MEASURES OF COMPLIANCE BY INSULIN DEPENDENT DIABETICS WITH AN EXERCISE PROGRAM

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BY

KAREN SICKING WIGGINS, B.S.

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Texas Woman's University

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We hereby recommend that the thesis prepared under our supervision by Karen Sicking Wiggins entitled Measures of Compliance by Insulin Dependent Diabetics with an Exercise Program

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Committee:

Barbara J. James
Chairman

Regina Michael Campbell

Don W. Long

Accepted:

Barbara J. James
Provost of the Graduate School

D E D I C A T I O N

TO

MY PARENTS

LEO AND MARTHA SICKING

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CHAPTER I

INTRODUCTION

Diabetes mellitus is a disease caused by an insufficient amount of available insulin. All tissues of the body are affected by it, especially the small blood vessels of the heart, kidneys, eyes, and nerves. The effects of the disease on these blood vessels may lead to heart disease, neuritis, blindness, or peripheral vascular disease.

Diabetes mellitus is a major health problem in the United States, affecting 10 million people. Its incidence is increasing by 6 percent per year. If this rate continues, the number of diabetics will double every 15 years (Krall, 1978).

Due to the severity of the disease and its rate of occurrence, research is ongoing in an attempt to discover new and better methods of controlling its effects on the body. One of the most recent additions to the treatment of the diabetic is an individualized exercise program (Skyler, 1979).

Exercise provides significant benefits for the diabetic patient, and therefore is often prescribed by physicians to assist the patient in gaining better control of

his disease. These benefits include "improved cardiovascular efficiency, psychological feeling of elation, lower blood sugar levels, and body weight maintenance" ("Diabetes and Exercise," 1979). However, it is unknown what percentage of diabetic patients are complying with their prescribed exercise program.

Statement of the Problem

Exercise has been shown to be a beneficial part of the treatment of diabetes. For various reasons many diabetics find it difficult to adhere to all the aspects of their medical regimen. Currently, patients are being instructed in home exercise programs on an inpatient basis. However, no follow-up has been carried out to determine whether these patients are adhering to their exercise program once they have been discharged from the hospital. In order to gain further information in this area the following question must be answered: Do insulin dependent diabetics (IDD) continue with their prescribed exercise program after they have been discharged from the hospital?

Purpose of the Study

The purpose of this study was to determine the differences between the resting heart rate, resting blood pressure, and heart rate 10 minutes after exercise of inpatient IDDs at discharge from the hospital and these

same patients after 45 days of performing a prescribed home exercise program as a measure of compliance.

Research Hypotheses

For the purposes of this study, the following hypotheses were stated:

1. There is no statistically significant difference between the resting heart rate of inpatient IDDs and these same patients after 45 days of performing a prescribed exercise program.

2. There is no statistically significant difference between the resting blood pressure of inpatient IDDs and these same patients after 45 days of performing a prescribed exercise program.

3. There is no statistically significant difference between the heart rate 10 minutes after exercise of inpatient IDDs and these same patients after 45 days of performing a prescribed exercise program.

Operational Definitions

For the purpose of this study the following terms were defined:

1. Diabetes mellitus. A disorder of carbohydrate metabolism, characterized by high blood sugar and urine sugar levels, and resulting from inadequate production or

utilization of insulin (Taber's Cyclopedic Medical Dictionary, 1970).

2. Insulin. A hormone secreted by the beta cells of the islets of Langerhans of the pancreas, which is essential for the proper metabolism of blood sugar and for maintenance of the proper blood sugar level (Taber's Cyclopedic Medical Dictionary, 1970).

3. Insulin dependent diabetic. "An individual with diabetes mellitus who is dependent upon insulin from a source other than his own body to control the storage and mobilization of fuels" (Duncan, 1973, p. 9).

4. Resting heart rate (RHR). The number of times the heart beats in one minute, after the individual has not done any physical activity within the last 30 minutes, and the individual has been at rest for at least five minutes.

5. Target heart rate (THR). The heart rate which has been prescribed for an individual to attempt to reach during an exercise session.

6. Exercise prescription. A set of exercises devised by the physical therapist in response to a referral by the patient's physician for the IDD patient to carry out at home.

