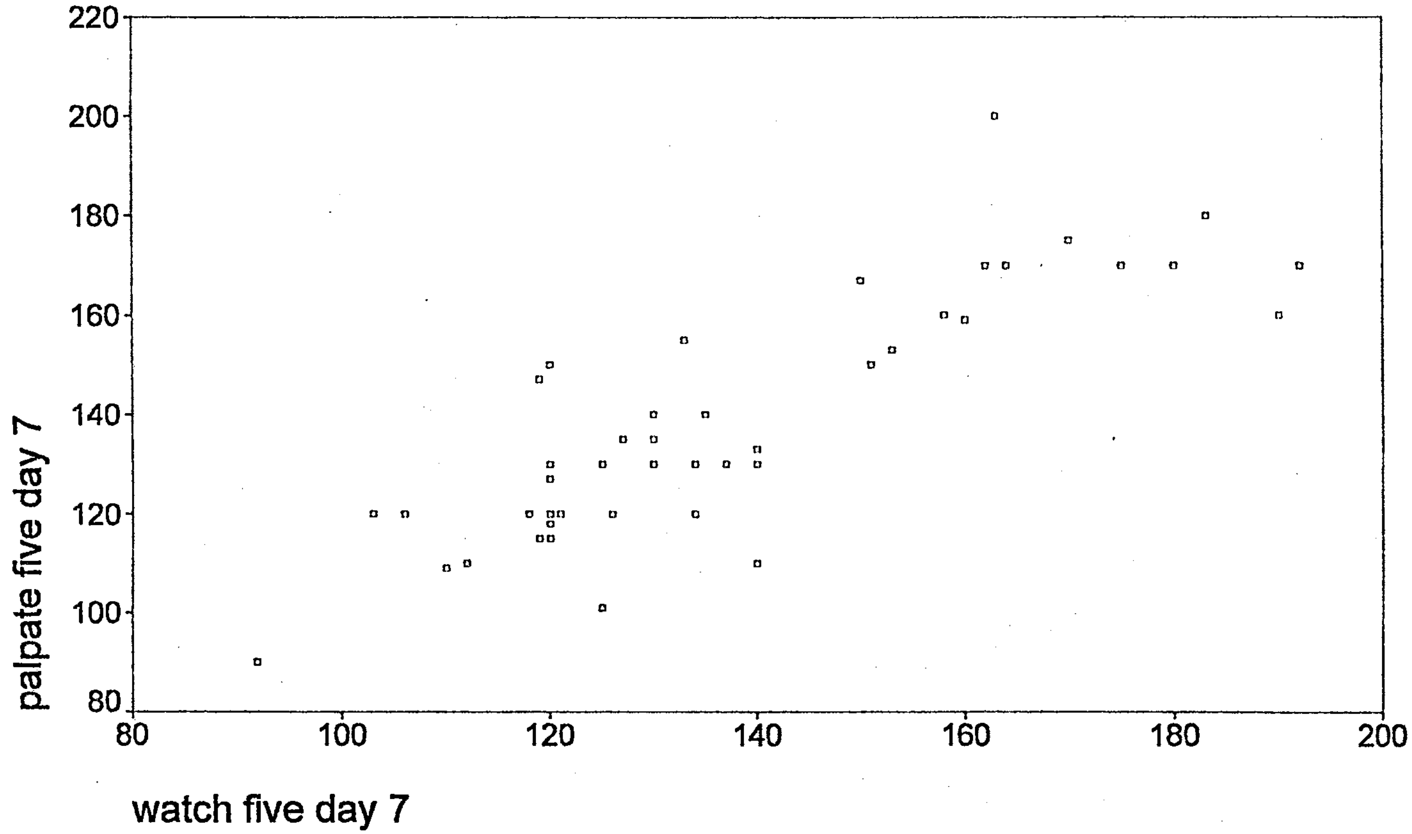
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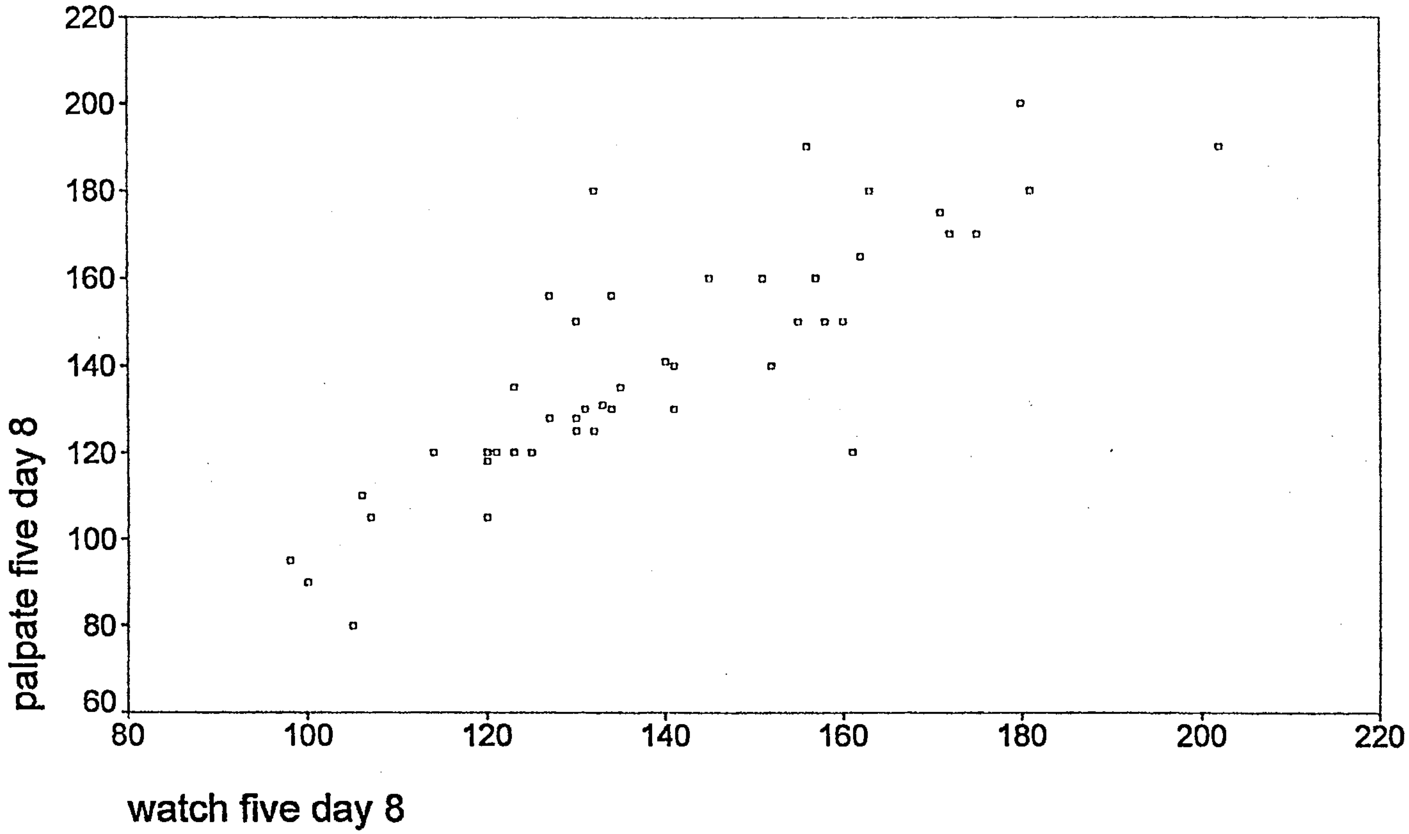
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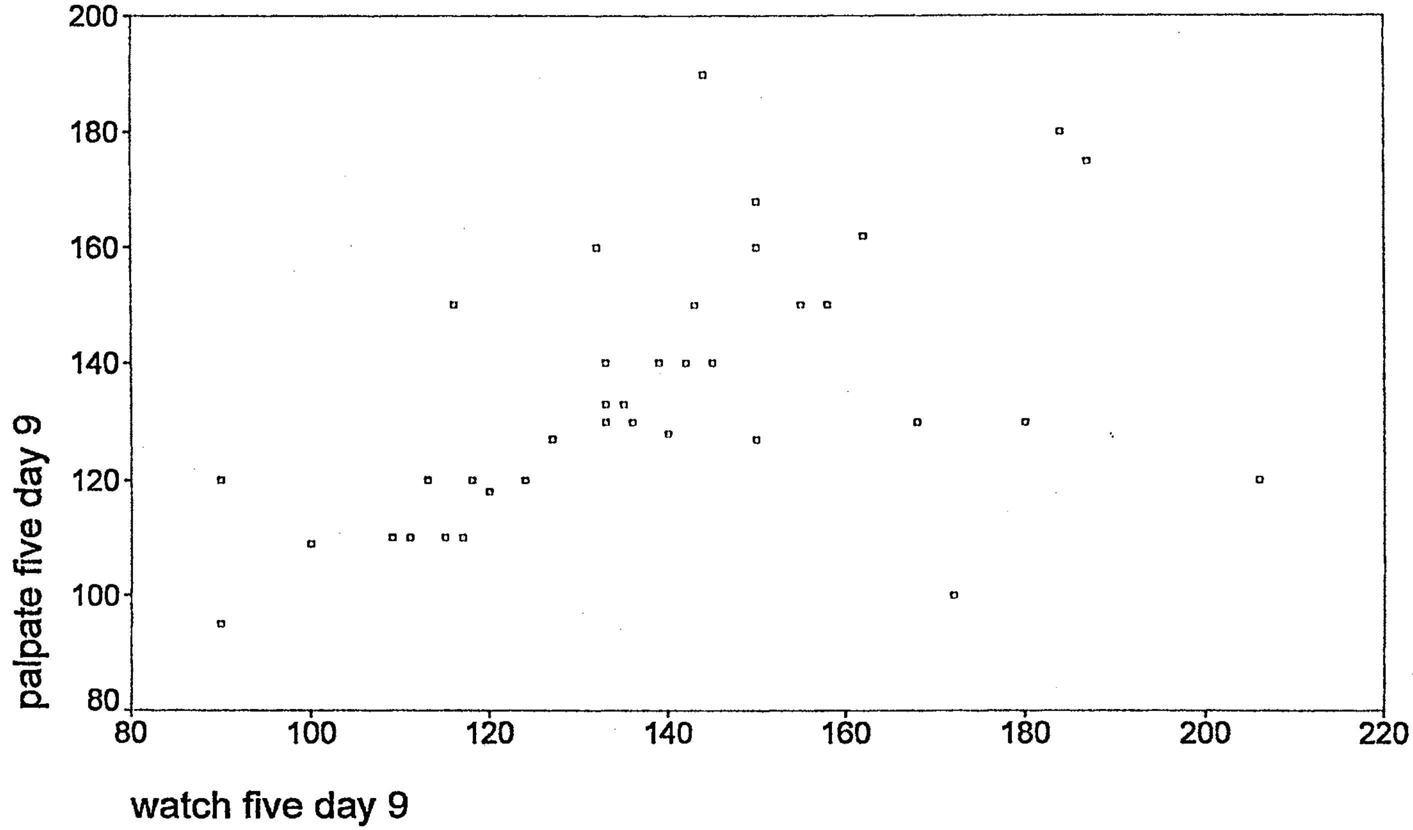
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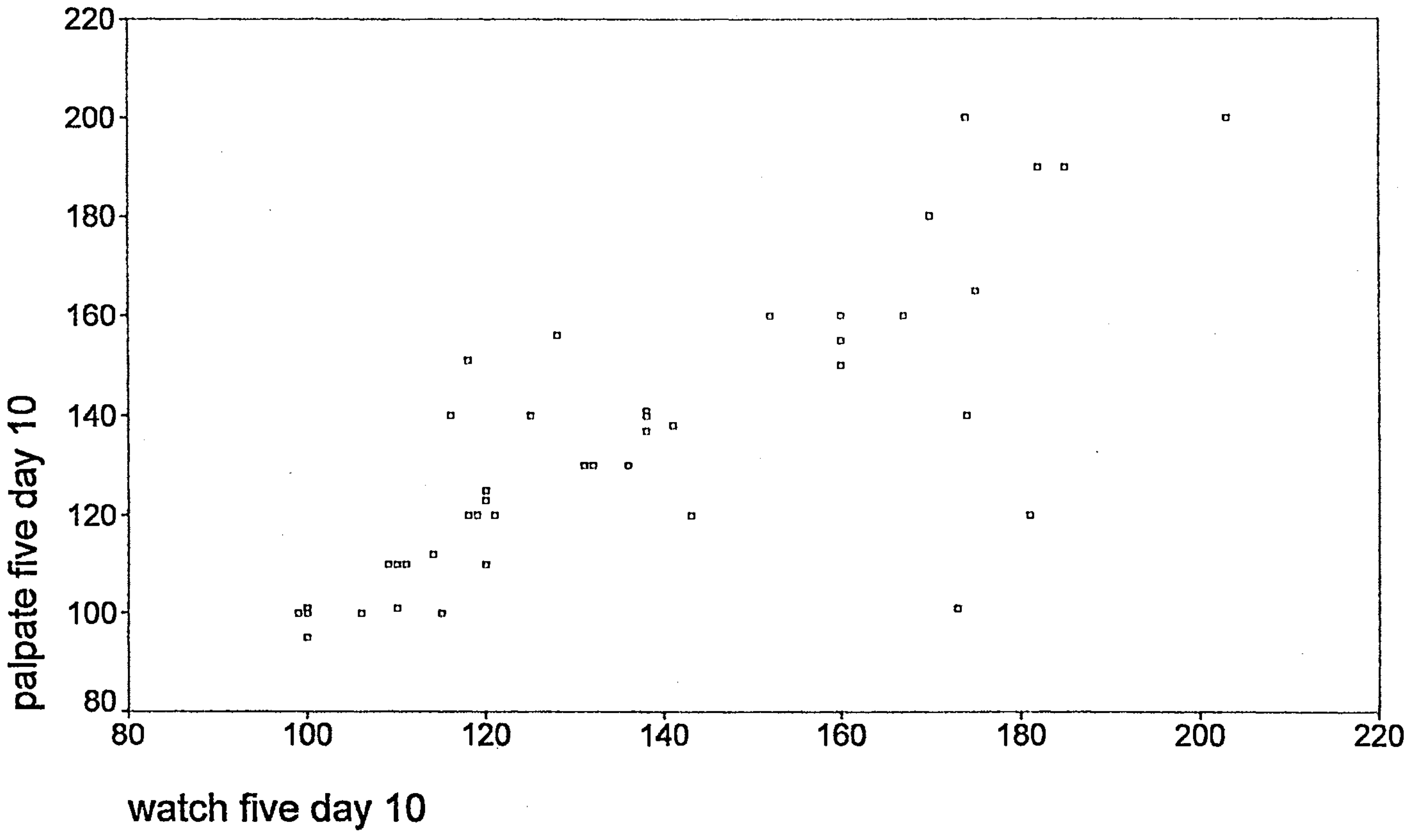
watch five day 9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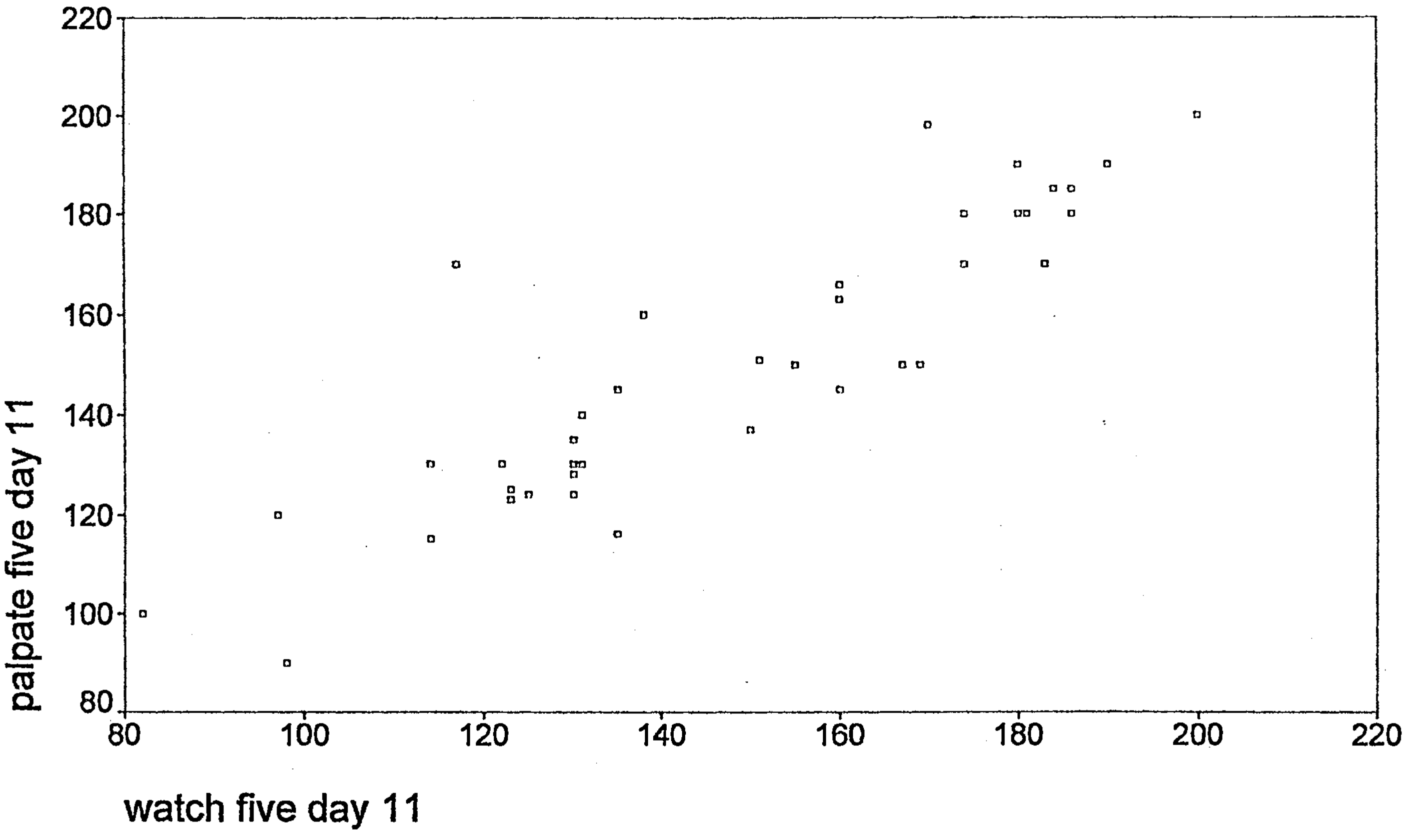
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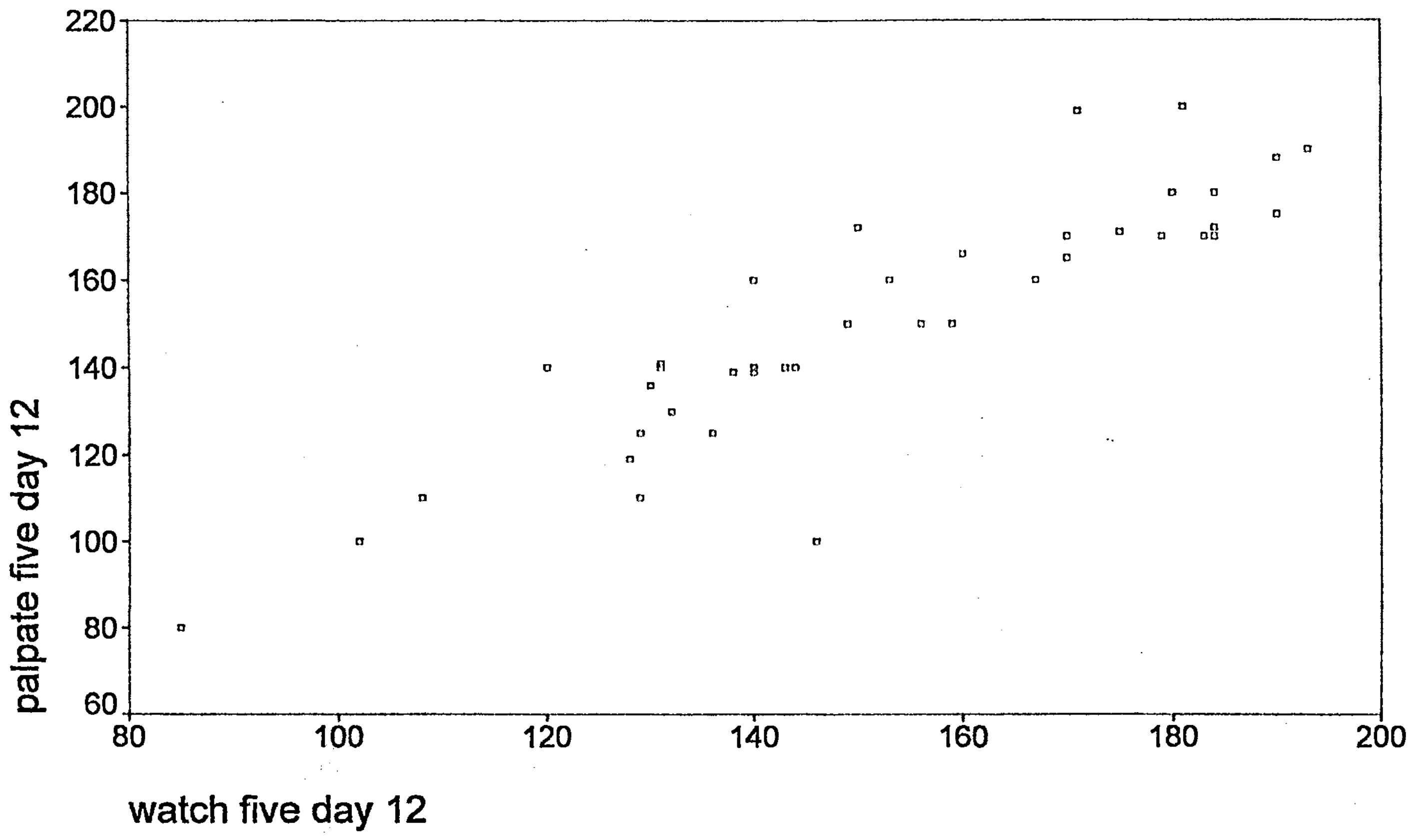
palpate five day 11
watch five day 11