7. Inpatient treatment (IPT). Those IDD patients who receive treatment as an inpatient.

8. Regular exercise. An exercise program which is carried out at least three times per week, during which the heart rate is elevated to 75 percent of the person's age-predicted maximum heart rate and sustained for 20 minutes as described by this investigator.

9. Patient compliance. Reduction of physiological measurements (resting heart rate, blood pressure, and heart rate 10 minutes after exercise).

Limitations

The limitations of this study included the following:

1. The sample from a convenient population consisted of patients who had been referred to the Physical Therapy Department in Dallas by a selected medical group.

2. Each patient had a different physiological response to exercise.

3. There was a variation of each patient's response to the physical therapist and the education methods used with him.

4. The validity of the education material given to the patient was not established.

5. There was a variation of up to 10 working days in the number of days post discharge in which patients returned for the follow-up session.

6. All diabetes mellitus patients were insulin dependent.

Assumptions

The assumptions of this study included the following:

1. Each patient was able to monitor his own pulse.

2. Each patient kept records as instructed.

3. Each patient understood and performed the exercises prescribed for him.

4. There was no difference in the patient's measured physiological response within 10 working days before or after a 45 day period after the last treatment session by the physical therapist.

5. Patients followed their diet and medication regimen as prescribed by their physician.

Significance of the Study

As the importance of exercise for the diabetic is recognized by greater numbers of physicians, the need for the development of diabetic rehabilitation programs will increase. Currently, these programs are being devised for the diabetic patient by physical therapists in acute hospital settings. Since the concept of exercise for the diabetic is new, the schools of physical therapy, especially in the state of Texas, have only been providing

instruction on the development of diabetic rehabilitation programs within the last year (Long, 1980). An inquiry by this investigator of Dallas/Fort Worth, Texas metroplex physical therapists, found that the majority of physical therapists have had no formal instruction on this subject. Also, very few continuing education courses or seminars are being offered on this subject ("APTA Progress Report," 1979). Therefore, the profession is in need of further information concerning diabetic exercise programs.

In the programs being carried out in two of the major hospitals in Dallas, no follow-up studies have been done to determine if patients are exercising at home (Young, 1980). If the patient is not performing the exercises prescribed for him, or if the amount of exercise prescribed is inappropriate, his diabetes may not be controlled as well. The diabetic patient is hospitalized to determine the type, amount, and frequency of administration of insulin. During this period of hospitalization he carries out the intensity, frequency, and duration of exercise he will be expected to continue at home. This specific amount of exercise affects the amount of insulin his physician will prescribe for him. Therefore, because his medication is regulated on the basis of a prescribed amount of exercise, he may have a more difficult time maintaining

control of his diabetes after discharge if he does not continue to exercise at home as he was taught in the hospital. Since exercise is important in the control of the patient's diabetes, it would be beneficial if the physical therapist knew if the patient education provided on an inpatient basis resulted in continued compliance with the prescribed exercise program after the patient was discharged from the hospital.

If the physical therapist knew whether treatment as an inpatient resulted in the patient's compliance with his medical regimen on an outpatient basis the therapist could adjust the treatment of inpatient diabetics to increase the patient's compliance with his exercise program. This information would assist the therapist in making decisions concerning the optimum mode of treatment/instruction on IDDs.

Frequently, research is done in the laboratory, in a very controlled setting. Although this type of research is necessary, it can be difficult to relate the results of such studies to the clinical environment. Clinical research allows the patient to initiate his exercise program in a setting similar to his home setting. The transfer of his exercise program to the "real world" may be easier in this situation than when it is initiated in a controlled

laboratory. Therefore, clinical research may result in the patient's compliance with his prescribed exercise program.

CHAPTER II

REVIEW OF LITERATURE

Selected literature was reviewed to determine the effects of exercise on diabetic patients. The six major areas which are covered in this review are: (1) Diabetes Mellitus, (2) Control in the Diabetic Patient, (3) In-patient Compliance, (4) Outpatient Compliance, (5) Benefits of Exercise, (6) Required Modifications for a Beneficial Response to Exercise, and (7) Effects of Exercise on Normal Subjects.