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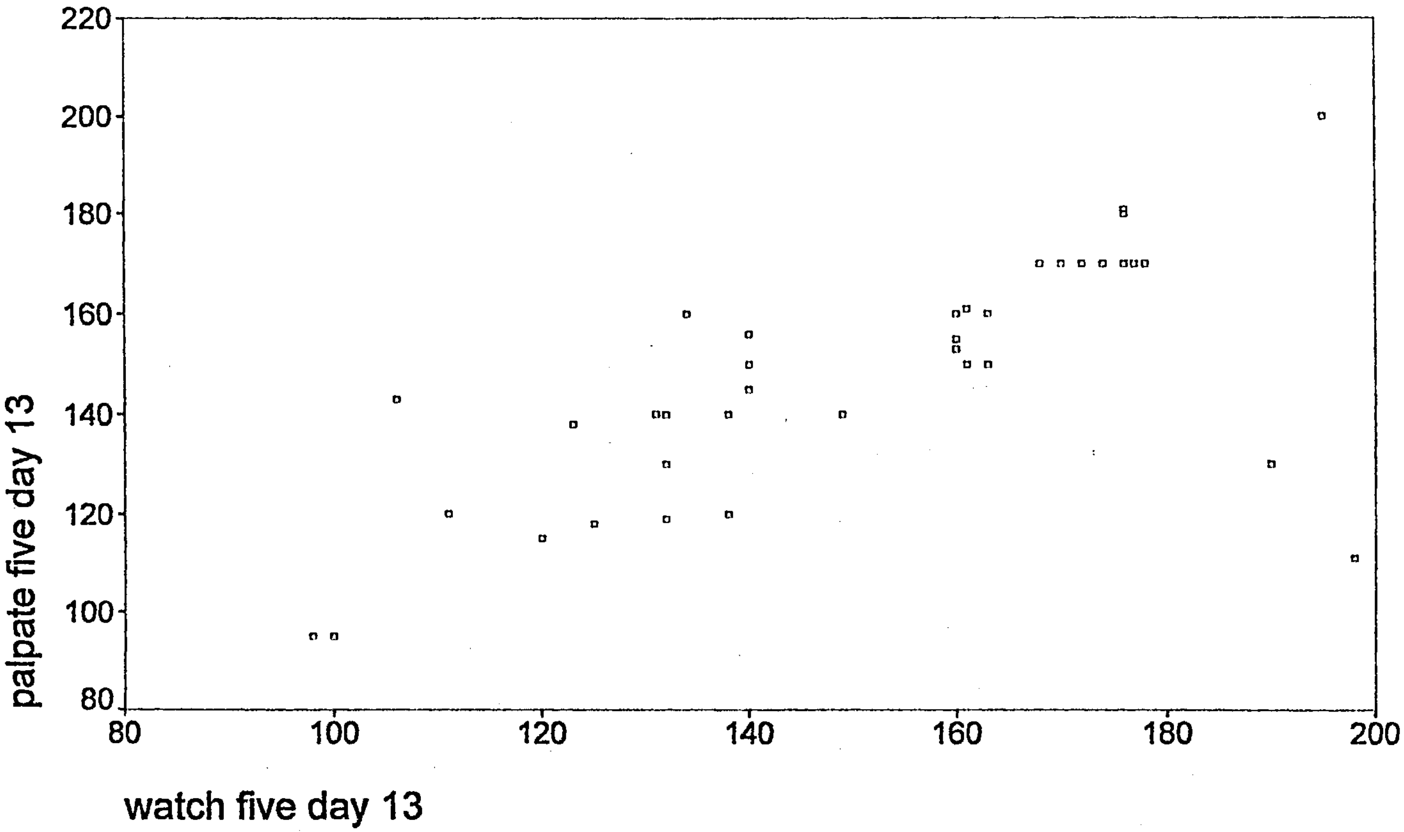
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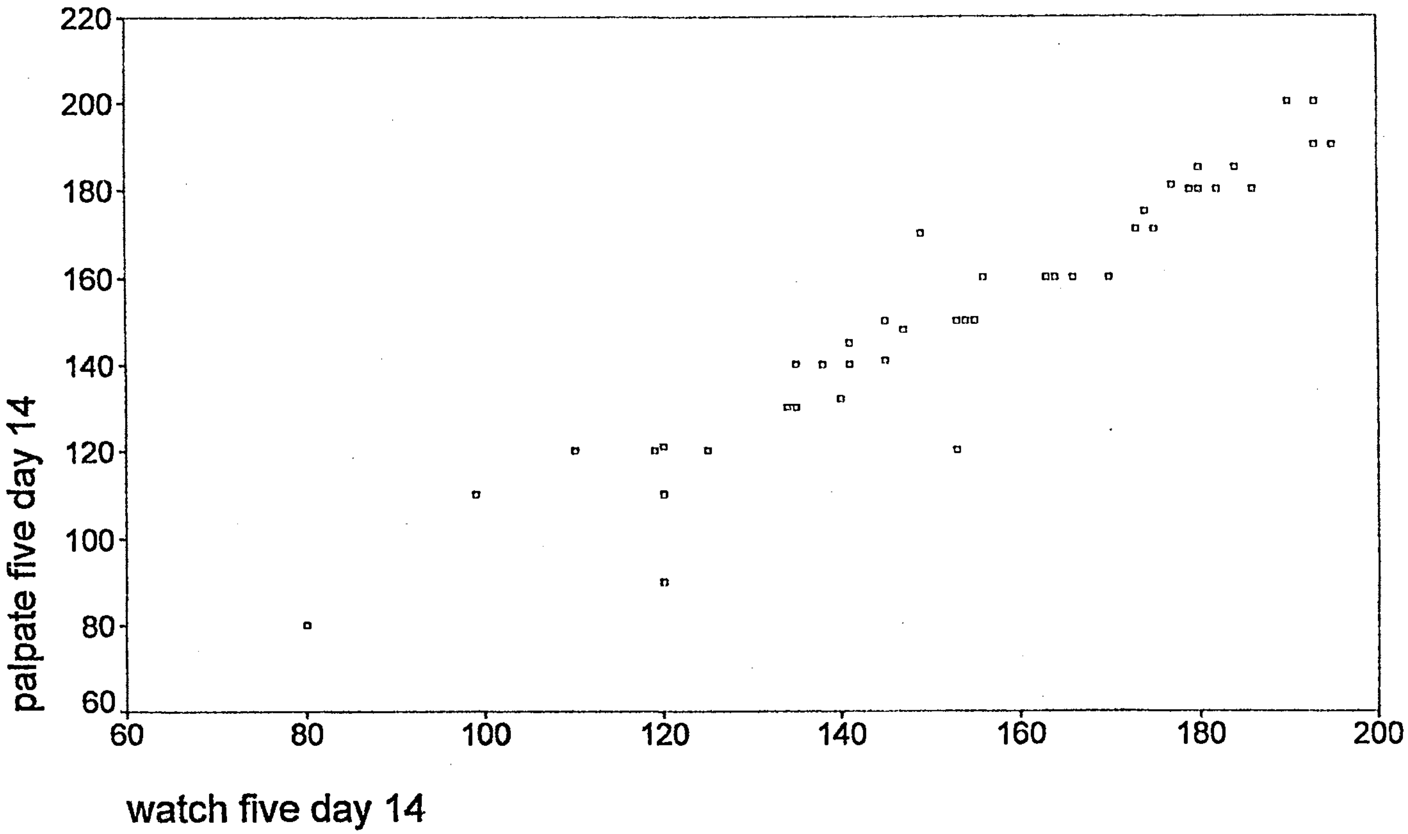
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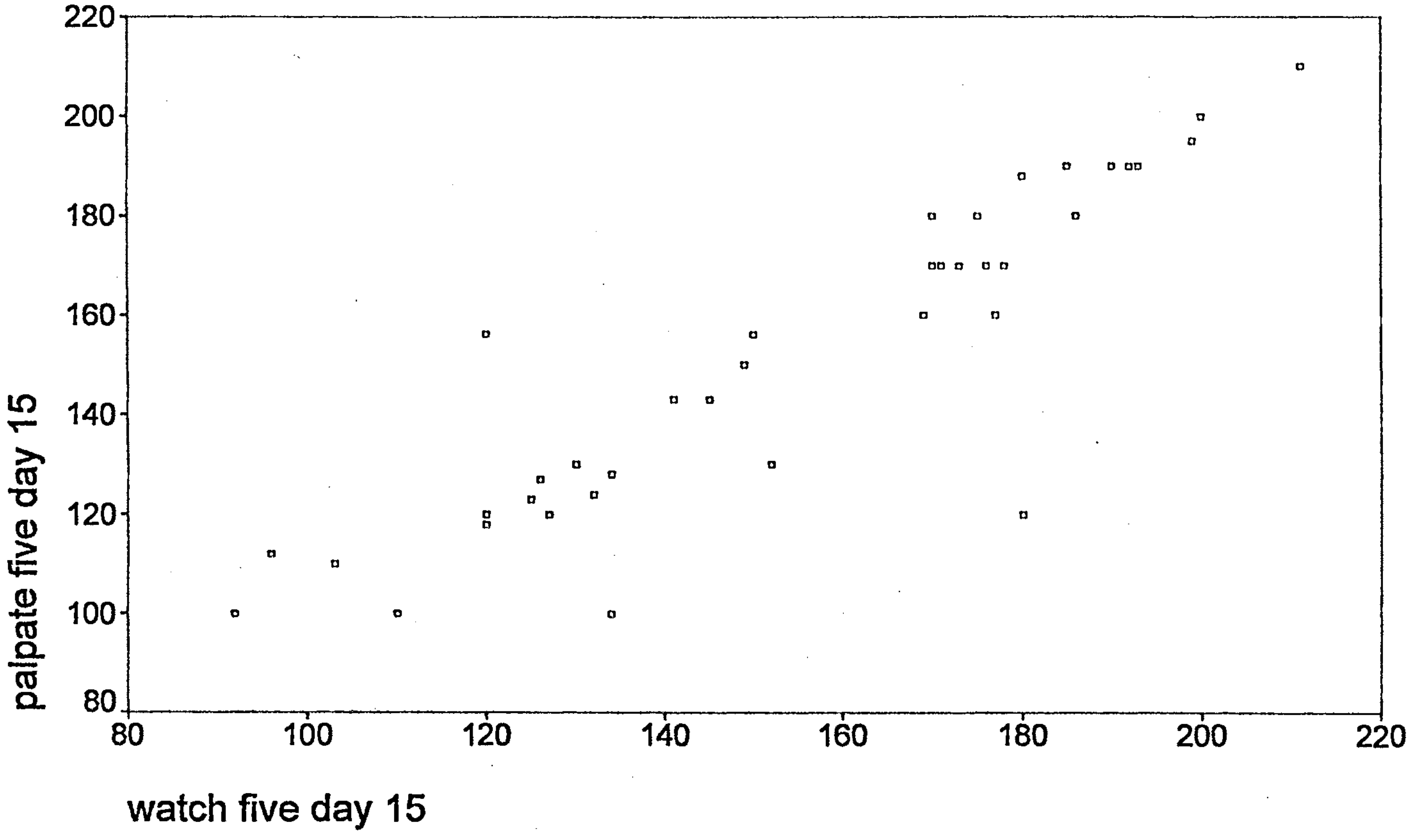
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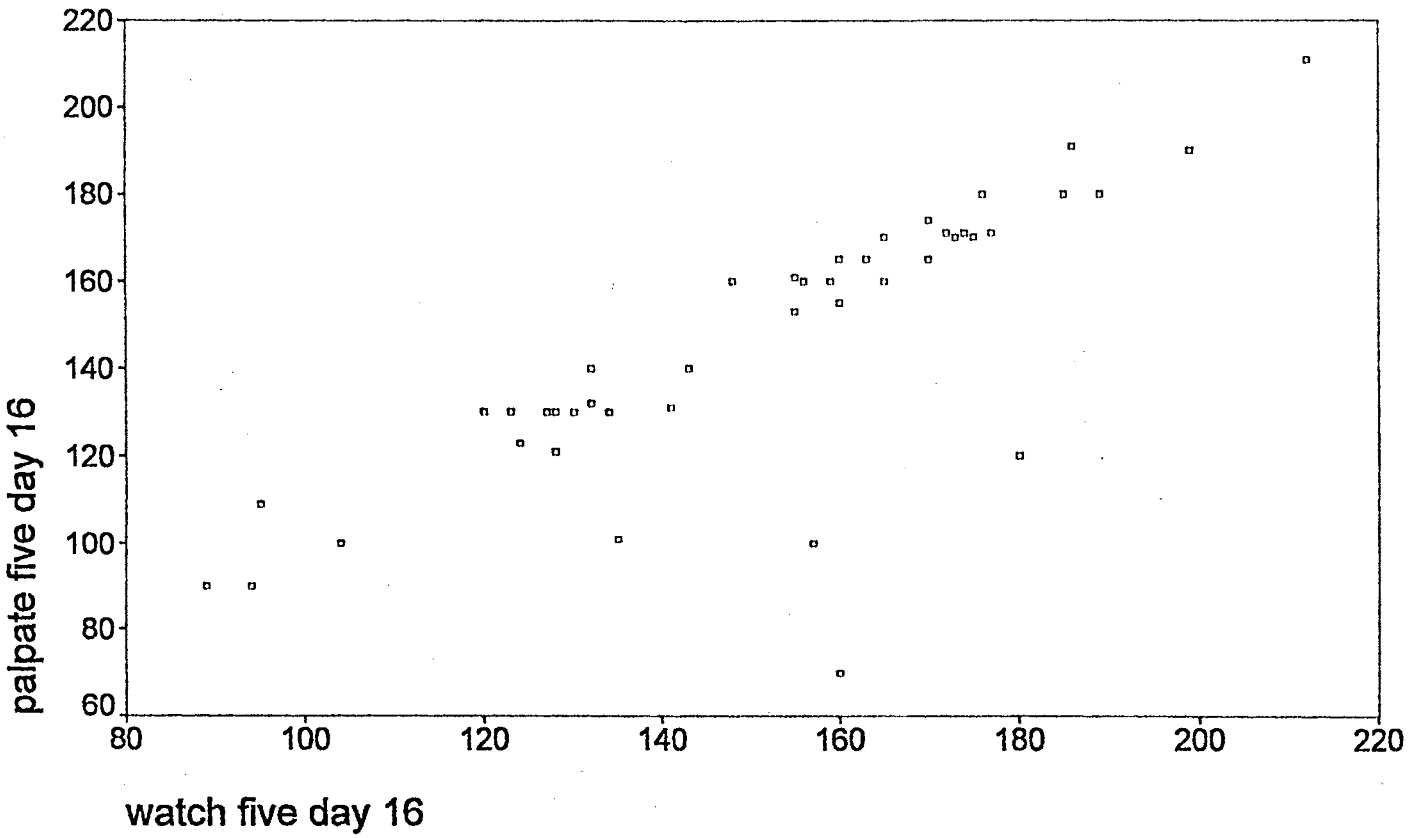
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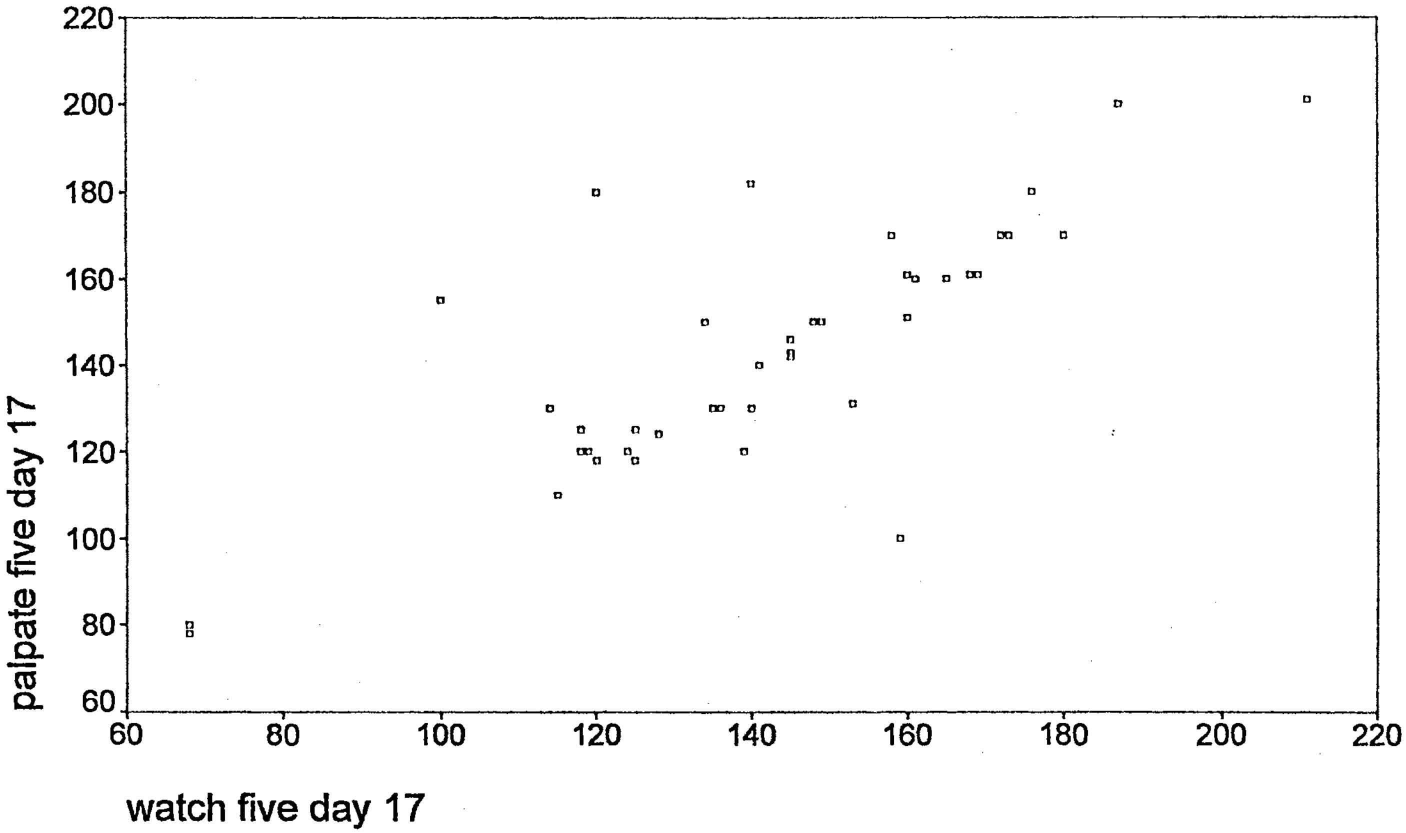
watch five day 16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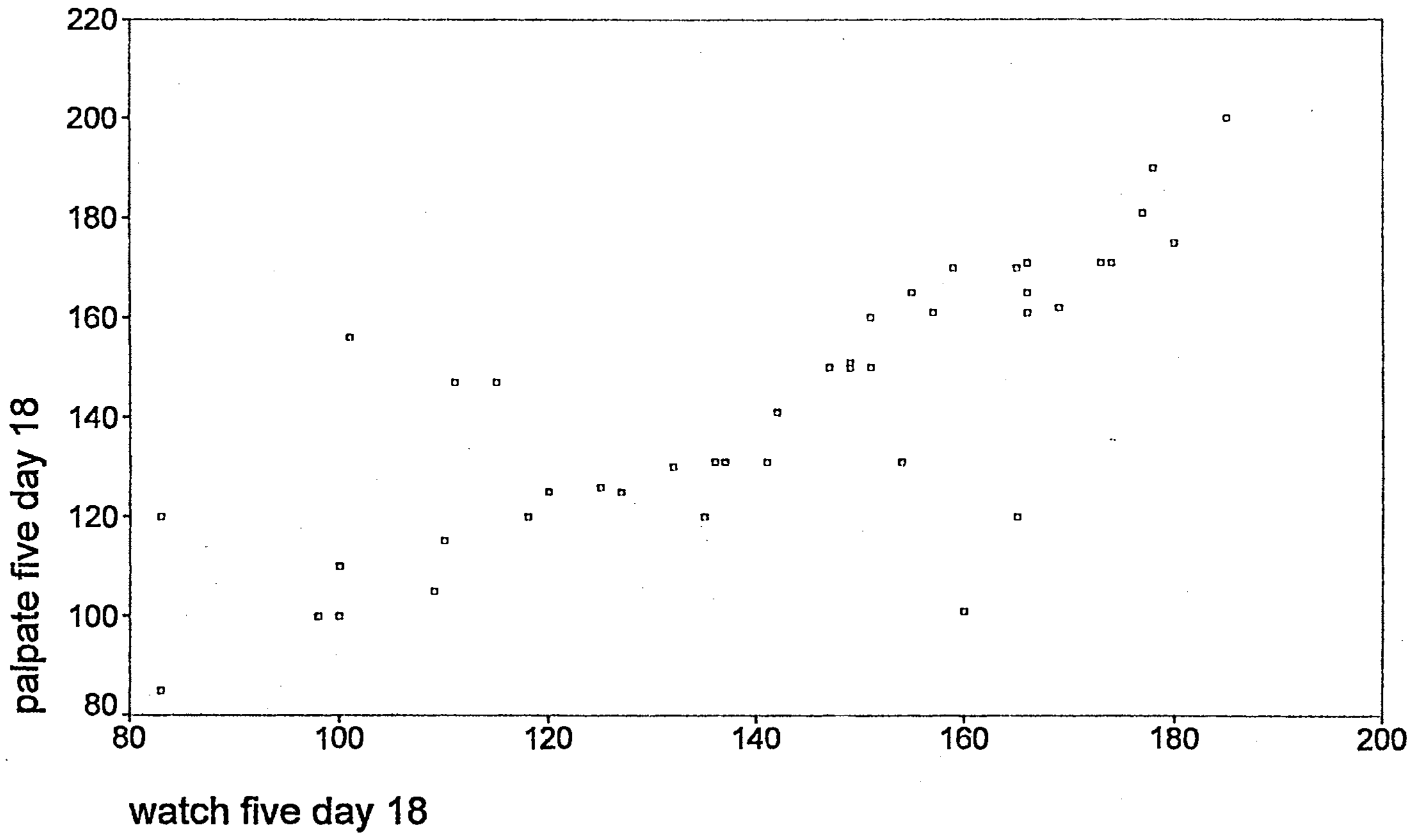
watch five day 17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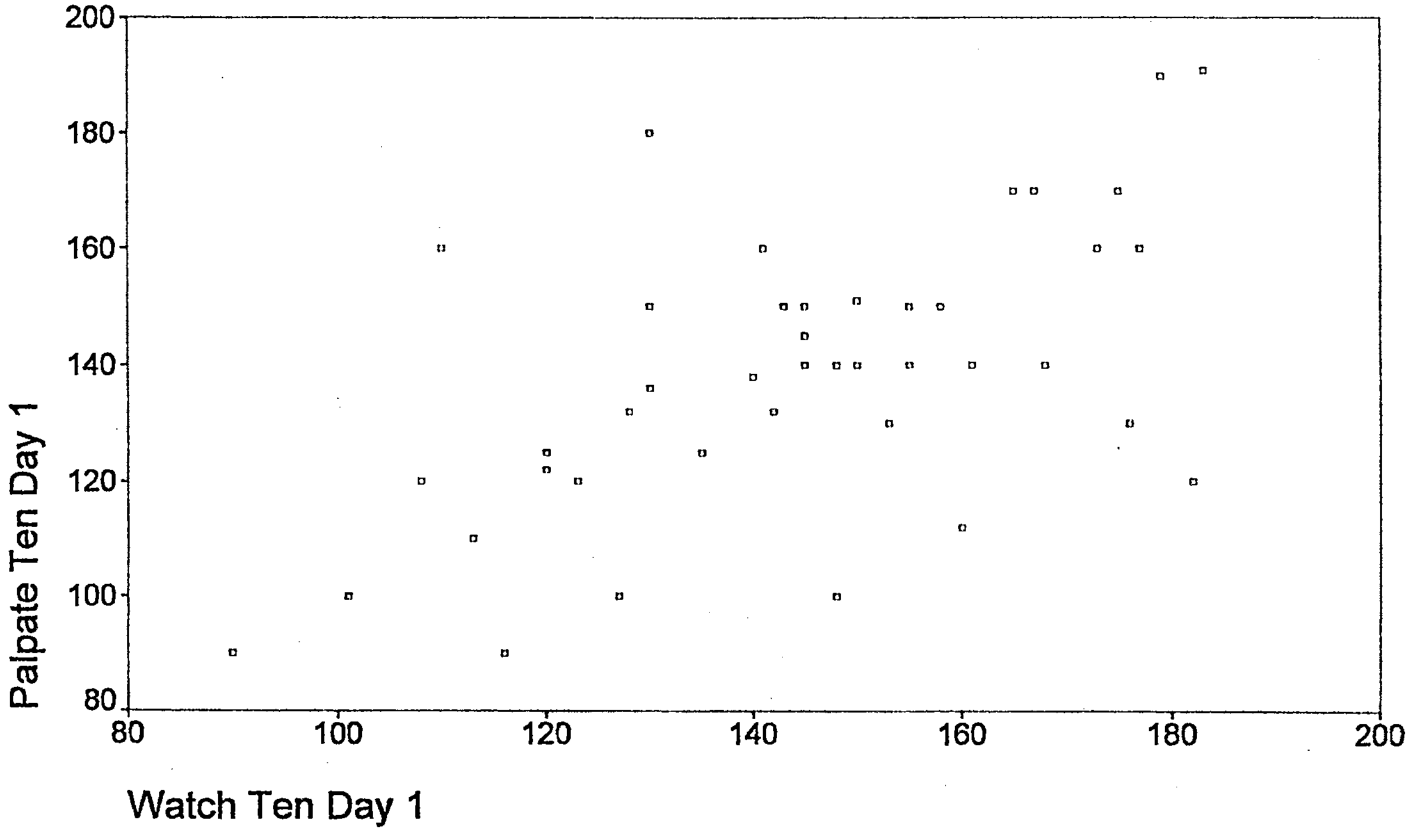
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Palpate Ten Day 1
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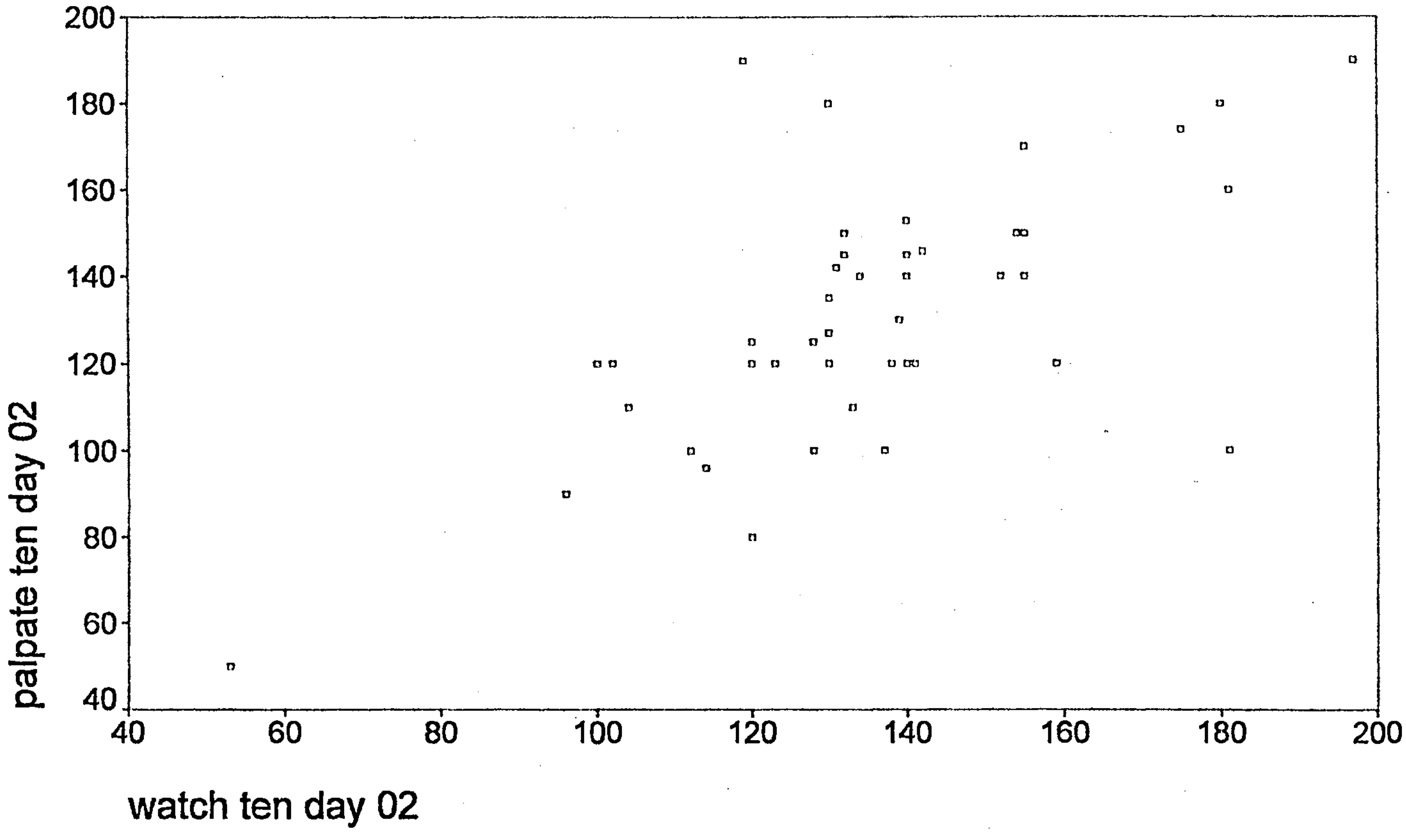
Watch Ten Day 1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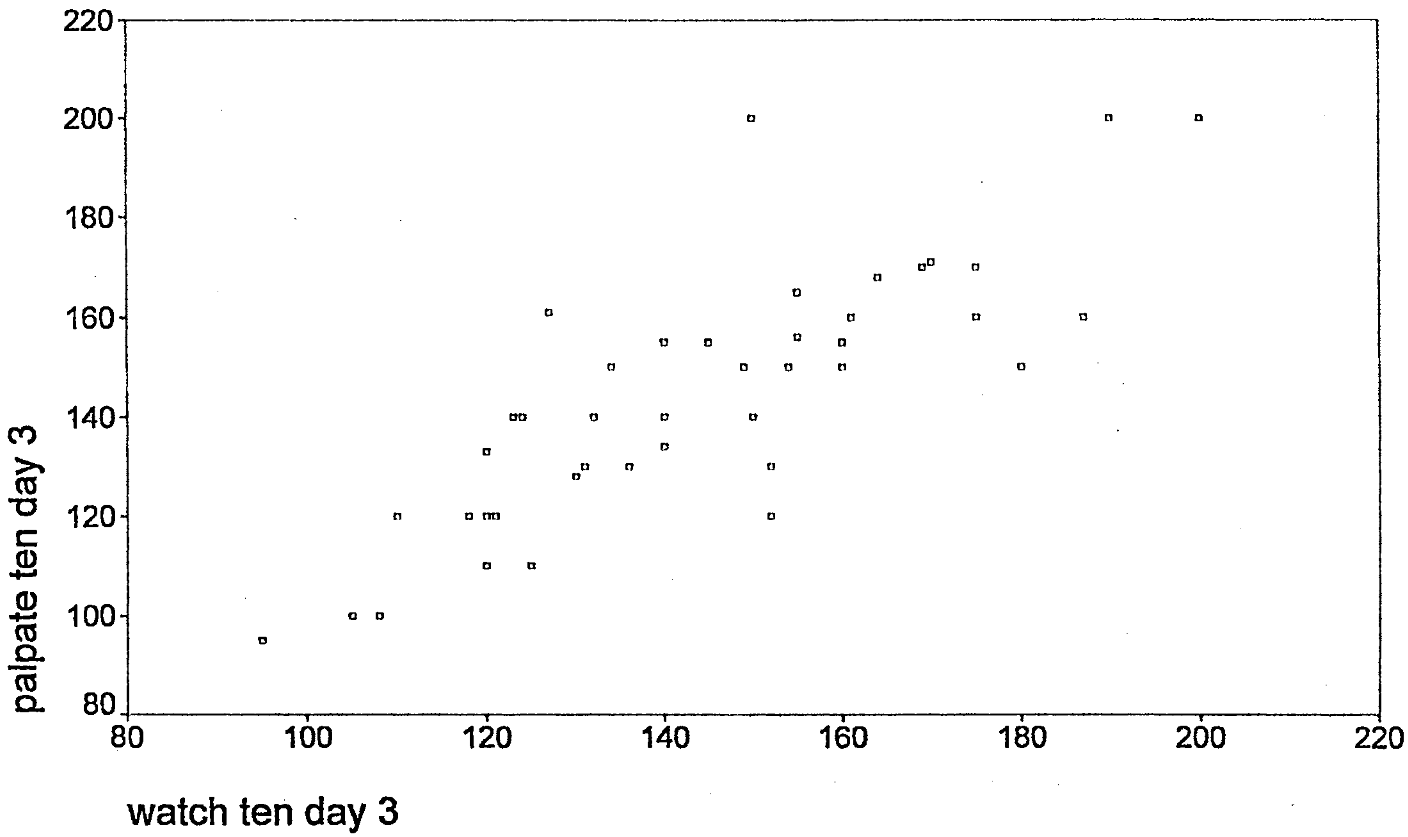
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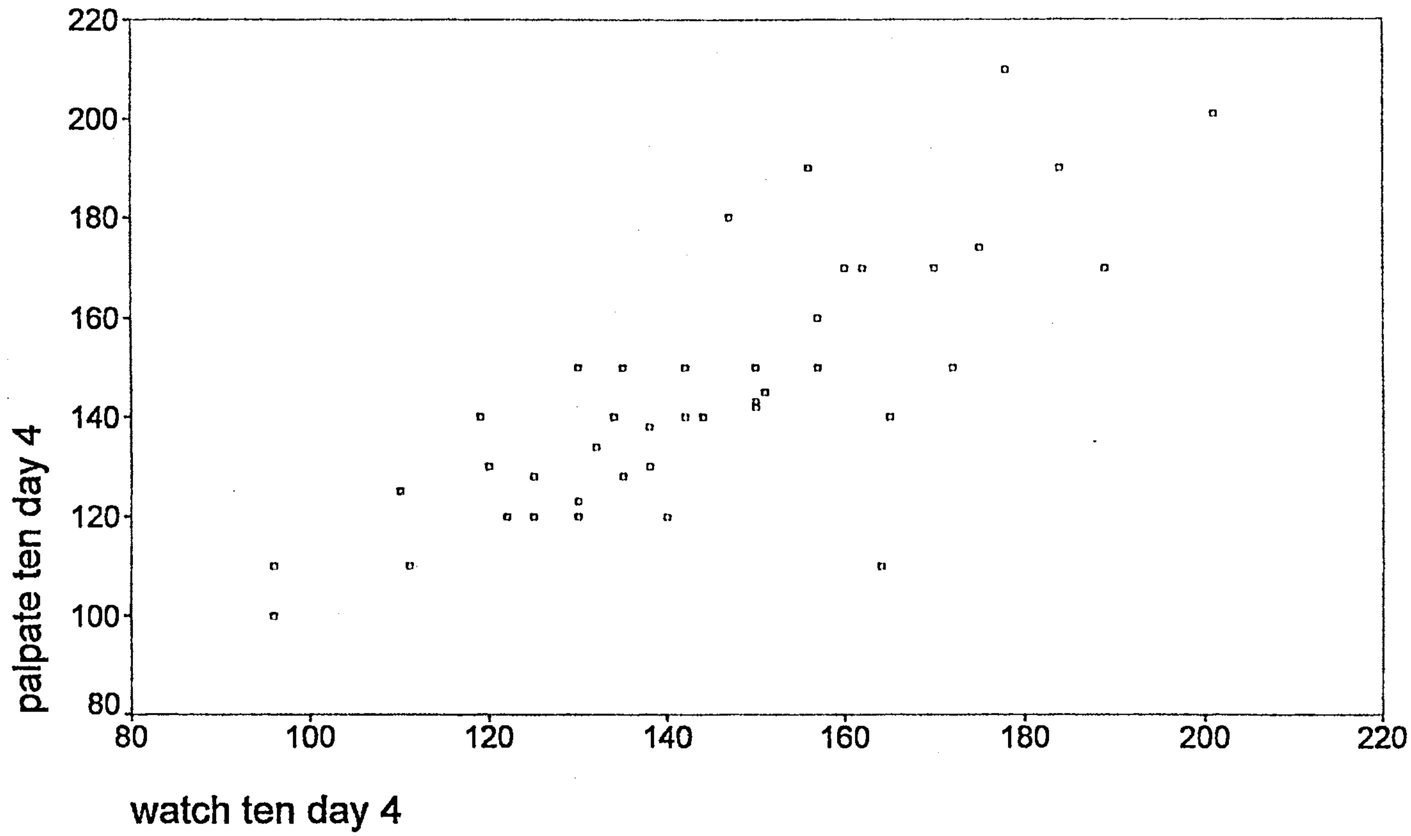

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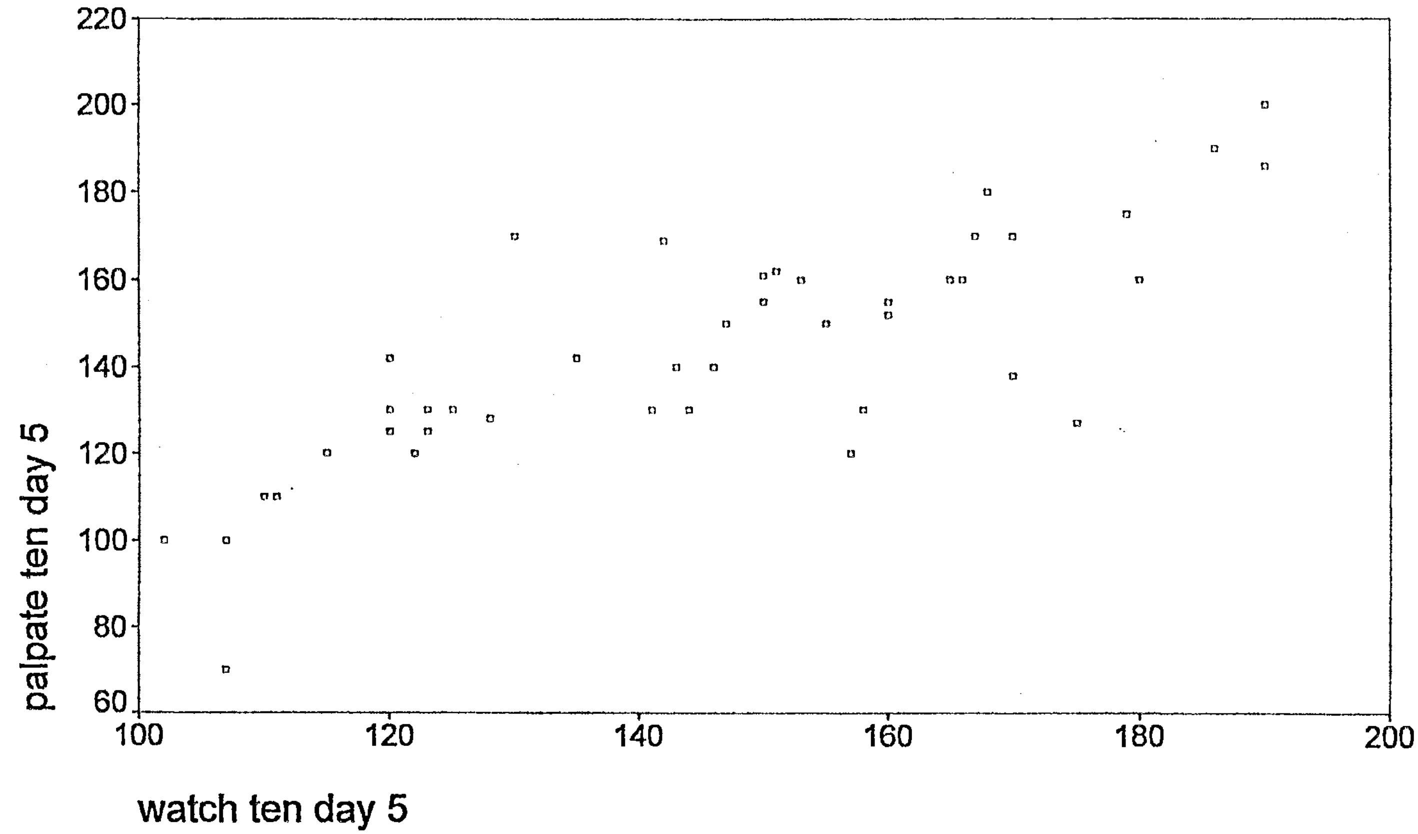
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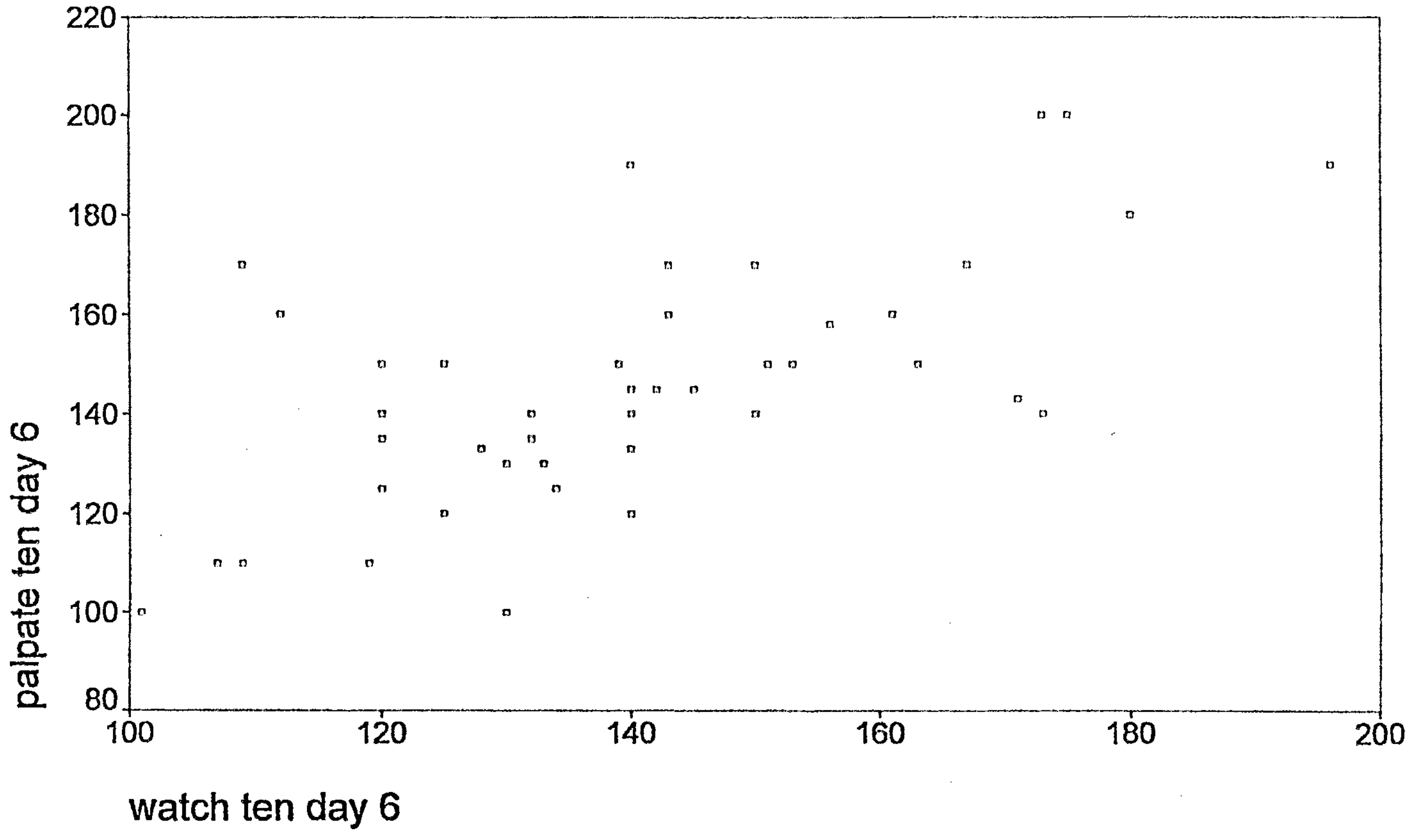