Diabetes Mellitus

Diabetes mellitus is a disease in which the supply of insulin from the pancreas is insufficient. Therefore, the body is unable to utilize carbohydrates, proteins, and fats properly. Sugar and sugar forming foods are not transposed into energy which is necessary for the cells to maintain life and normal body function. The result is hyperglycemia and glycosuria. The most common symptoms of diabetes mellitus are excessive thirst, urination, hunger, weight loss, and weakness. Other symptoms include vision changes, slow healing of injuries, itching of the skin

especially in the vaginal area, pain and numbness of distal extremities, and drowsiness.

There are two major types of diabetes mellitus with significant differences in their characteristics. The first type is juvenile diabetes. Its onset usually occurs during childhood or puberty, though it can occur at any age. Ten percent of all diabetics have juvenile onset. They require the use of insulin on a regular basis to control normal body functions. The pancreas in a juvenile diabetic produces no insulin. Therefore, he must have insulin administered to him. He is insulin dependent. Without the insulin the disease progresses very rapidly.

The second type of diabetes mellitus is maturity onset. Ninety percent of all diabetics have this type. It is usually a milder form than juvenile diabetes. The majority of patients in the maturity onset group are obese. The onset is gradual. A patient may have hyperglycemia for 8 to 10 years before symptoms begin to appear. Maturity onset diabetics are still producing a normal or even elevated level of insulin. It is used less effectively. Diet is the primary treatment of this type of diabetes. Insulin is required in only 20 to 30 percent of these patients (Duncan, 1973).

The following table indicates the differences between juvenile and adult onset types of diabetes.

TABLE 1

THE DIFFERENCE BETWEEN JUVENILE AND ADULT ONSET TYPES OF DIABETES

	Juvenile Type	Adult Type
Age of Onset	Frequently less than 20 years but can be any age	Most often over 30 but a few start before 30 years of age
Type of Onset	Abrupt	Gradual
Symptoms	Thirst, urinary frequency, increased appetite, weight loss	Sometimes none
Family History	Commonly positive	Commonly positive
Stability	Wide fluctuations of blood sugar with marked sensitivity to diet, exercise, insulin	Usually easily controlled if patient adheres to a proper diet
Coma (Ketosis)	Frequent, only if treatment program is inadequate	Uncommon except with severe stress, infection, etc.
Hypoglycemia	More frequent	Uncommon
Control of Diabetes	Difficult	Less difficult--if patient adheres to a proper diet
Pancreatic Insulin	Absent	Present
Complications	May occur	May occur
Diet	Most important	Important--may be the difference between needing insulin, oral hypoglycemic drugs, or diet only

Table 1--Continued

	Juvenile Type	Adult Type
Insulin Need	Yes--100%	Yes, in only 20 to 30%
Oral Hypoglycemic Agent	Not indicated	Yes, when other types of therapy fail

SOURCE: T. G. Duncan, The Good Life with Diabetes: p. 7, Table 1.

Another type of diabetes is diabetes insipides. Diabetes insipides is excessive thirst and urination which is caused by an inadequate secretion of vasopressin, the antidiruretic hormone (Taber's Cyclopedic Medical Dictionary, 1970). However, the patient population for this study only includes diabetes mellitus patients who are insulin dependent.

Control in the Diabetic Patient

When a physician speaks of "control in the diabetic patient" he is referring to the blood glucose levels (BGL). It is when the BGLs are too high that complications occur in the body (Cerami, 1979). The blood vessels undergo more damage from high BGLs than other areas of the body. The blood vessels which are primarily affected are those of the eyes, kidneys, legs, nervous system, and heart.

Obstruction of these blood vessels leads to blindness, renal failure, claudication, peripheral neuropathies, and arteriosclerotic heart disease (Duncan, 1973).

Research shows that the complications of diabetes are related to high BGLs and that good control of the blood glucose values is essential in minimizing these complications. The medical regimen which results in control for the insulin dependent diabetic (IDD) includes proper diet, medication, and exercise.

Inpatient Compliance

Diabetic patients usually have difficulty in complying with their medical regimen. There are several reasons for this: (1) diabetes usually requires a modification of the lifestyle of the individual, (2) the patient's independence may be limited and future plans may be affected by the restrictions of the medical regimen, (3) presently, there is no means of curing the diabetic patient and he must continue to live with the restrictions on his lifestyle, whereas in many other diseases there is either a recovery or death of the individual (Etzwiler, 1978).