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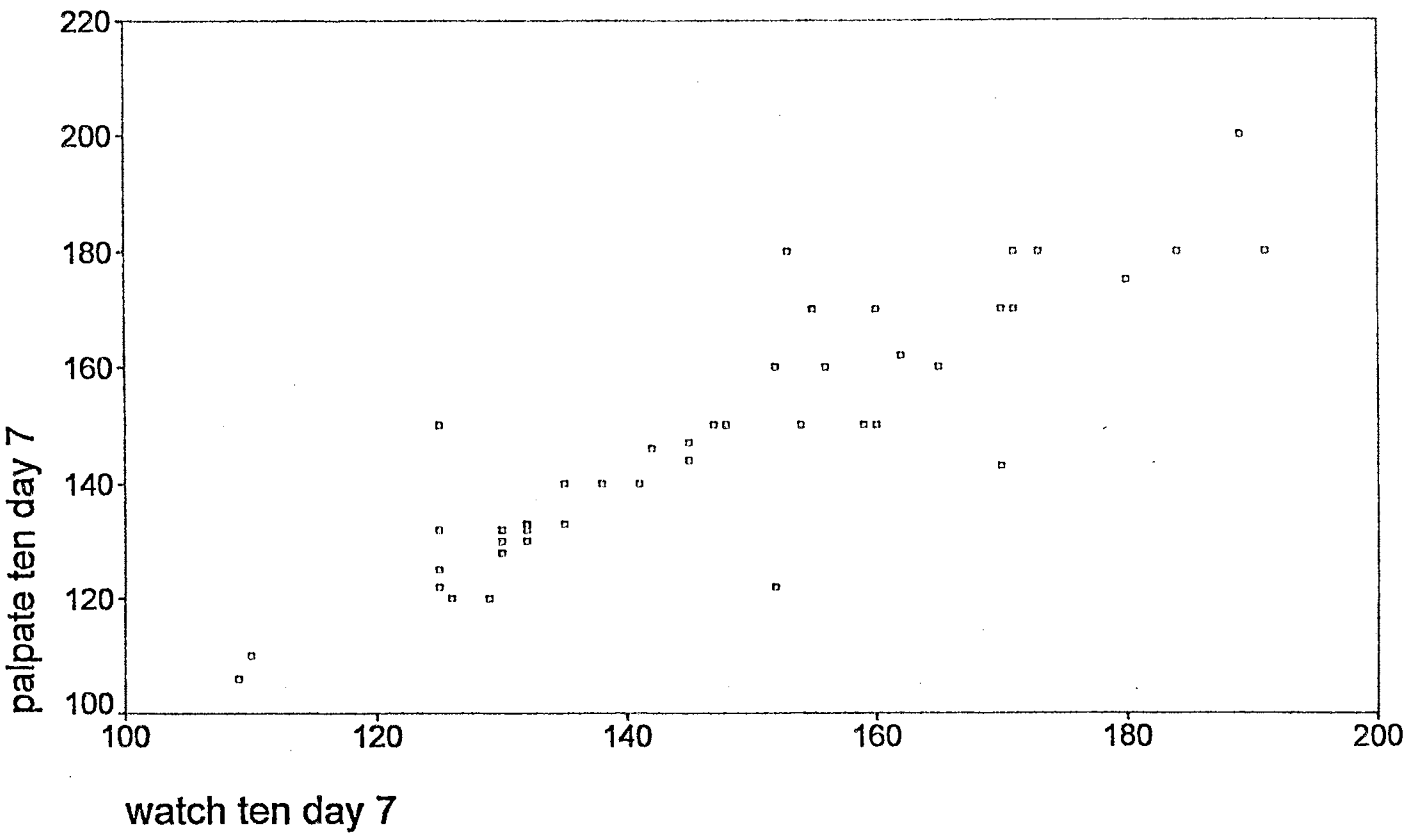
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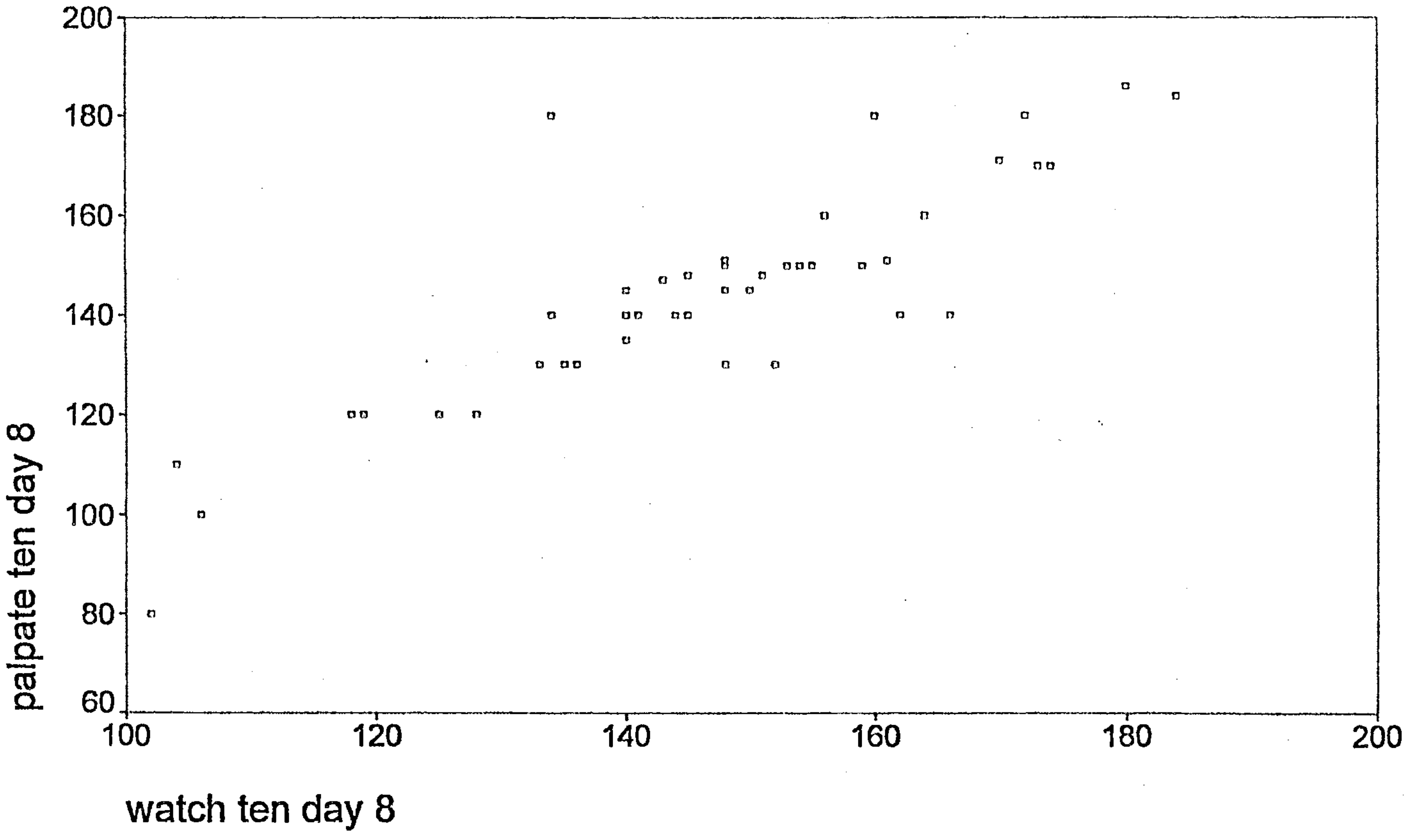
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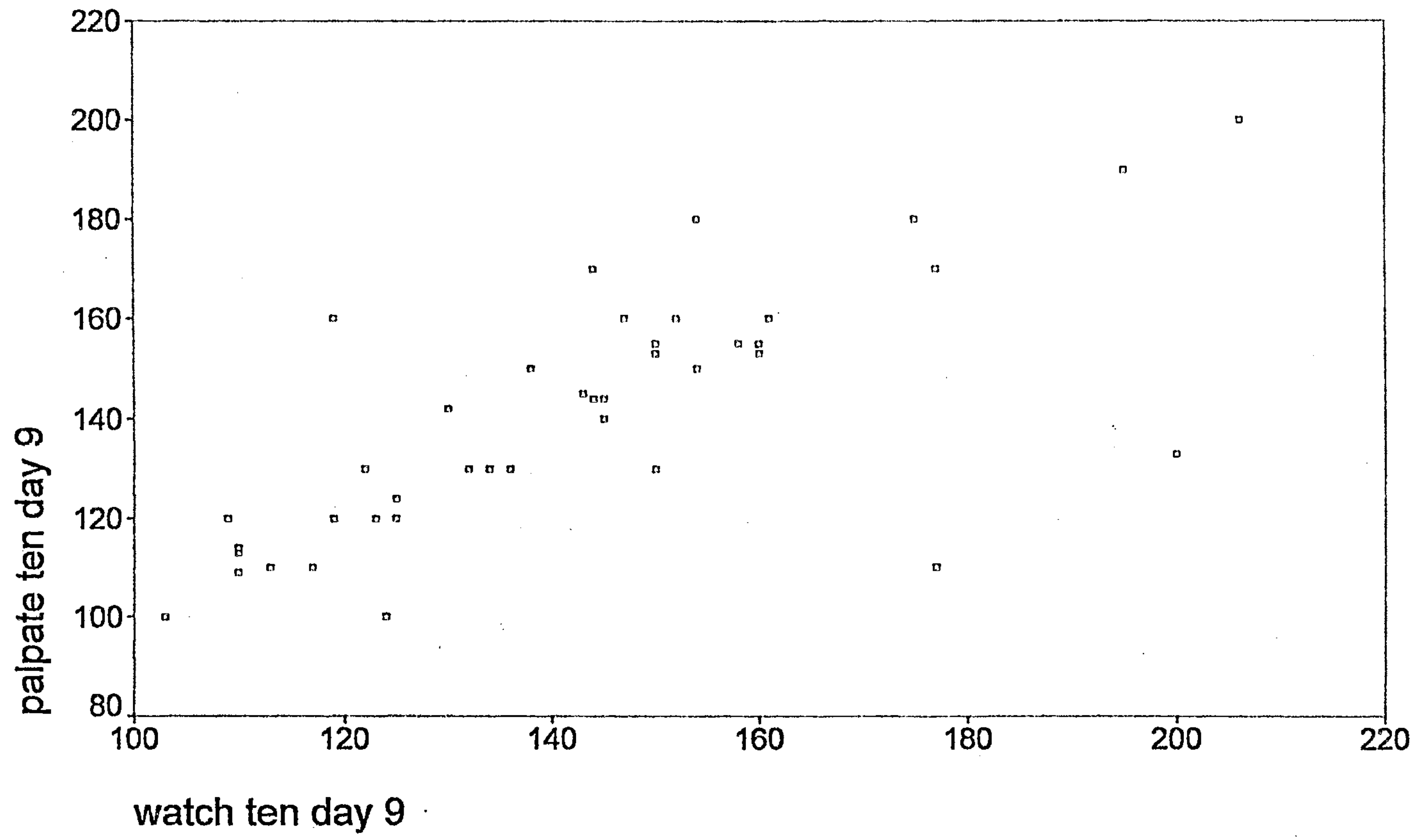
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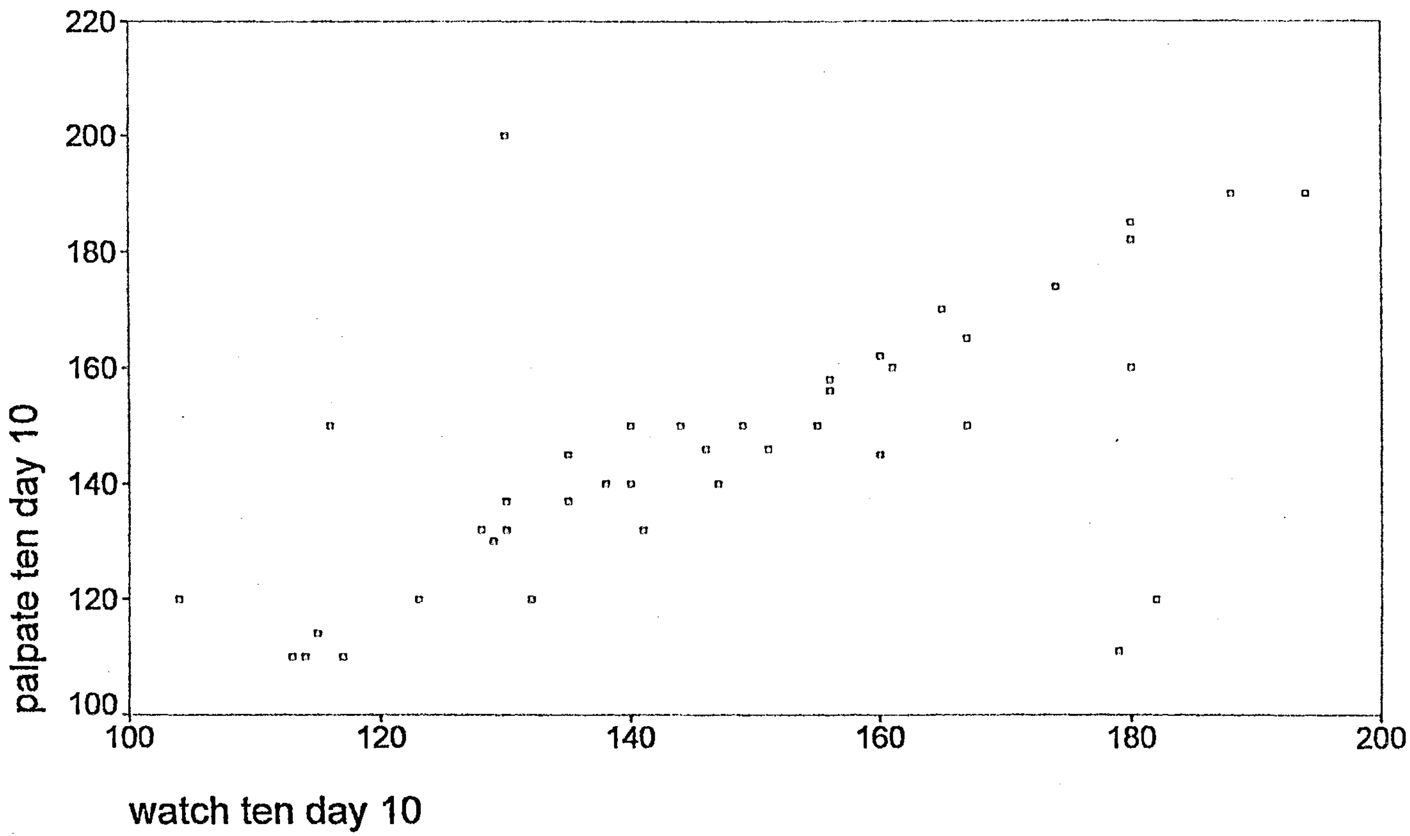
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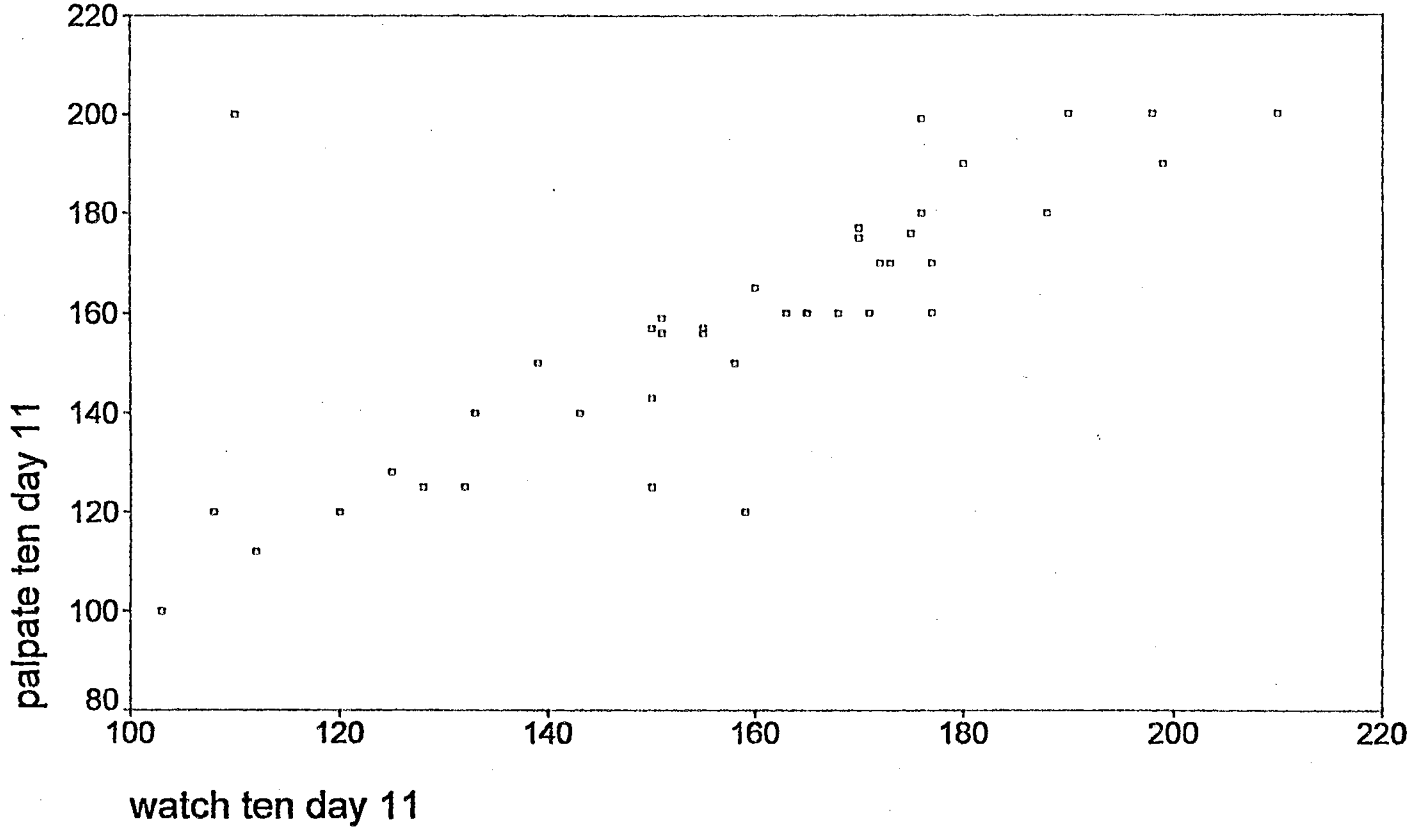
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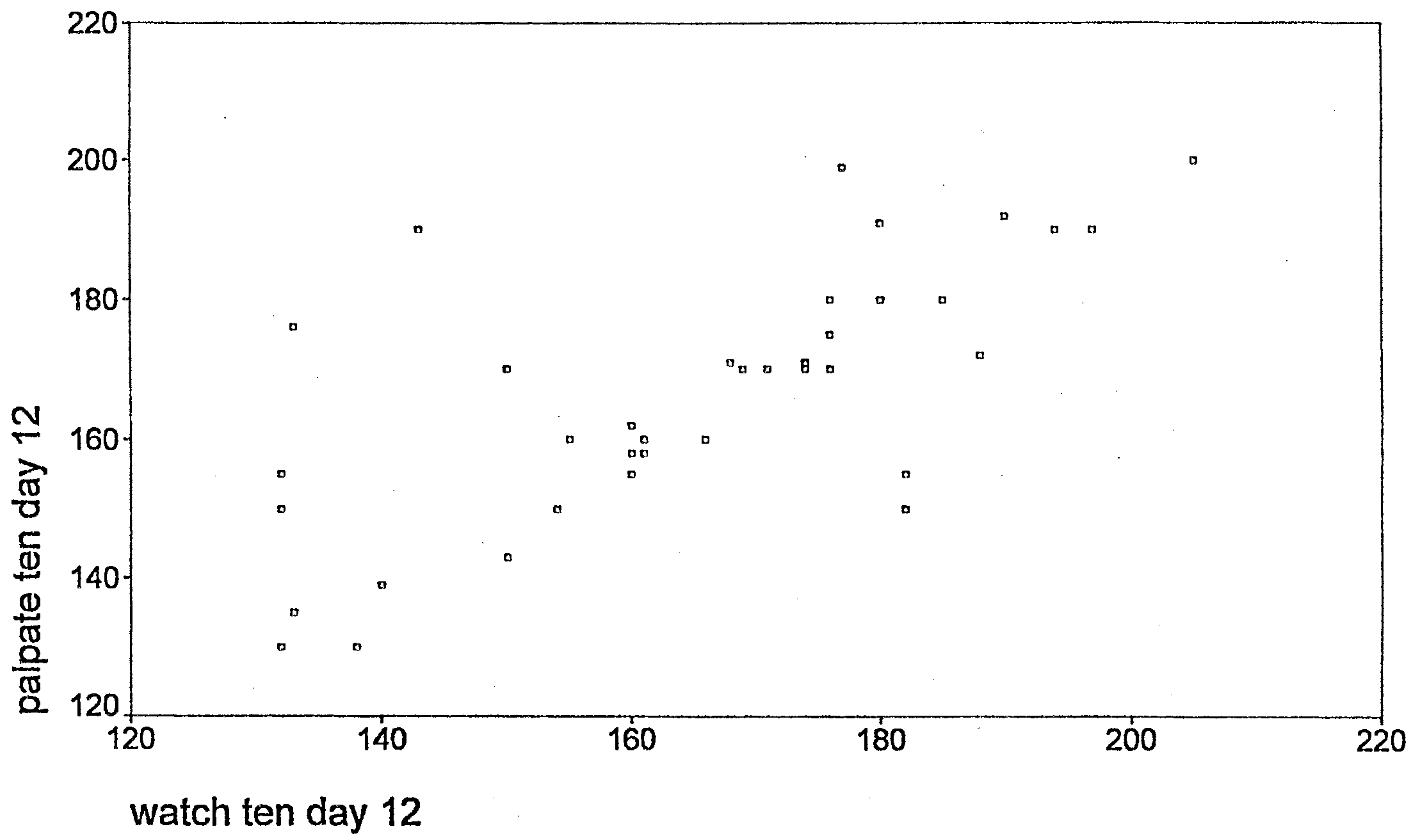
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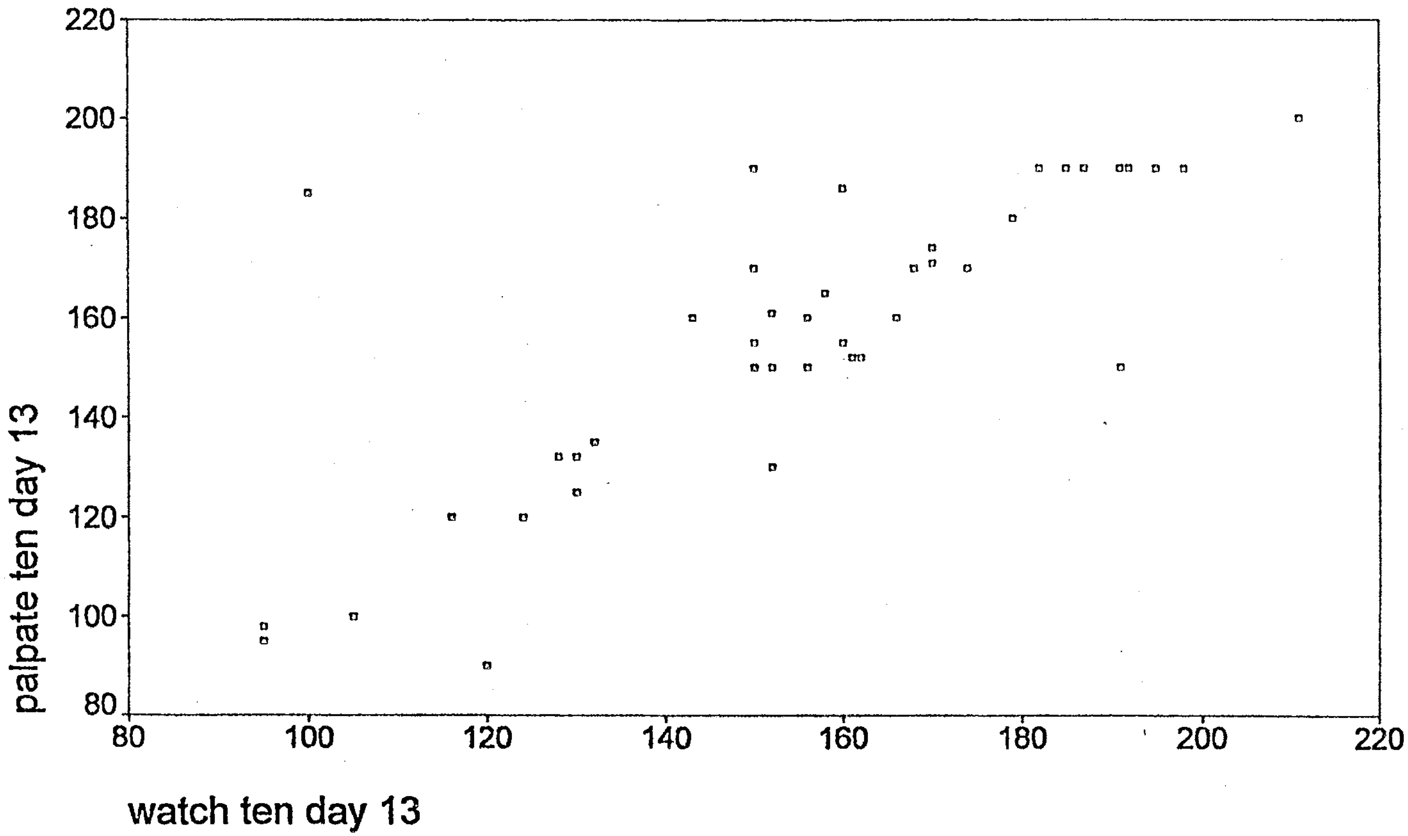
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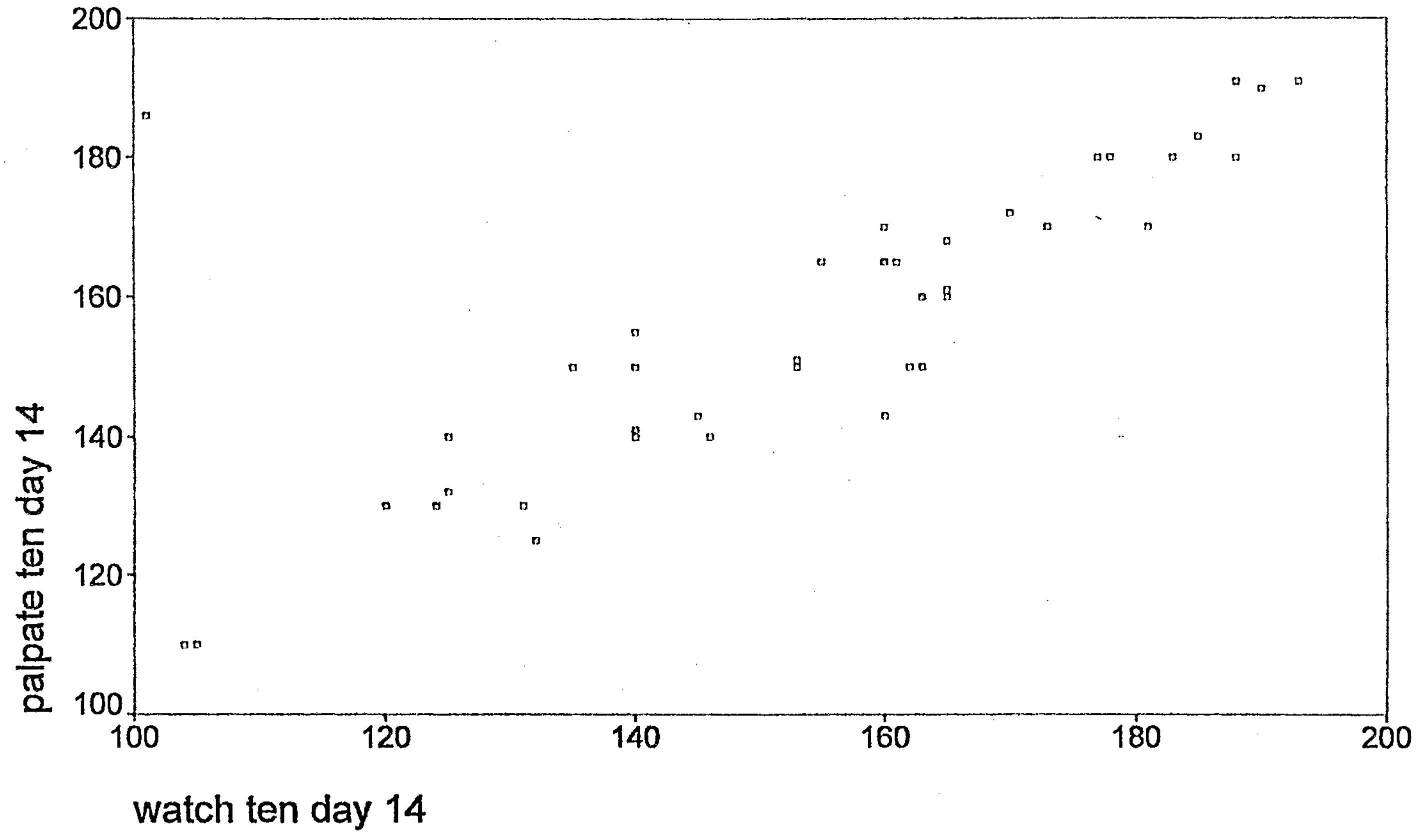
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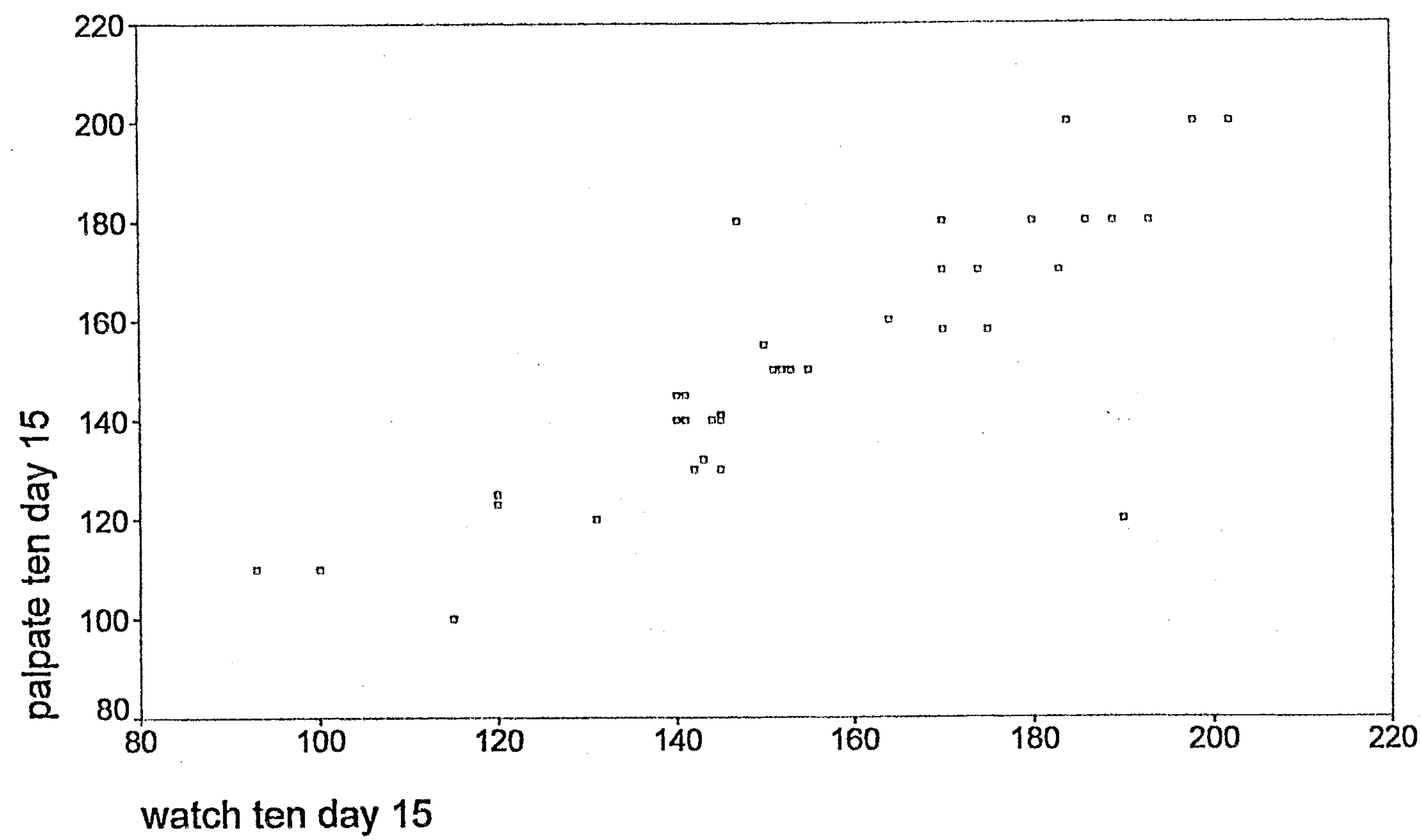
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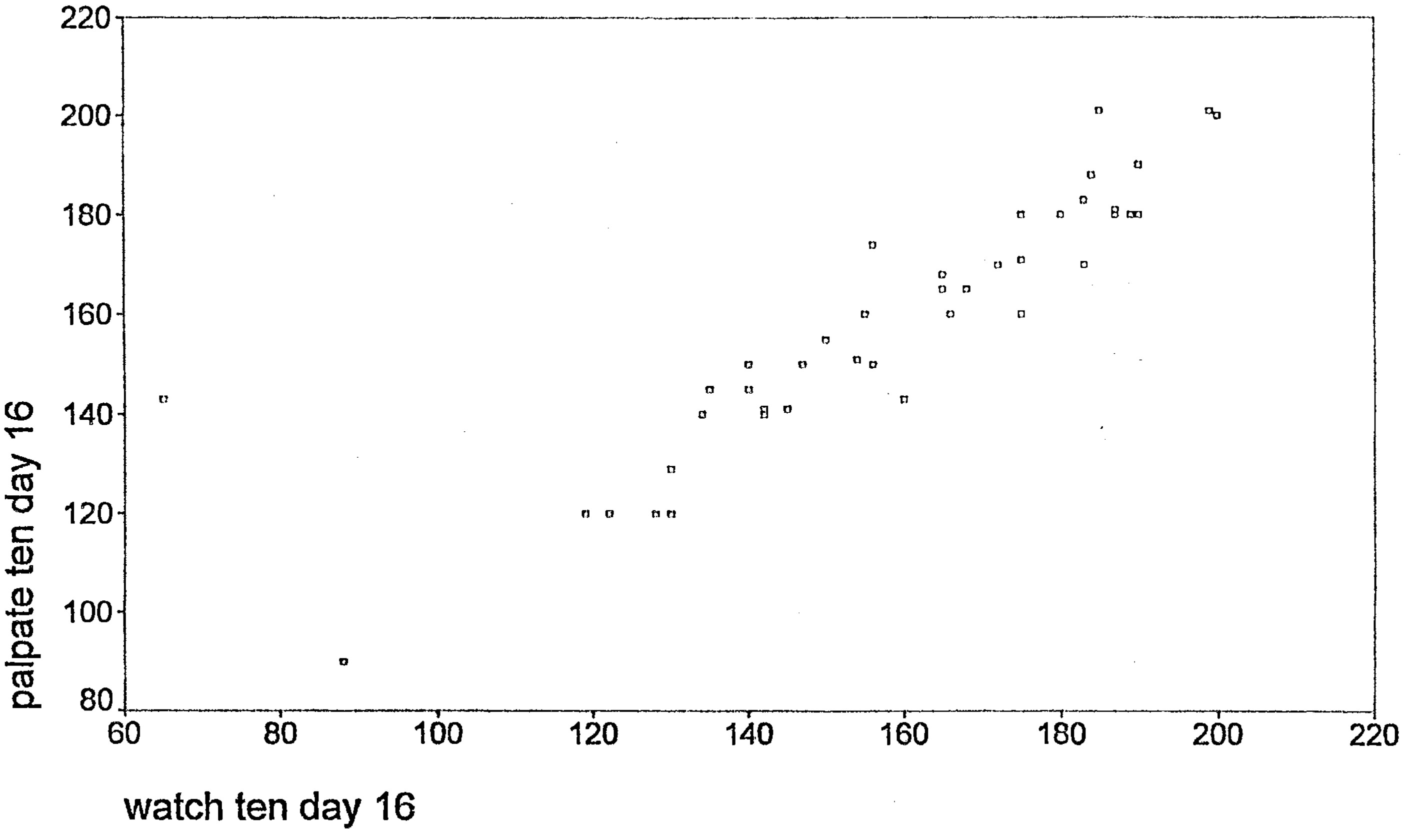
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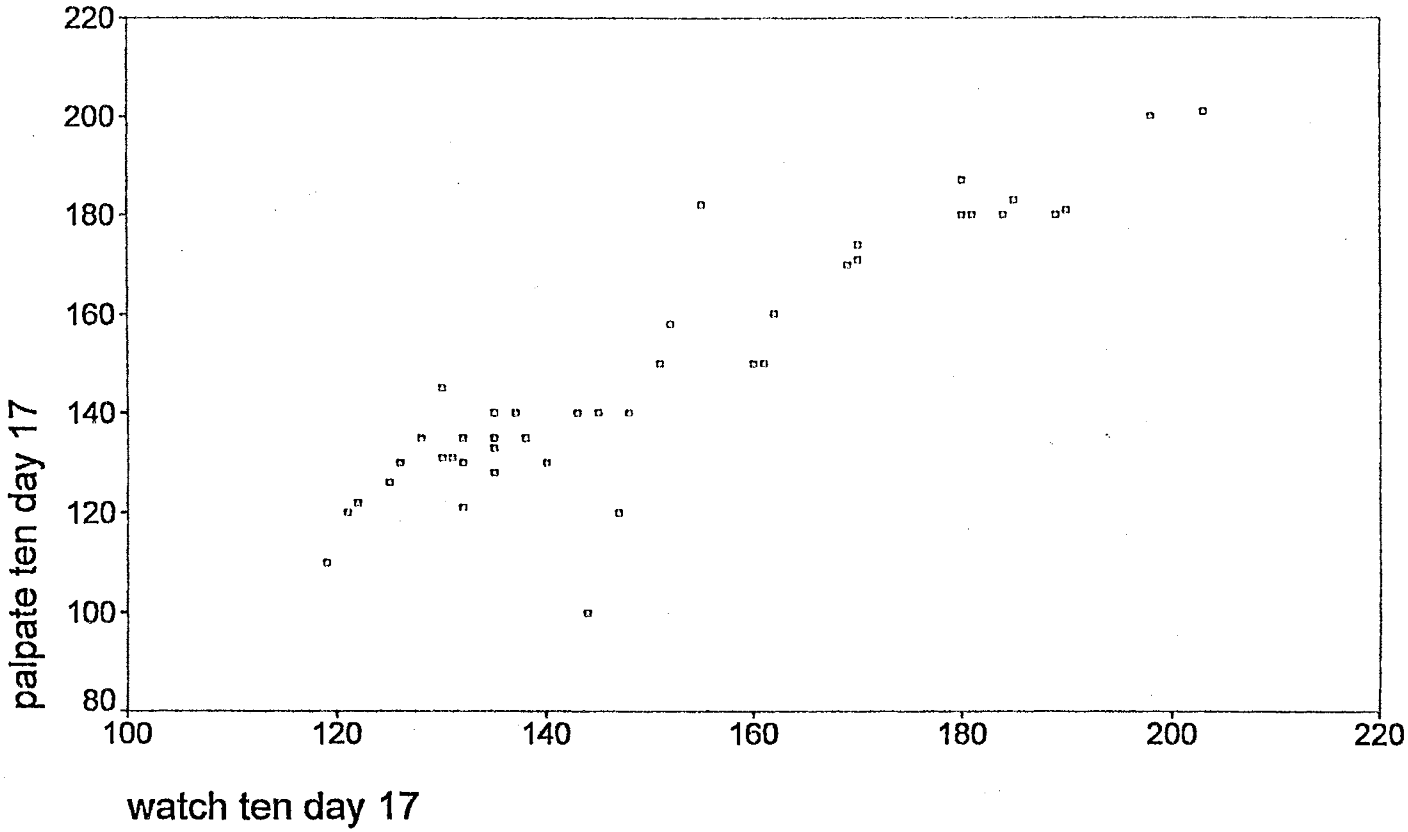
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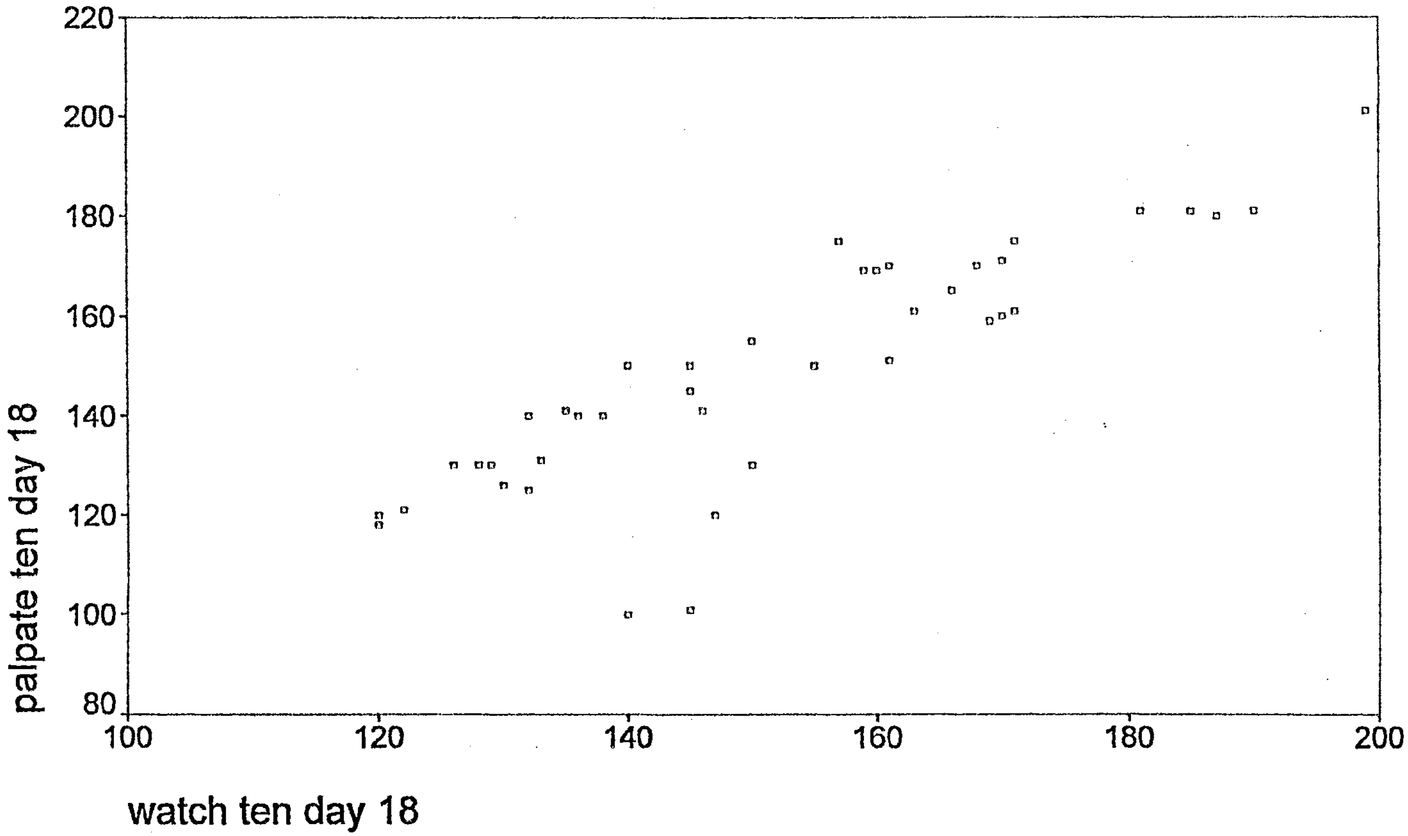