Although the medical regimen is usually restrictive, the success of the diabetic in maintaining good health is dependent upon his understanding and compliance with these restrictions (Whitehouse, 1979). One method used to assist

the diabetic in complying with the prescribed therapy is treatment on an inpatient basis.

The most significant advantage of treating diabetics on an inpatient basis is that they are confined to the hospital. During their hospitalization the three most important aspects of their treatment, diet, medication, and exercise, can be controlled by their physician and the other health professionals. Strict control of these areas leads to better control of blood glucose levels in the diabetic (Duncan, 1973).

The hospitalization period can also be used to provide education for the diabetic patient. This is a beneficial time to provide him with information about his disease. According to Kucha, "Acquisition of learning is faster and easier if learning is meaningful (relevant) to the learner" (1977, p. 33). The reason a diabetic is hospitalized is usually because he has not been successful in maintaining control of his BGLs. He now realizes the detrimental effects of not maintaining control of BGLs. The education sessions will assist him to regain and maintain controlled BGLs. If he is able to do this his frequency of hospitalizations and complications should be decreased. This is an important reason why patient education on an inpatient basis is advantageous (Kucha, 1972).

However, there are also disadvantages in providing education for the patient on an inpatient basis. A study of pregnant IDD women was conducted to determine if it was necessary to continue routine hospitalization at 32 weeks. It was found that good control was maintained by the pregnant IDDs at home. In fact, patients maintained lower BGLs at home than they did in the hospital. One suggestion as to why this occurred was that the patients were probably less active in the hospital than they were at home. They were encouraged to be active, but were not provided with a prescribed exercise program in the hospital. It was felt that the lowered level of exercise led to higher BGLs (Stubbs, 1981).

In the hospital the patients were kept on a very strict schedule of medications and diet. At home patients regulated their own medications, diet, and exercise. They made small changes in diet, time and dose of insulin, or exercise to maintain the best regulation of their diabetes. The rigidity of the hospital schedule may prevent this flexibility (Stubbs, 1981).

Outpatient Compliance

A second method of assisting the IDD in complying with the prescribed therapy is through the use of outpatient supervision. Several benefits of outpatient treatment for

the diabetic have been documented. Outpatient treatment "keeps the patient healthier and out of the hospital, keeps him employed, and diminishes his morbidity" (Whitehouse, 1979, p. 37). Without follow-up treatment a diabetic may change his treatment habits, which may lead to a deterioration of his diabetic state. Changes in his condition, such as illness, growth, or pregnancy, can also affect his metabolic balance. There are many different aspects of diabetic control, such as the strict diet, variations in medication regimen, frequency and amount of exercise, and the proper combination of these to maintain good control of BGLs. The diabetic needs constant guidance and counseling in order to maintain a balance between these variables (Deckert, 1978).

In a study conducted between 1933 and 1978, 180 insulin dependent diabetics (IDD) were followed to determine whether outpatient visits increased the length of life of juvenile diabetics and whether the cost of the visits was reasonable in relation to the benefits. The length of life was significantly correlated with increased frequency of outpatient visits. The average length of life was prolonged by 11.9 years with an average of 4.4 annual outpatient visits. These findings suggested "that outpatient supervision of diabetic patients in a subspecialized clinic

is beneficial for the patients and involves relatively little cost as compared with the benefit derived" (Deckert, 1978, p. 284). It was felt that with the outpatient visits, diabetics were able to maintain long periods of good metabolic regulation, and therefore had fewer or no complications. The discussions among patients at the clinic gave them information which assisted them to adjust their treatment to the changing demands of the disease (Deckert, 1978).

Lawrence (1980) recommends frequent reassessment of patient's skills and knowledge through the use of outpatient sessions. However, very little has been done to determine the frequency with which these outpatient visits should occur.

Benefits of Exercise

The use of exercise to help control certain types of diabetes was first used in 600 B.C. by an Indian physician. The physicians of the eighteenth century also used exercise routinely in the treatment of their diabetic patients. However, in 1798, John Rolls began putting diabetic patients on bed rest until they had improved considerably. Only as recently as 100 years ago was exercise recognized once again as a beneficial method of treating diabetes mellitus. After the discovery of insulin, Elliott

Joslin emphasized the role exercise plays along with diet and medication in the management of diabetic patients (Vranic, 1979).

Exercise produces many beneficial responses in the IDD. The major benefits are: (1) a decrease in BGLs, (2) increased sensitivity of the body to insulin, (3) improved cardiovascular and respiratory functions, (4) increased participation by the patient in self-education about his disease, and (5) decreased glycosylated hemoglobin levels.

The first benefit, lowering the BGLs, is the most significant response to exercise. Maintaining BGLs within normal limits may decrease the possibilities of developing the complications of diabetes mellitus (Diabetes and Exercise, 1979). The main cause for this fall in blood glucose is an increase in the uptake of glucose in peripheral tissues, such as the exercising muscles (Koivisto, 1980). The glucose uptake by these muscles is 7 to 20 fold above basal levels, in proportion to the intensity and duration of the exercise. The additional glucose need of these muscles is met from an increased production of glucose by the liver. The increase in glucose production by the liver is three to five times. If the duration is long enough, lipid mobilization from adipose tissue is

stimulated, which results in an increase in free fatty acids (FFA) and an augmented usage of the FFA as oxidative fuel (Koivisto, 1980).

The muscular work during exercise leads to a decrease in plasma insulin. The decline is proportional to the duration and intensity of exercise.

Although the acute effects of exercise are important, the extended effects on the blood glucose levels may be more beneficial to the diabetic. There is a prolonged influence on glucose metabolism which is caused by the replenishment of muscle and liver glycogen in the 24 to 48 hours after exercise. When compared to the basal resting state, the post-exercise period causes a greater proportion of an orally ingested glucose load to escape hepatic metabolism and become accessible for peripheral utilization in normal subjects and possibly also in diabetic patients. Simultaneously, the decrease in the glycogen content of the exercising muscle, causes a prolonged glucose utilization in muscle tissues. Therefore, the glucose tolerance of the diabetic improves, and insulin requirements are diminished (Wahren, 1979). In summary, exercise causes a decline in BGLs because the stimulation of glucose utilization exceeds the rise in glucose production (Lowenthal, 1979).

A second major benefit of exercise for the IDD is an increased sensitivity of the body to insulin. After conducting a study of the effects of exercise on IDDs, Lowenthal (1979) stated that acute exercise increased the utilization of insulin which was intravenously administered immediately after exercise. The improvement of the rate of disappearance of the glucose was proportional to the intensity of exercise. This disappearance rate may increase from 0.4 mg/kg/min in the resting state to 0.8-0.9 mg/kg/min after intensive exercise. Therefore, the amount of exogenous insulin may be reduced in some diabetic patients who exercise regularly.

The method by which glucose uptake and insulin sensitivity are increased during and after exercise is not completely understood. Changes in the tissue sensitivity to insulin correlate with changes in the binding of insulin to monocytes. A study on insulin binding demonstrated a 36 percent increase in insulin binding to monocytes after three hours of exercise (Soman, 1979). The increase was caused by a rise in receptor affinity rather than an elevation in the number of receptors. The facilitation of insulin binding was proportional to a decline in the level of plasma glucose during exercise. Therefore, insulin binding may augment glucose uptake and insulin sensitivity may be increased by acute exercise (Lowenthal, 1979).

If acute exercise improved insulin sensitivity, repeated exercise may cause a more significant increase of body sensitivity to insulin. It has been shown that physical training in obese individuals and athletes has a hypoinsulinemic effect, but does not cause deterioration in glucose tolerance. However, physical inactivity results in hyperinsulemia and a deterioration of glucose tolerance. This suggests the development of insulin resistance (Felig, 1979; Lowenthal, 1979).

In long distance runners insulin binding was 69 percent higher than in sedentary individuals. In Felig's (1979) study, individuals who had been sedentary were monitored after a six week training program for insulin binding to monocytes and insulin stimulated glucose uptake. Both increased by 35 to 40 percent. Therefore, the facilitation of insulin binding to receptors may be the method of insulin sensitivity induced by physical training. These findings suggest that acute exercise and especially physical training improves insulin sensitivity in the resting state, which may assist in the control of diabetes mellitus (Lowenthal, 1979).

Thirdly, cardiovascular and respiratory efficiency are also improved with physical training. With the increase in cardiovascular efficiency a decreased time for wound healing has also been demonstrated. This is due to the increased peripheral circulation seen with physical training (Vranic, 1979).