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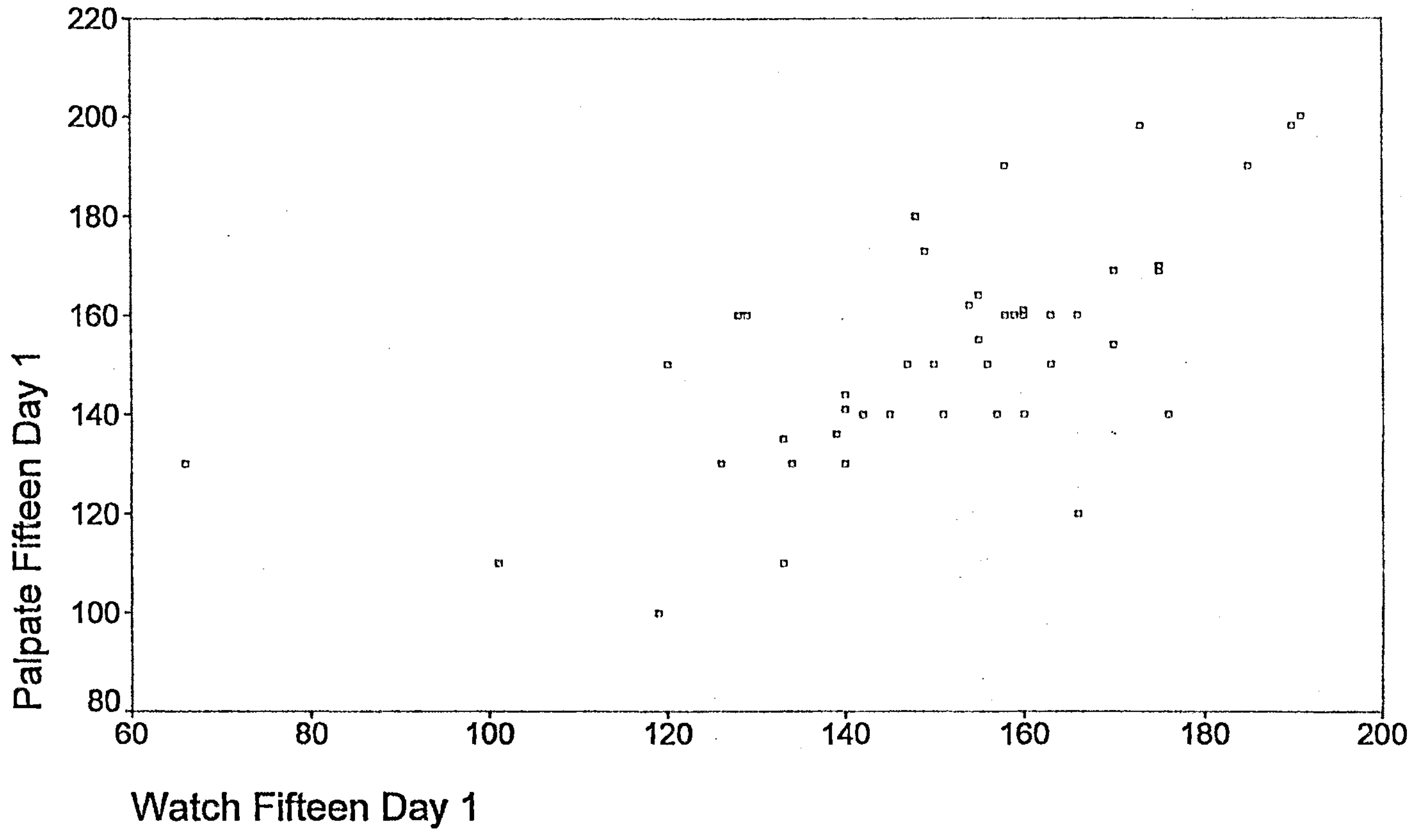
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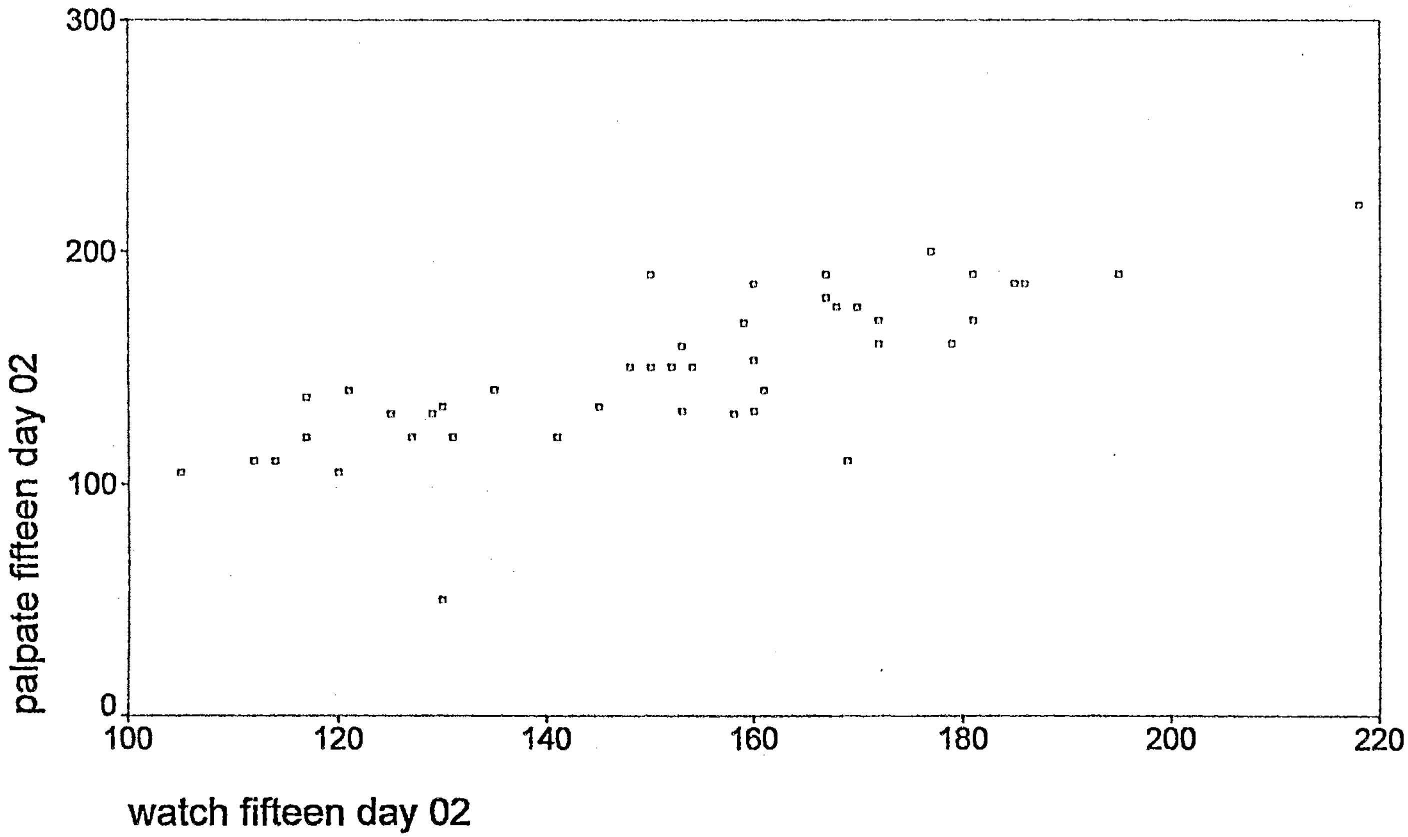
Palpate Fifteen Day 1
Watch Fifteen Day 1