The fourth major benefit of exercise is that the patient involvement in exercise may stimulate him to participate in self-education about his disease. An IDD must learn his individual adaptations and intolerances. If patients can become conscious of their health through exercise involvement, they may attempt to control all aspects of their medical regimen (Diabetes and Exercise, 1979).

The fifth major benefit of exercise in the diabetic is a decreased level of glycosylated hemoglobin (hemoglobin A_{1c}). When diabetic patients have BGLs which are greater than normal over a period of three to four weeks, there is a rise in the nonenzymatic addition of glucose to hemoglobin A (Cerami, 1979). When diabetics were strictly controlled, or their BGLs were maintained within normal limits for a three to four week period, the hemoglobin A_{1c} fell to normal values (Koenig, 1976). If IDDs are able to maintain normal BGLs with the assistance of exercise, they may have a lower concentration of hemoglobin A_{1c}.

Many other common benefits of exercise have been demonstrated in the IDD. These include an increase in physical work capacity, decreased triglyceride levels, increased high density lipids, lowered anxiety states, and greater ease in the maintenance of body weight (Diabetes and Exercise, 1979).

Required Modifications for a Beneficial Response to Exercise

In order for the IDD to receive maximum benefit from physical training there are several facts he should consider prior to each exercise session. These factors are: (1) injection site, (2) time of exercise, and (3) control of hypoglycemia.

First, the site of insulin injection should be considered. An exercising limb will absorb insulin into the system more rapidly than an inactive limb (Zinman, 1979). If the insulin is absorbed quickly into the body a hypoglycemic response will occur. In order to avoid this, care should be taken to inject the insulin into an area that will be used as little as possible. The two areas of the body which result in hypoglycemia the least are the subcutaneous tissues over the abdomen and the gluteals. The abdomen does not have a significant amount of activity during most aerobic activities, and the gluteals have a thick layer of tissue into which the insulin is injected; therefore, it takes longer for the insulin to be absorbed into the body from these two areas (Zinman, 1979).

The second concern for the exercising diabetic is the time of exercise as related to his BGLs. Many diabetics have a specific time of day when hyperglycemia tends to occur. Blood glucose levels are decreased during exercise.

If the IDD exercises during a hyperglycemic period he may be able to use his exercise period to keep his BGLs within normal limits the majority of the time (Berg, 1979).

The third consideration for the exercising IDD is how to control hypoglycemia. Exercise lowers BGLs and periodically causes hypoglycemia; therefore, certain adjustments must be made to avoid this reaction. The IDD has two alternatives to choose from. One, is to ingest a carbohydrate snack approximately 30 minutes prior to the exercise session. Having the additional carbohydrate will keep the BGLs high enough to avoid hypoglycemia (Skyler, 1979). The second alternative is to decrease the insulin level. Decreasing the insulin level also decreases the amount of glucose which is made available to the individual. If the diabetic is overweight and does not require the additional glucose, he should decrease his insulin level. However, if weight loss is not desired, the carbohydrate snack should be ingested rather than decreasing the amount of insulin (Skyler, 1979).

Effects of Exercise on Normal Subjects

There are many beneficial physiological responses to regular aerobic exercise. Those which are mentioned most frequently in the literature are lowered triglyceride and cholesterol levels (Snyder, 1979), decreased weight,

improved psychological state, and improved cardiovascular efficiency (Exercise and the Cardiovascular System, 1979). These benefits have been documented for diabetic and normal subjects.

In order for these benefits to occur the individual must exercise a minimum of 3 times per week, 20 minutes per session (Exercise and the Cardiovascular System, 1979). The greatest training effect occurs in the first 2 to 3 weeks after one initiates an exercise program. This training effect is exhibited by an improved cardiovascular response. The resting heart rate and blood pressure are decreased and the length of time it takes the heart rate to return to normal after exercise is also decreased (Exercise and the Cardiovascular System, 1979).

In older subjects the cardiac response to exercise is slower. The response is the same in that the resting heart rate and blood pressure can be decreased and the length of time it takes for the heart rate to return to within normal levels after exercise is decreased, however these responses take a longer time to occur in the older subject (Snyder, 1979).