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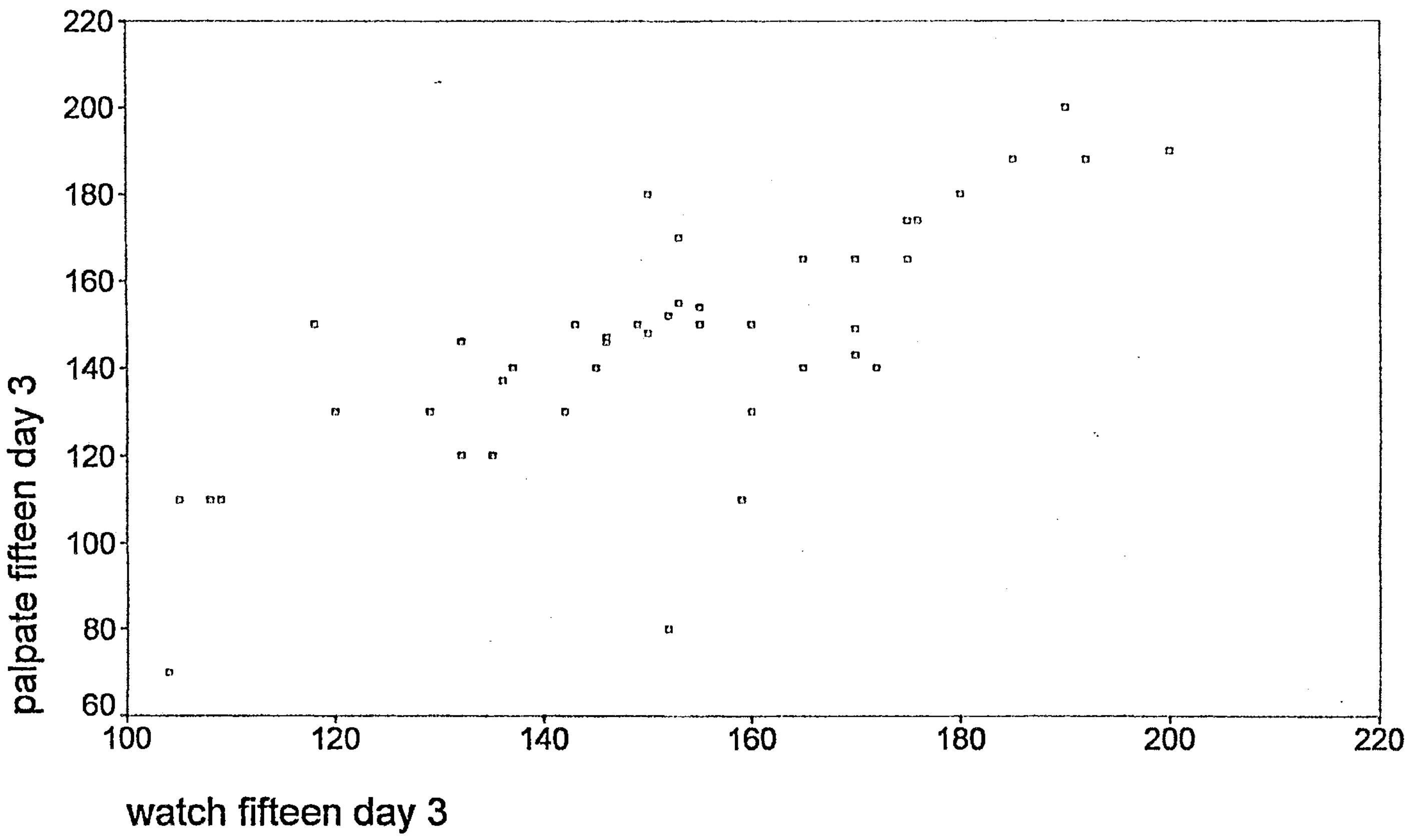
watch fifteen day 02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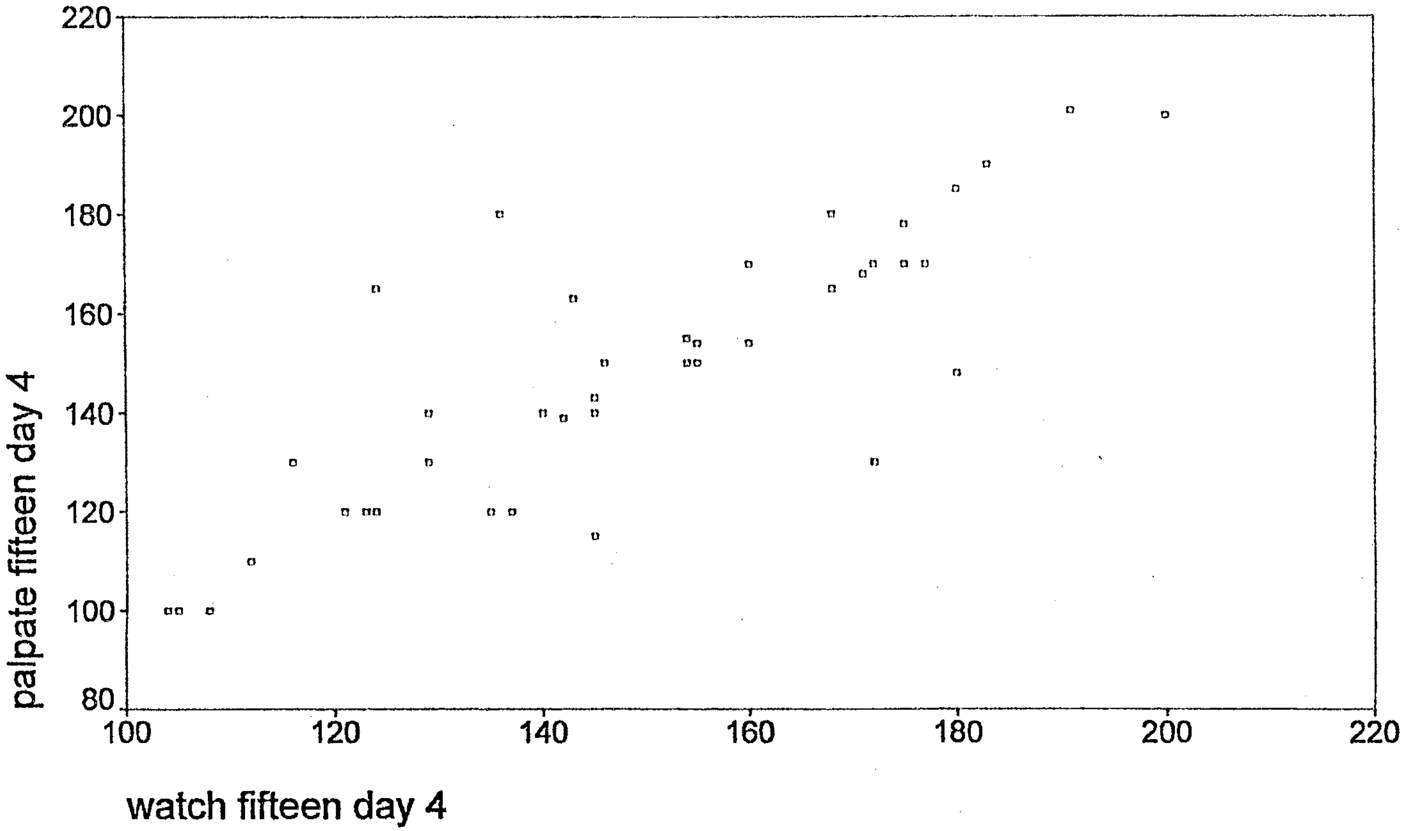
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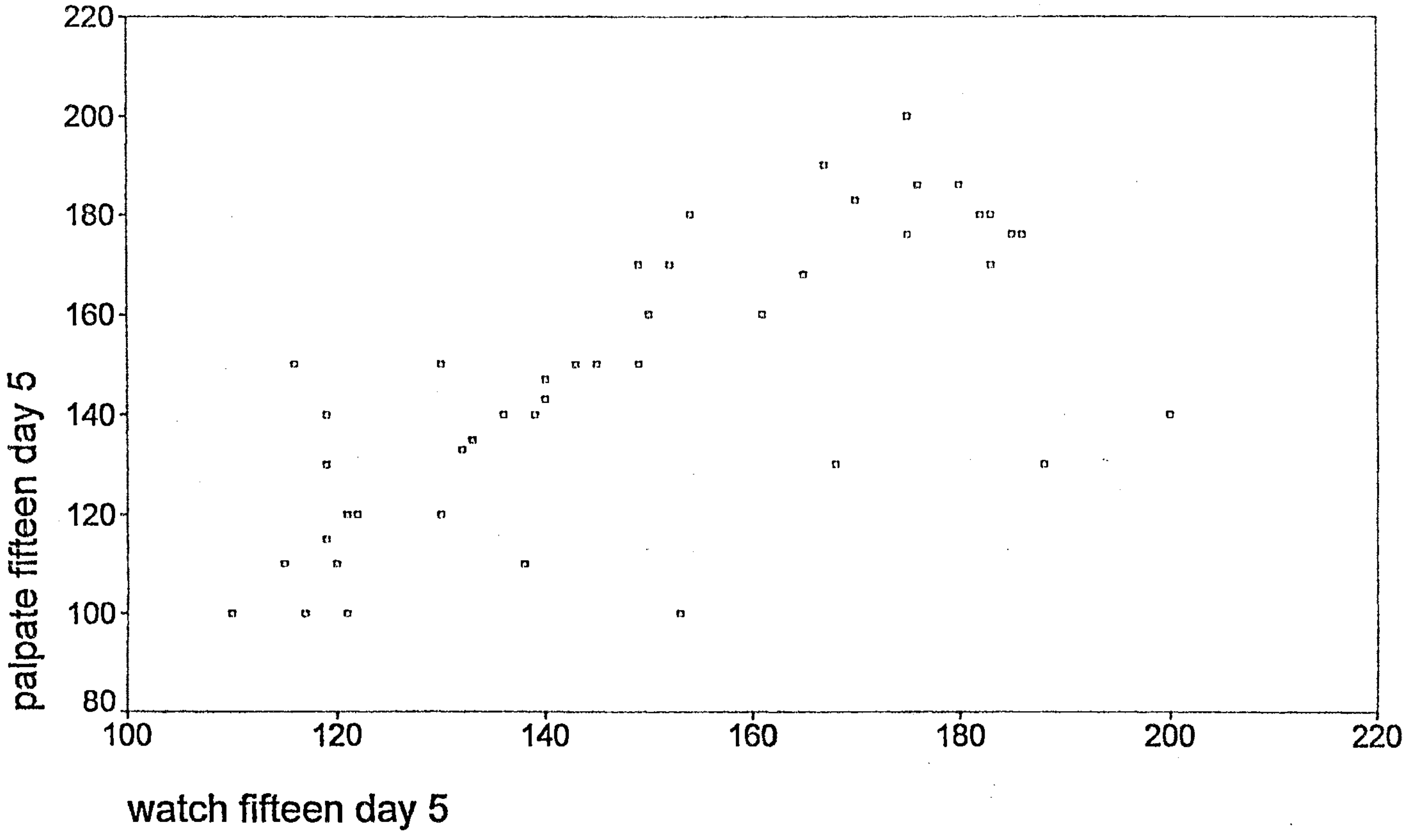
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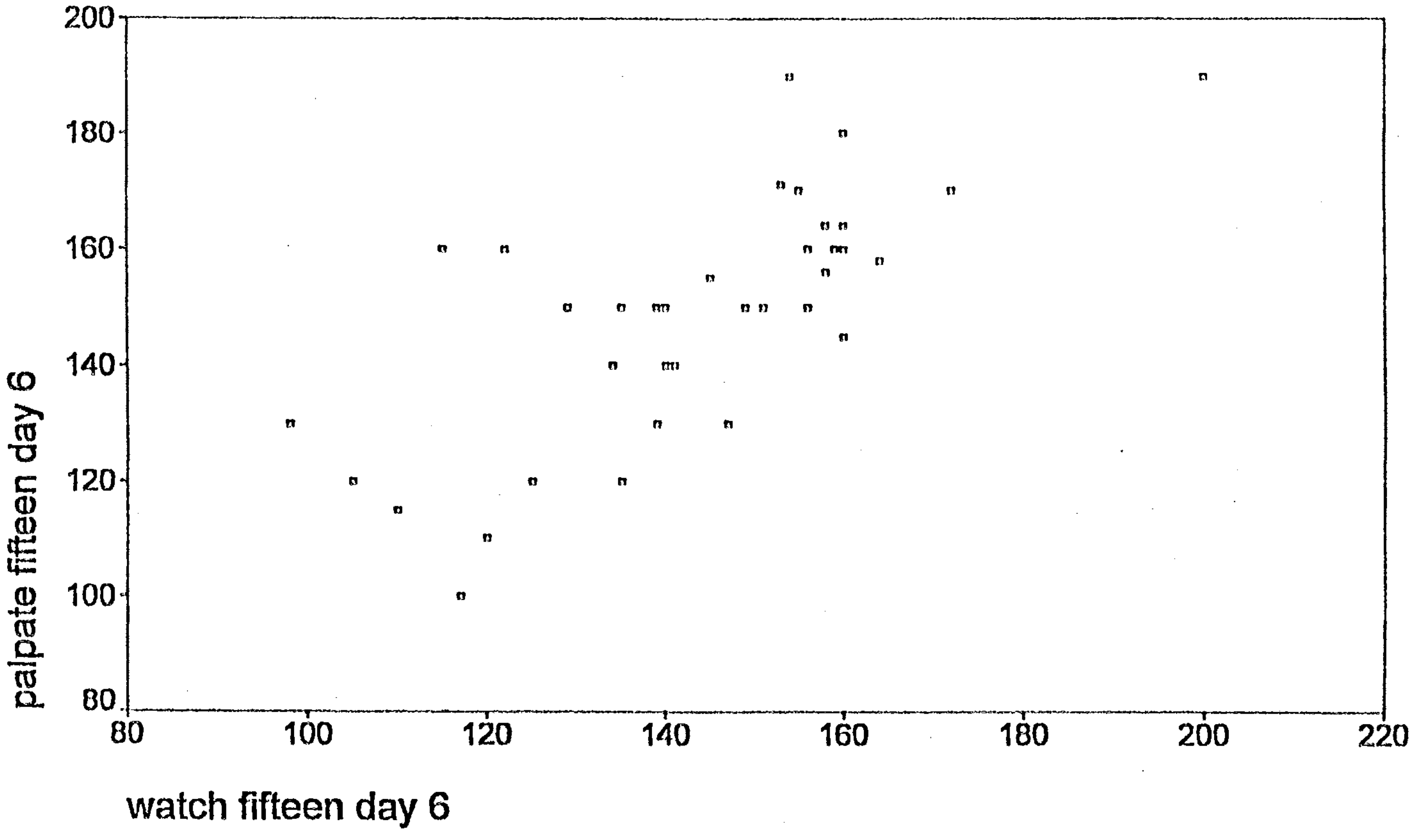

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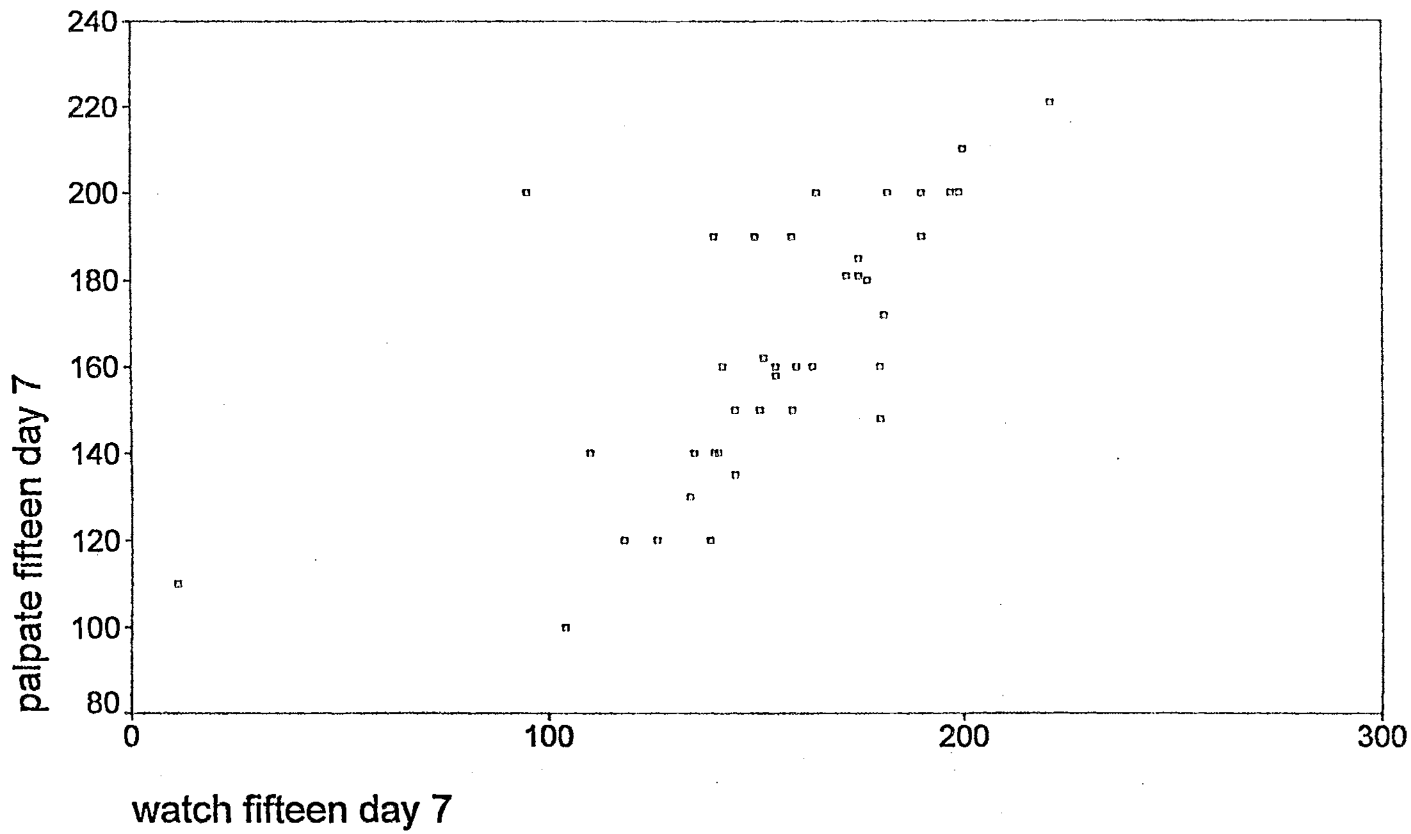
watch fifteen day 6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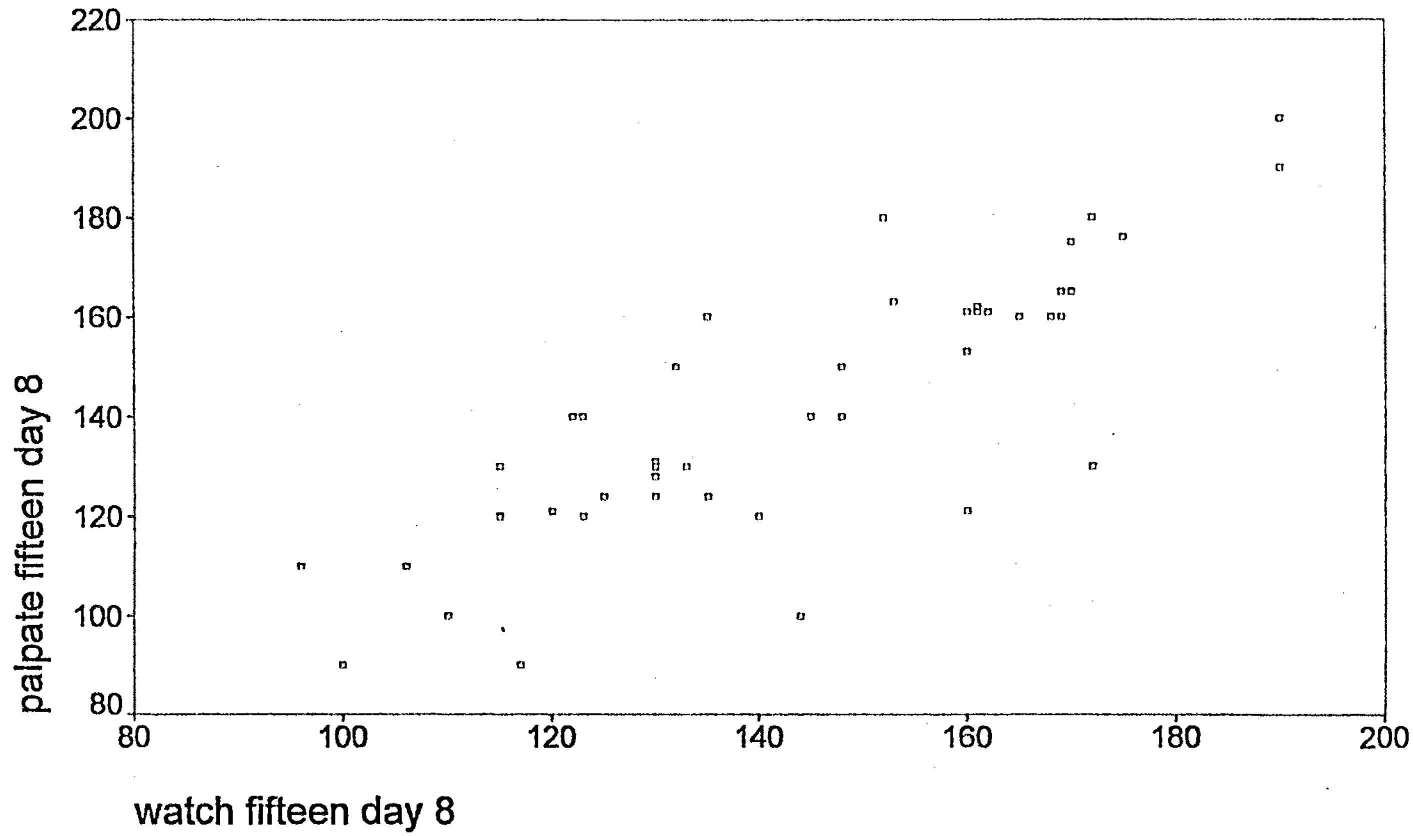
watch fifteen day 7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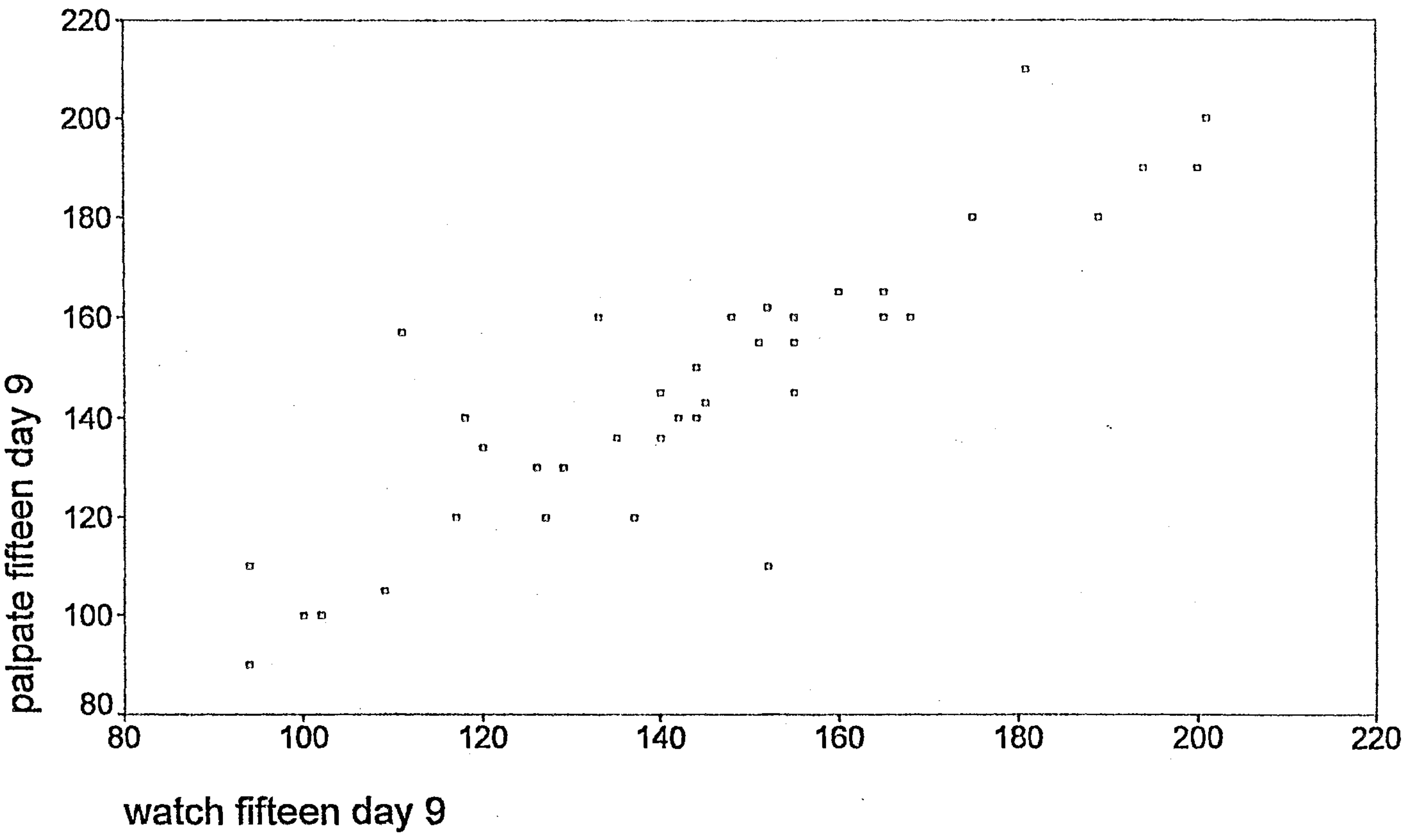
watch fifteen day 8



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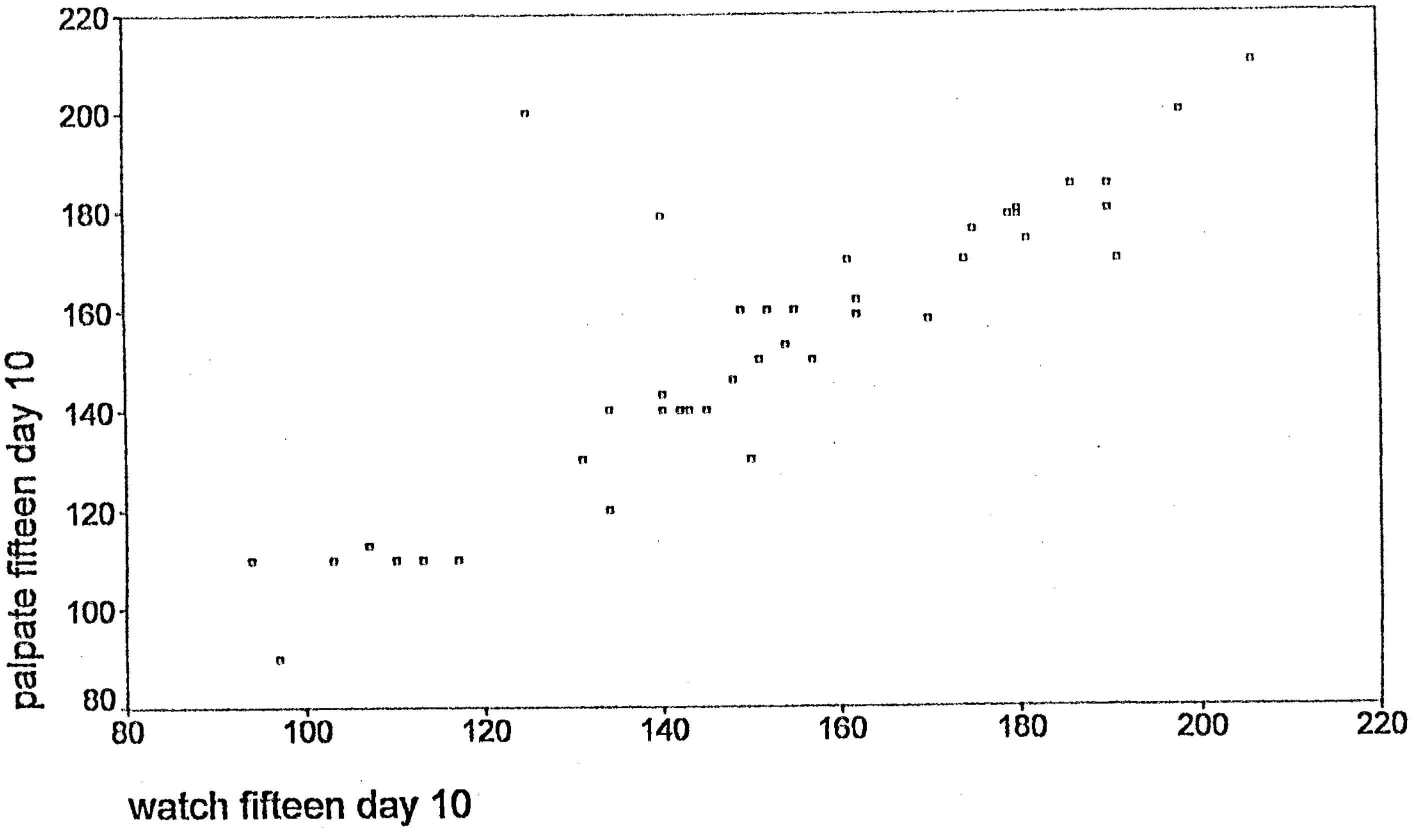
watch fifteen day 9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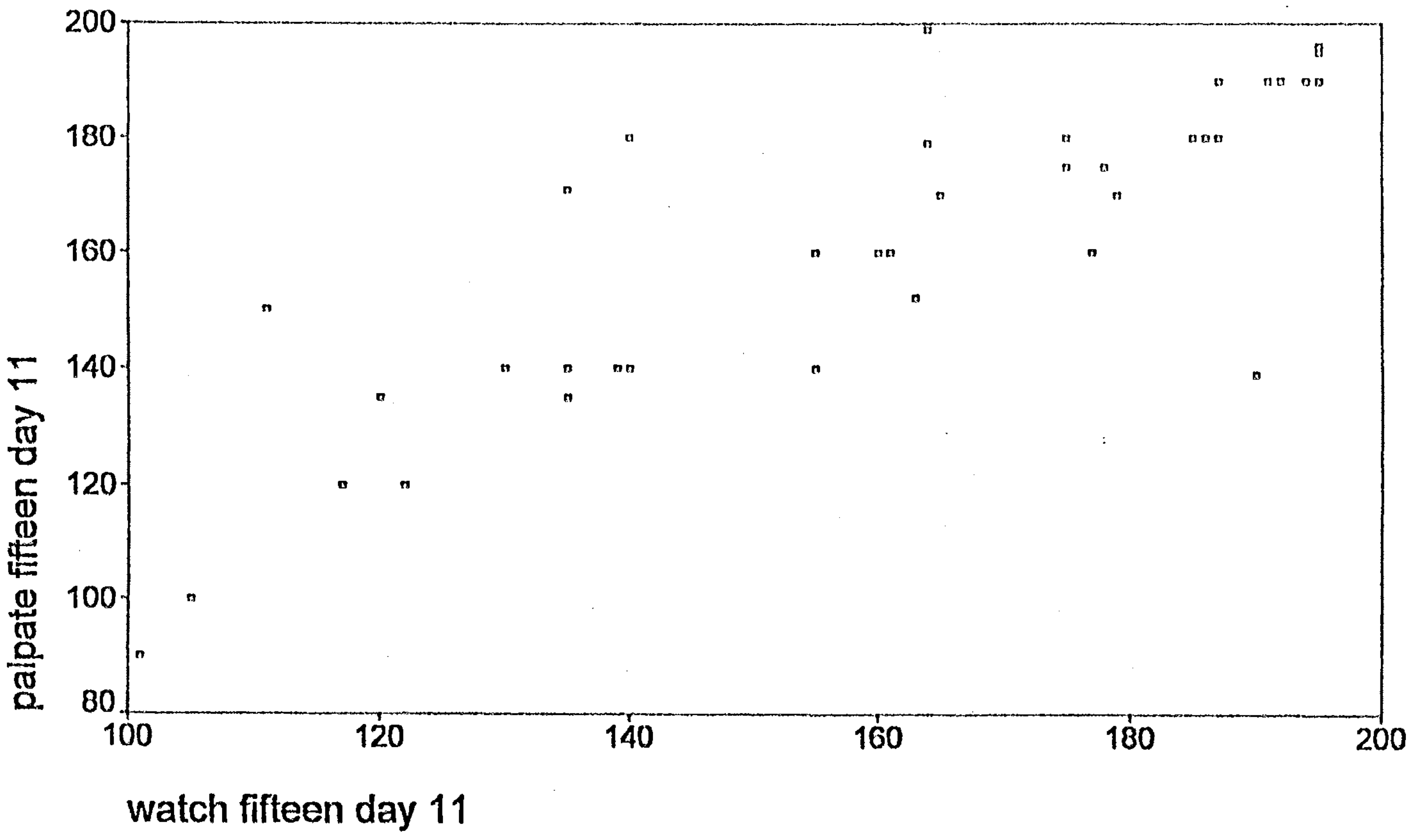
watch fifteen day 10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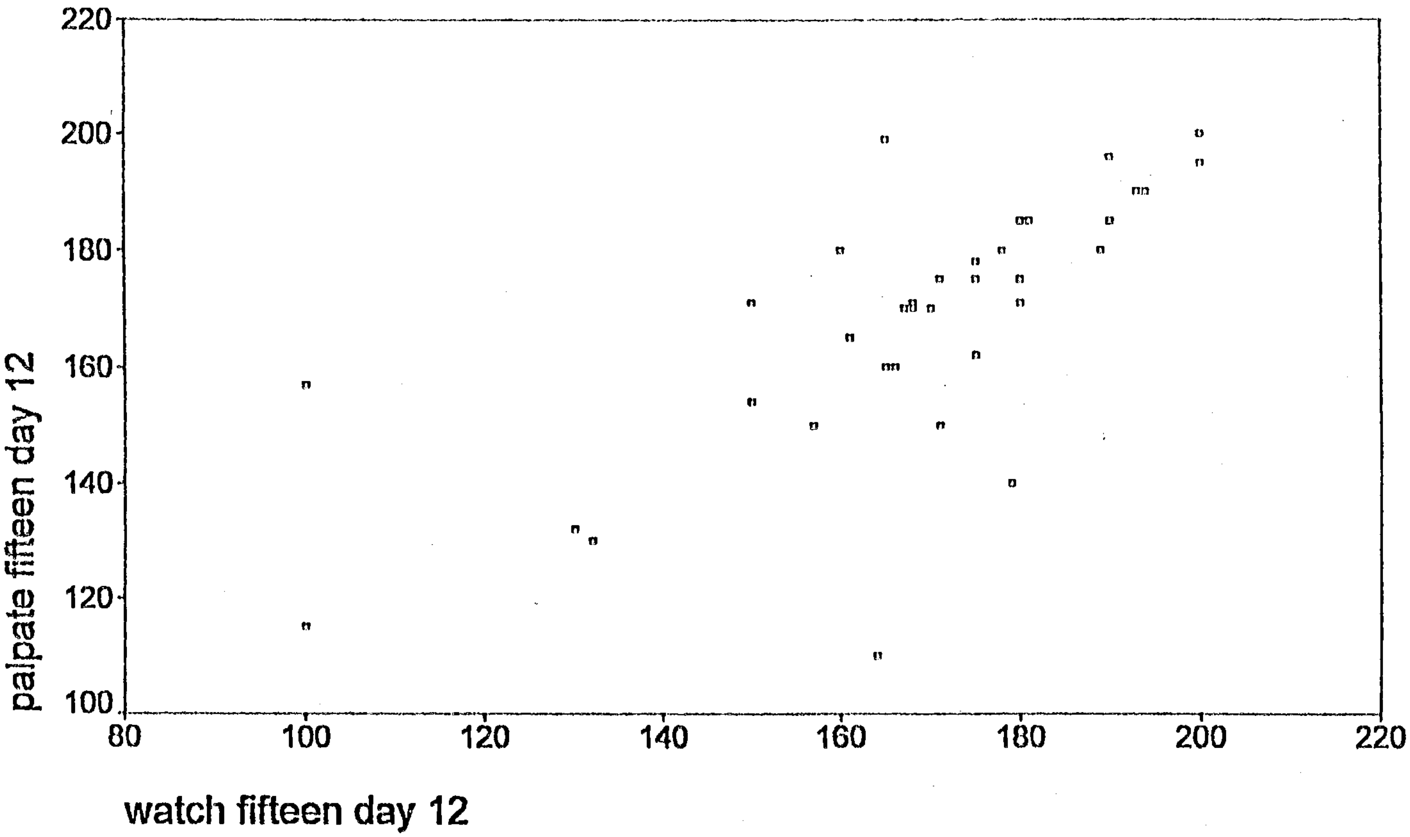

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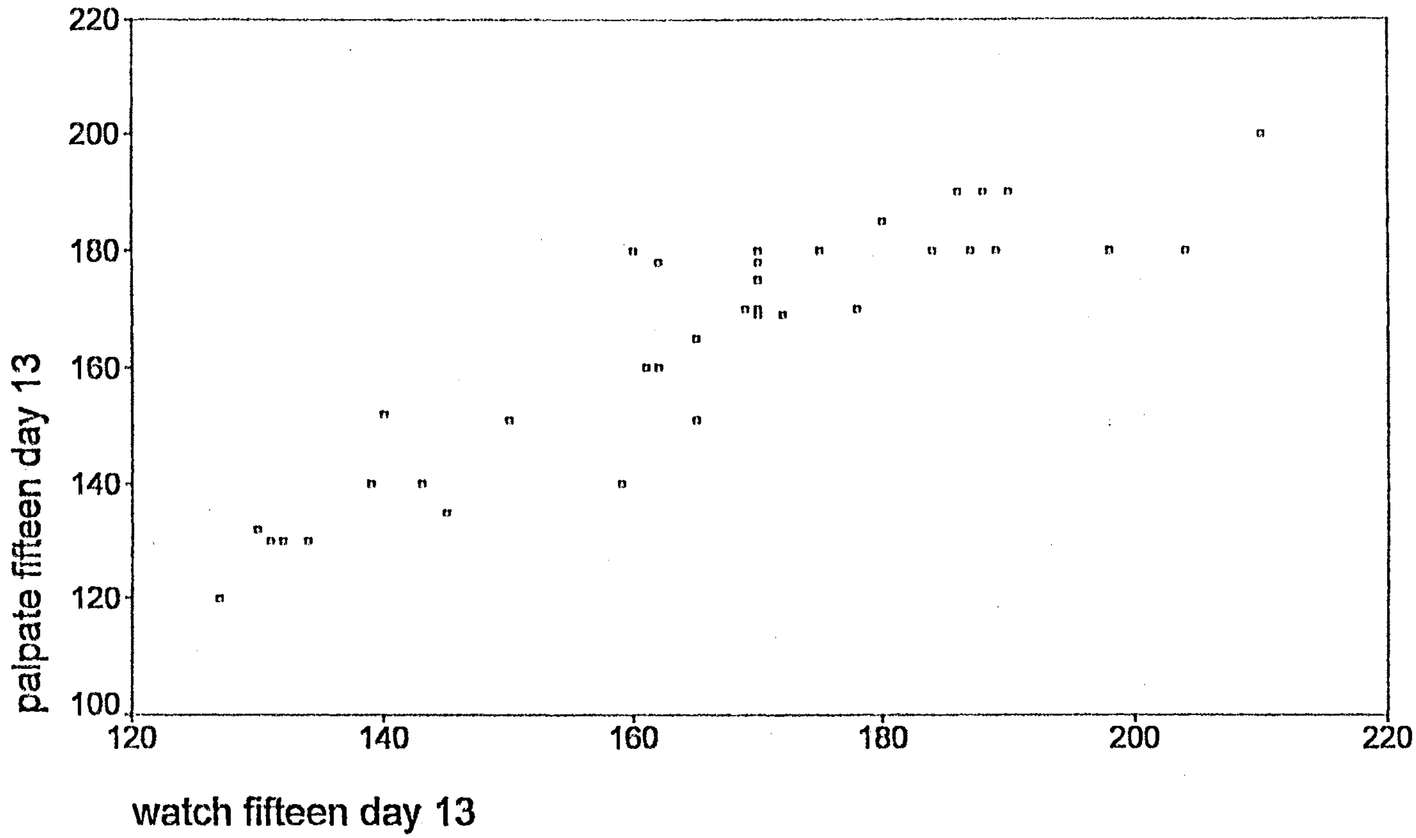
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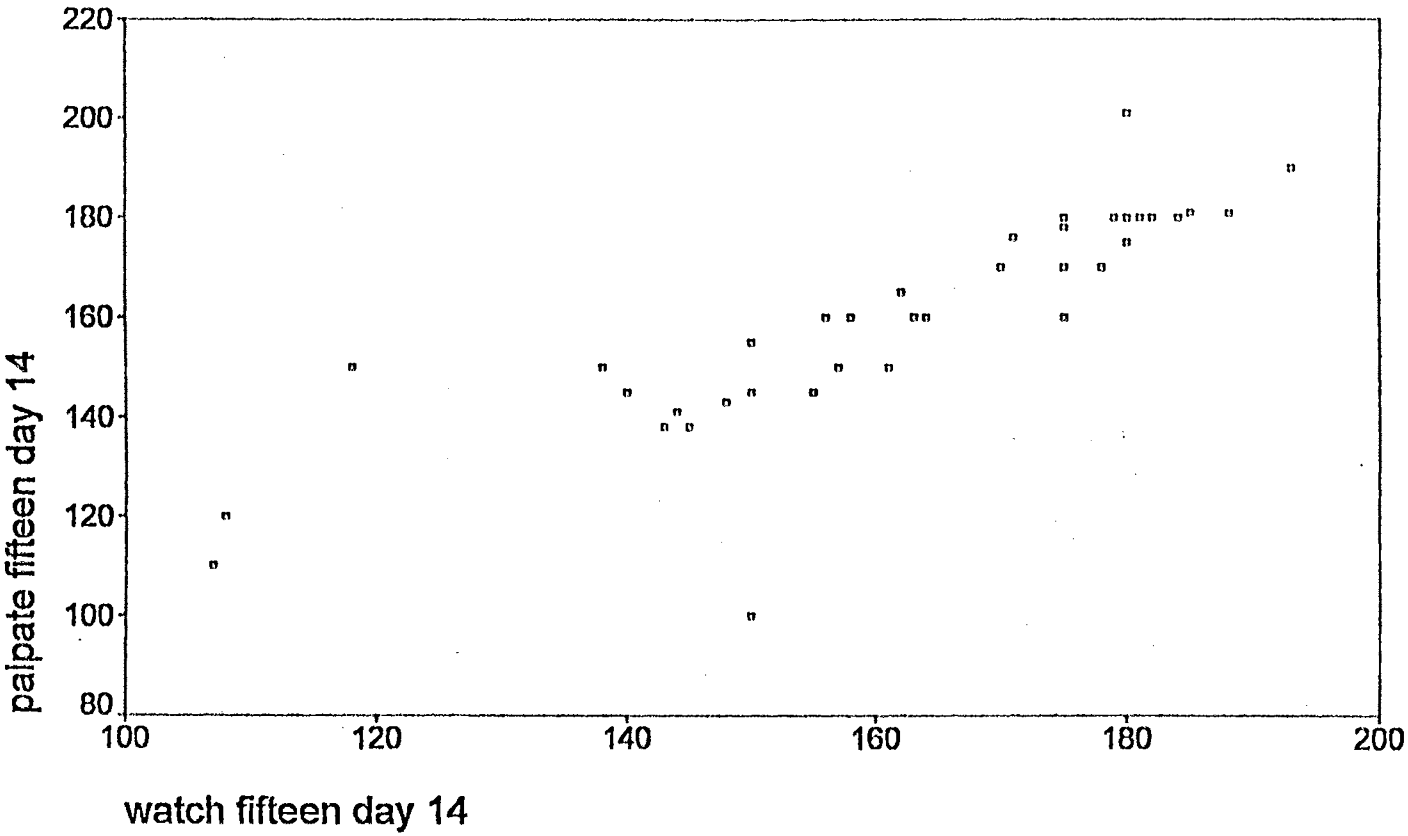
palpate fifteen day 13
watch fifteen day 13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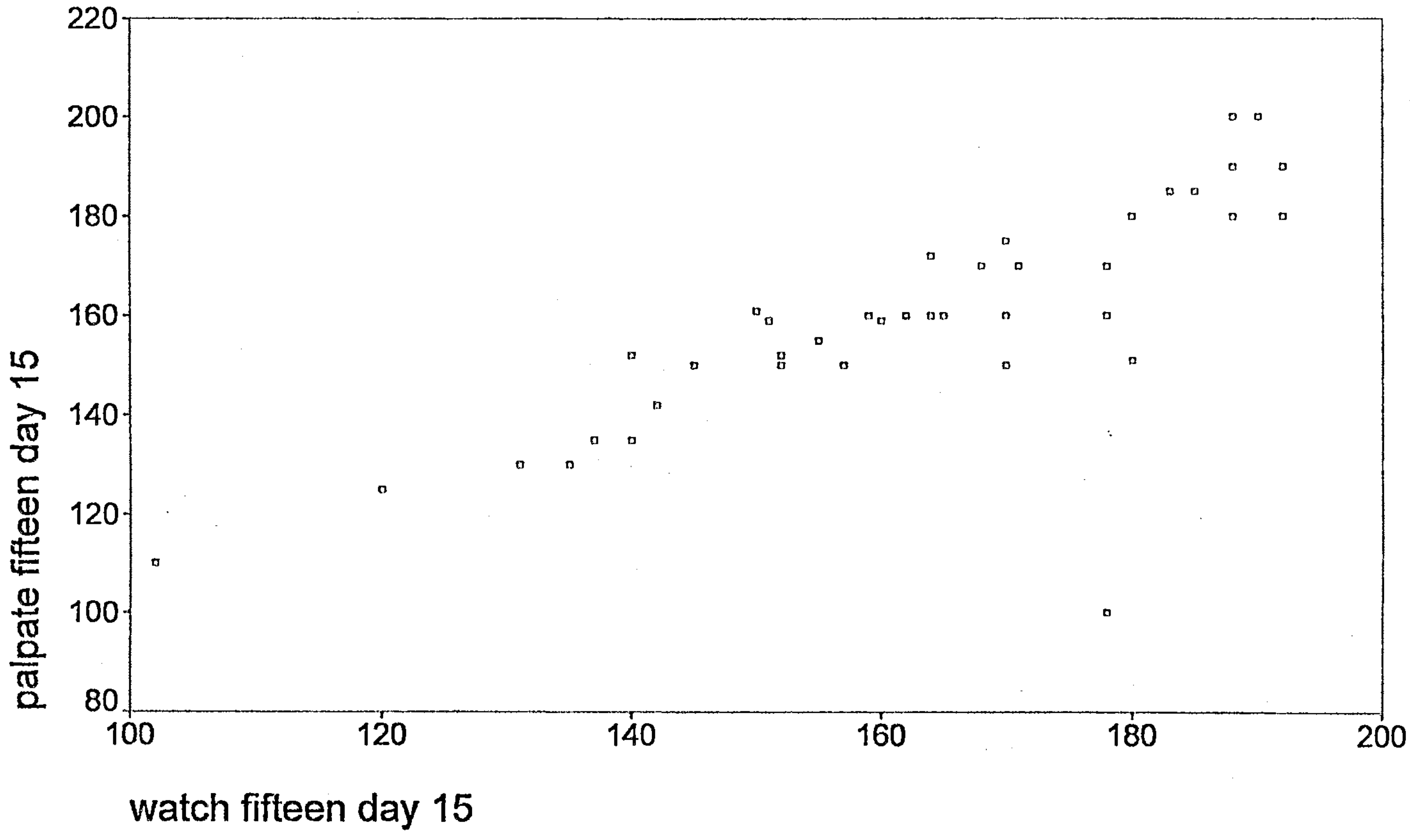
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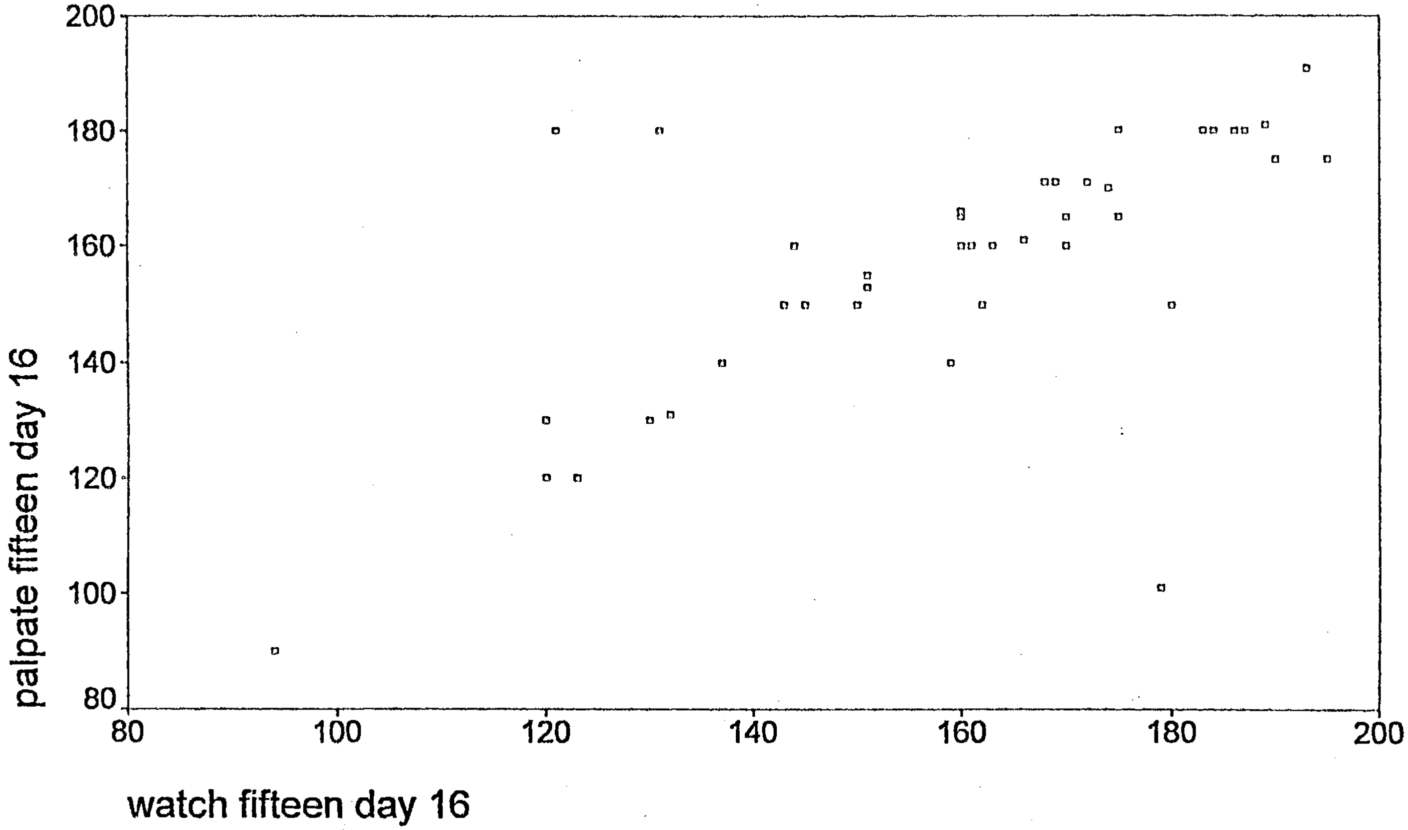
watch fifteen day 15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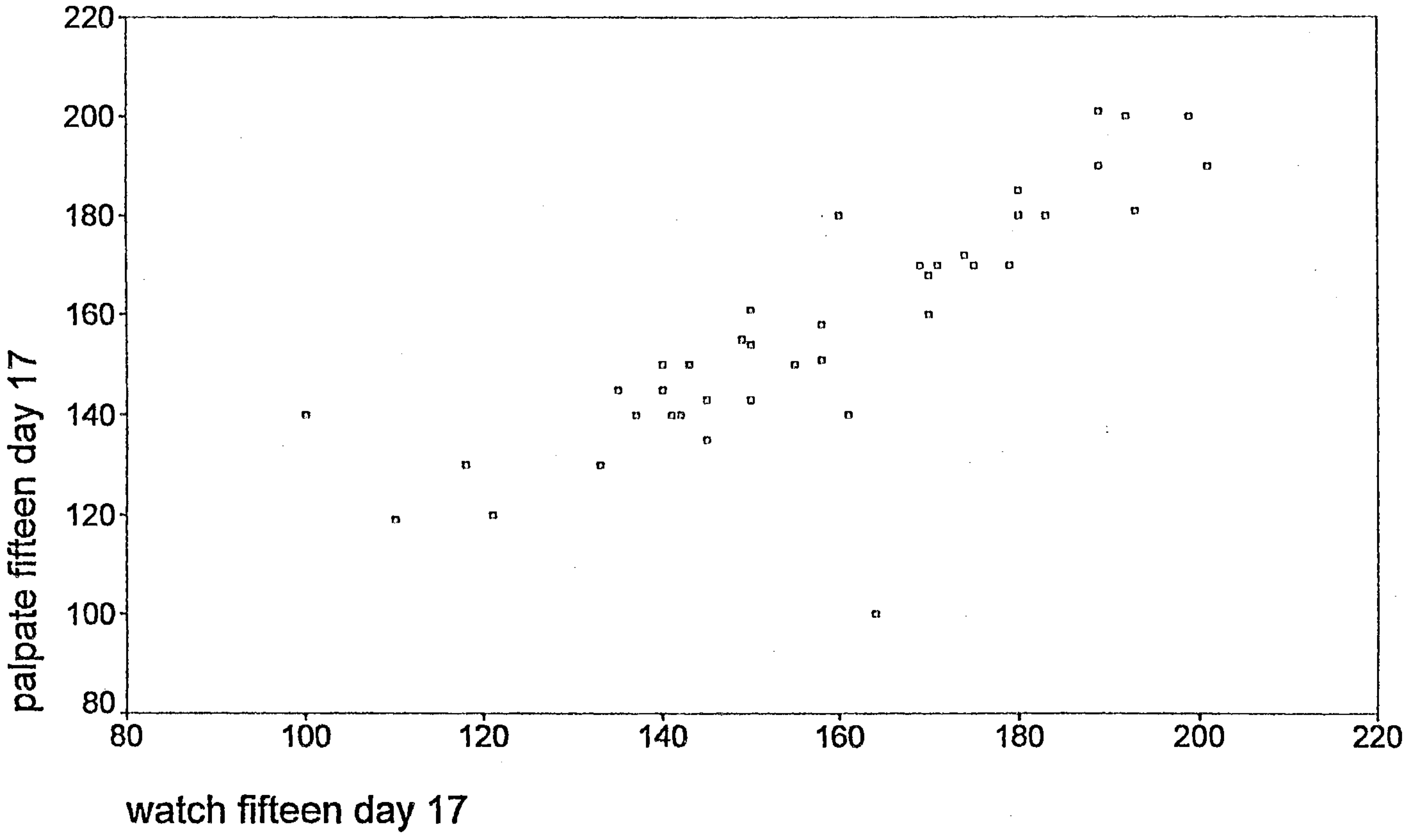
watch fifteen day 16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200
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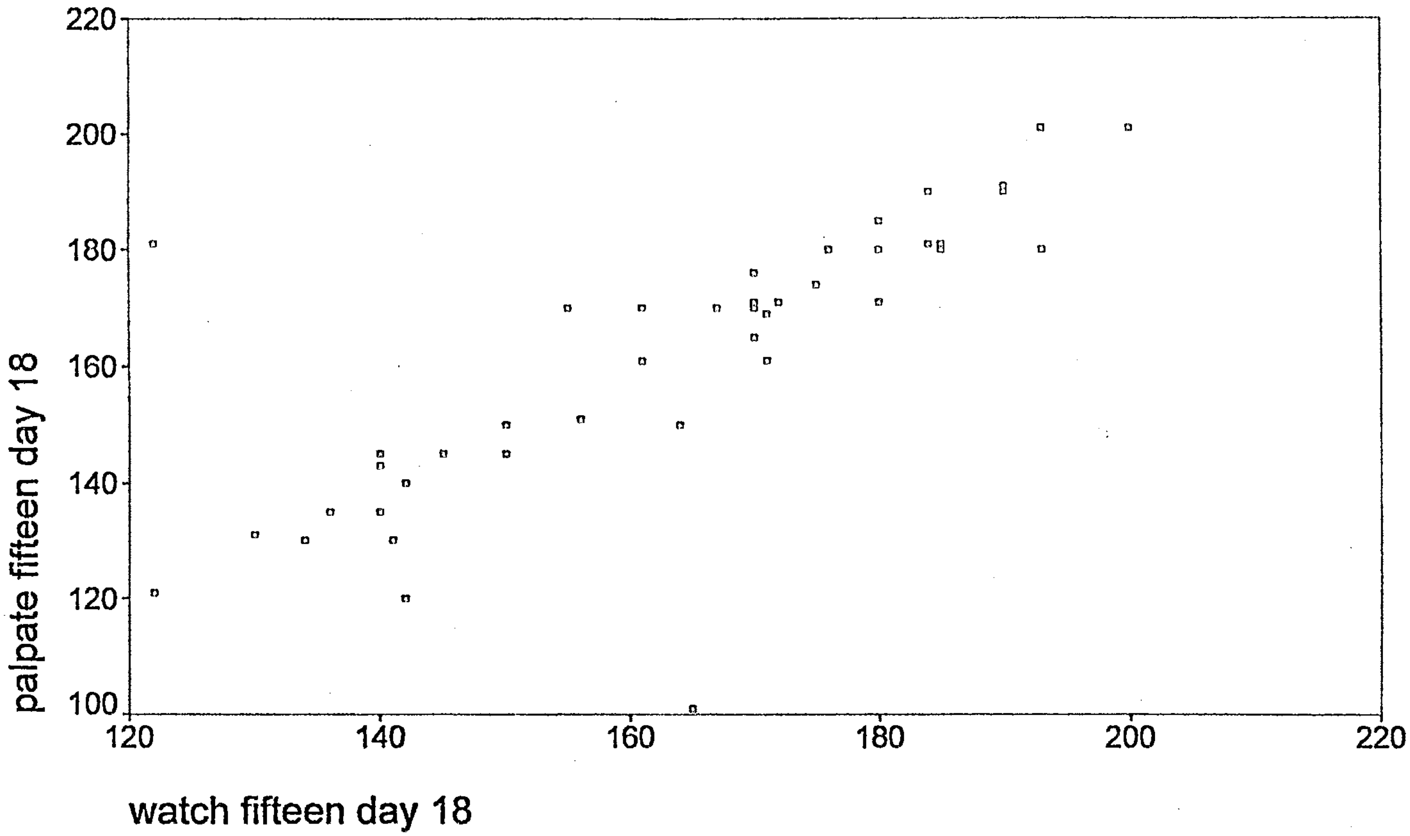
watch fifteen day 17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140
120
100
120
140
160
180
200
220

APPENDIX Q

LETTER TO SUPERINTENDENT

LETTER TO SUPERINTENDENT

(DATE)

(NAME)
(SCHOOL DISTRICT)
(ADDRESS)
(CITY, STATE ZIP CODE)

Dear

I am a Doctoral Candidate at Oklahoma State University pursuing a degree in education and am preparing to conduct my dissertation research in the area of physical education. I am very interested in comparing the use of Polar heart rate monitors and the palpate method (the use of the fingers to test the pulse) in order to measure cardiovascular fitness in seventh grade girls. This letter is to request your permission to conduct research at Simmons Middle School in your district.

The purpose of my research is the use of heart rate monitors to measure cardiovascular fitness of seventh grade girls. I would like to conduct this study during the fall of 1998. The data for the study will be collected by Carol Chestnut, physical education teacher at Simmons Middle School. I will make four or five visits to the school. I can assure you that I will take every precaution not to interfere in any way with instructional programs or class schedules. I will arrange my visits with Carol Chestnut.

The study requires no cost to the school system. Subjects will be selected at random. No one will participate in the study without consenting to do so. Please be assured that the administration, teachers and students will remain anonymous.

I would be most happy to answer questions regarding the nature of the study and will be pleased to send you the results which I plan to have completed no later than the end of December 1999. Please feel free to contact me at either my office (405) 224-3140 Chickasha, OK, or home (405) 691-4046 Oklahoma City. You may contact my dissertation advisor, Dr. Segall at his Oklahoma State University office (405) 744-8023.

Sincerely,

Nancy Osborn
Researcher
College of Education
Oklahoma State University

Dr. William E. Segall
Professor
College of Education
Oklahoma State University

APPENDIX R

LETTER TO PRINCIPAL

LETTER TO PRINCIPAL

(DATE)

(NAME)
(SCHOOL DISTRICT)
(ADDRESS)
(CITY, STATE ZIP CODE)

Dear

I am a Doctoral Candidate at Oklahoma State University pursuing a degree in education and am preparing to conduct my dissertation research in the area of physical education. I am very interested in comparing the use of Polar heart rate monitors and the palpate method (the use of the fingers to test the pulse) in order to measure cardiovascular fitness in seventh grade girls. This letter is to request your permission to conduct research at Simmons Middle School in your district.

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I would be most happy to answer questions regarding the nature of the study and will be pleased to send you the results which I plan to have completed no later than the end of December 1999. Please feel free to contact me at either my office (405) 224-3140 Chickasha, OK, or home (405) 691-4046 Oklahoma City. You may contact my dissertation advisor, Dr. Segall at his Oklahoma State University office (405) 744-8023.

Sincerely,

Nancy Osborn
Researcher
College of Education
Oklahoma State University

Dr. William E. Segall
Professor
College of Education
Oklahoma State University

APPENDIX S
LETTER TO TEACHER

LETTER TO TEACHER

(DATE)

(NAME)
(SCHOOL DISTRICT)
(ADDRESS)
(CITY, STATE ZIP CODE)

Dear

I am a Doctoral Candidate at Oklahoma State University pursuing a degree in education and am preparing to conduct my dissertation research in the area of physical education. I am very interested in comparing the use of Polar Heart rate monitors and the palpate method (the use of the fingers to test the pulse) in order to measure cardiovascular fitness in seventh grade girls. I have been given permission to conduct my research at Simmons Middle School and would appreciate your participation in the study.

The purpose of my research is the use of heart rate monitors to measure cardiovascular fitness of seventh grade girls. I would like to conduct this study during the fall of 1998. It would be for a nine-week period. The student participants would participate in your class schedule of high intensity activities. I would like for you to collect and record the data and in the five visits I make, we can discuss the progress and the comparisons of the two methods of recording a student's heart rate. On the final visit I will collect all the data and return to Oklahoma State University for the analysis. I will be most happy to send the results to you.

The study requires no cost to the school system. Subjects will be selected at random. No one will participate in the study without consenting to do so. Please be assured that the administration, teachers, and students will remain anonymous.

I look forward to hearing from you regarding this study. Please use the enclosed self-addressed stamped envelope to reply to this request. You may contact me at home (405) 691-4046 or at school—USAO (405) 224-3140 or you may contact my dissertation advisor, Dr. Segall at his Oklahoma State University office (405) 744-8023.

Sincerely,

Nancy Osborn
Researcher
College of Education
Oklahoma State University

Dr. William E. Segal
Professor
College of Education
Oklahoma State University

APPENDIX T

ORAL PRESENTATION

ORAL PRESENTATION TO STUDENTS

I am Nancy Osborn, a graduate student at Oklahoma State University in Stillwater, Oklahoma. I also teach physical education at USAO, University of Science and Arts of Oklahoma, in Chickasha, Oklahoma.

My research study is to compare the use of heart rate monitors and the use of the palpate method of calculating the pulse after twenty minutes of high intensity activities. The activities will be ones that are included in your semester class.

Sixty female students will be needed for the study. If, for some reason you are unable to participate in this study, please let me know. The sixty students in the study will be selected at random. Thirty of the students will wear the heart monitors and the other thirty will use the palpate method (using the fingers on the neck or the wrist to calculate the pulse).

Each student will calculate and know their target heart rate. This will allow each student to know the proper target heart rate in which they should be working in order to achieve a cardiovascular training effect. The study will continue for nine weeks and the pulse will be recorded for the purposes of this study on Tuesday and Thursday.

I am pleased to be here and look forward to having you help me with this study. It could not be done without the willing help of the school district, school principal, and your teachers. A big thanks to all of you.

APPENDIX U

PARENTS CONSENT FORM

PARENTS CONSENT FORM

I, ______________________________, hereby authorize or direct Carol Chestnut, physical education teacher at Simmons Middle School to perform the following treatment or procedure: to record and collect the heart rate data for the research study of Nancy Osborn at Oklahoma State University, Stillwater, Oklahoma.

Procedure: Sixty, seventh grade, female subjects (students) will be selected to participate in this study. They will participate in high intensity activities in their physical education class (the activities are currently a part of the school curriculum). The physical education class is of a 50-minute duration. While participating, 30 female students will wear Polar heart rate monitors and 30 female students will use the palpate method (use the fingers to record the pulse). At the conclusion of the 20 minutes of high intensity activity, the students will record their target heart rate. This will be done twice a week—on Tuesday and Thursday for nine weeks.

Confidentiality of identifying the subjects (students) will be maintained as the 60 students will be selected at random. No names will be used, rather each student will be assigned a number.

The possible benefits for the subjects (students)/society are that by using the heart rate monitors, if the individuals have a more accurate reading of their target heart rate and are better able to stay in their target heart rate zone, then they will be maintaining their own cardiovascular fitness level. They will be working their heart in their own fitness level.

This study is being conducted as part of a dissertation entitled—Use of Heart Rate Monitors to Measure Cardiovascular Fitness of Seventh Grade Girls.

The purpose of this study is to compare the use of Polar heart monitors and the palpate method (the use of fingers to record the pulse) in high intensity activities of seventh grade girls. Further, this study will determine which method of recording pulse is the most accurate.

I understand that participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withhold my consent and participation of my child in this project at any time without penalty after notifying Carol Chestnut and Nancy Osborn.

Carol Chestnut may be contacted at Simmons Middle School and Nancy Osborn may be contacted at (405) 224-3140 extension 246 concerning this study. I may also contact Gay Clarkson, Institutional Review Board Executive Secretary, 305 Whitehurst, Oklahoma State University, Stillwater, Oklahoma 74078; telephone number (405) 744-5700.

I have read and fully understand the parent consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: ____________________ Time: ____________________ (A.M./P.M.)

Signed: ______________________________
(signature of student)

____
(person authorized to sign for subject)

I certify that I have personally explained all elements of this form to the subject or his/her representative before requesting the subject or his/her representative to sign it.

Signed: ______________________________
(project director)

APPENDIX V

INSTITUTIONAL REVIEW BOARD FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 08-12-98 **IRB #: ED-99-007**

Proposal Title: USE OF HEART RATE MONITORS TO MEASURE CARDIOVASCULAR FITNESS OF SEVENTH GRADE GIRLS

Principal Investigator(s): William Segall, Nancy Osborn

Reviewed and Processed as: Expedited with Special Population

Approval Status Recommended by Reviewer(s): Approved

ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING, AS WELL AS ARE SUBJECT TO MONITORING AT ANY TIME DURING THE APPROVAL PERIOD.
APPROVAL STATUS PERIOD VALID FOR DATA COLLECTION FOR A ONE CALENDAR YEAR PERIOD AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL.
ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Disapproval are as follows:
All changes/revisions meet requirements.

Signature: Thomas C. Collins

Interim Chair of Institutional Review Board
and Vice President for Research

Date: August 19, 1998

cc: Nancy Osborn

VITA

Nancy Susan Osborn

Candidate for the Degree of

Doctor of Education

Thesis: USE OF HEART RATE MONITORS TO MEASURE CARDIOVASCULAR FITNESS OF SEVENTH GRADE GIRLS

Major Field: Curriculum and Instruction

Minor Field: Education

Biographical:

Personal Data: Born in St. Louis, Missouri, June 28, 1944, the daughter of Donald and Muriel Carline.

Education: Graduated from Ritenour High School, St. Louis, Missouri, May 1962; received Bachelor of Science degree in Health and Physical Education, Recreation, and Dance from Phillips University in 1966; received Master of Education in HPERD in 1971; completed the requirements for the Doctor of Education degree at Oklahoma State University in July, 1999.

Professional Experience: Instructor in the Department of PHED at the University of Science and Arts of Oklahoma in Chickasha, Oklahoma in 1980 – 1986; Instructor in the Department of HPERD at University of Texas at Austin, Texas, in 1988; Instructor in the Department of HPERD at Florida Atlantic University in Boca Raton, Florida, in 1989; Instructor in the Department of PHED at University of Science and Arts of Oklahoma in Chickasha, Oklahoma 1992 – present.

Professional Memberships: OAHPERD, ABWA, ALA/OK, OM/OK, OEA/NEA