According to one study on age and response to exercise, ages 50 and above were classified as "older" (Julius, 1967). Another study referred to age groups of 70 and above as "older" (Snyder, 1979). With exercise,

younger subjects develop an increase in systolic blood pressure, while older subjects show an increase in systolic and diastolic blood pressure. The change in heart rate for the older individual is not as drastic as the changes in blood pressure. In general, the resting heart rate and the heart rate with exercise remain relatively stable as the individual ages (Snyder, 1979). However, the length of time for the heart rate to return to within normal levels after exercise is lengthened for the older individual (Exercise and the Cardiovascular System, 1979).

In summary, the diabetic may have difficulty in adhering to a strict medical regimen. It has been shown that outpatient visits assist the diabetic in following his prescribed therapy. Part of that therapy is a regular exercise program. Regular exercise produces many benefits in diabetics and normals. One of the major benefits is improved cardiovascular efficiency. This can be measured by monitoring heart rate and blood pressure changes in response to exercise. The older individual has a much slower response to exercise and is therefore infrequently included in studies on human responses to exercise.

CHAPTER III

METHODOLOGY

The study was conducted to investigate patient compliance to a prescribed exercise program. A one group pretest/posttest research design was utilized in this quasi-experimental study.

Population and Sample

The sample from the convenient population consisted of 10 IDDs between the ages of 18 and 60 from one selected acute care hospital in Dallas, Texas. All patients were referred to the Physical Therapy Department for exercise by a selected medical group. The criteria for participation in the program included: (1) patients not actively involved in a regular exercise program prior to referral to the department and (2) patients able to monitor their pulse prior to discharge from the hospital. These criteria were determined in an interview/demonstration situation with the patient.

The sample of patients was selected by chronological date as they were referred to the Physical Therapy Department for treatment. The first 10 eligible inpatients comprised the subjects included in the study.

Patient Treatment

All patients in this study received the same patient education program and carried out the same exercise program in the Physical Therapy Department. The patient education and patient treatment were given by the same physical therapist. This physical therapist was an individual other than the investigator.

The patients received education on the benefits of exercise and the guidelines to follow when exercising. The group was taught the prescribed exercises and encouraged to continue to exercise at home after discharge from the physical therapy treatment sessions.

The education information consisted of an explanation that keeping diabetes in better control with exercise usually leads to fewer complications. This was followed by a discussion with the patient of all secondary complications which can occur with diabetes mellitus. The education information was followed by an explanation of the expected benefits of and guidelines for exercising. An outline of these topics was given to the patient (Appendix A).

A checklist (Appendix B) was placed in each patient's chart for the physical therapist to initial and date, to ensure that each patient had verbalized an understanding of each concept, or accurately demonstrated the exercise

activity. In the verbalization of each concept the patient was asked to give an explanation of his understanding of each concept which could not be demonstrated. All parts of the checklist were completed by the time of discharge from the physical therapy treatment sessions.

A complete exercise program, consisting of warm up exercises, an aerobic activity, and cool down exercises was designed for each patient (Appendix C). The intensity and duration of the exercises were based on the patient's age, physical endurance, and preference. Each patient was taught how to monitor his pulse in order to monitor his reaction to each exercise session.

The patient received patient education for diabetics and an individualized exercise program. Just before discharge the patient was given a verbal explanation of the study, and a consent form (Appendix D) was signed by the patient. He was given a daily record sheet (Appendix E) with a verbal and written explanation of how to use it (Appendix F). The daily record sheet, which the patient used on an outpatient basis, provided space for the patient to record his resting heart rate, highest heart rate reached during exercise, heart rate 10 minutes after exercise, type of exercise, and length of exercise.

Patients were asked to keep these records for the first 45 days after discharge. At the end of 45 days the

patients returned to the Physical Therapy Department for final treatment measurements. The end of a 45 day period may have fallen on a weekend, or the patient may not have been able to return for treatment on that particular day. Therefore, the patients were allowed to return for their final visit to the department within the period of time either 10 working days before or 10 working days after the forty-fifth day after discharge from the treatment sessions. The patient's resting heart rate, resting blood pressure (systolic and diastolic), maximum heart rate during exercise, heart rate 10 minutes after exercise, type of exercise, and length of exercise were recorded on this final visit.

Collection of Data

Data were collected on the patients between the months of January 1981 and August 1981. The data used for statistical analysis included information collected by the physical therapist while the patients were hospitalized and upon their return after 45 days. It consisted of the resting heart rate, resting systolic and diastolic blood pressure, and heart rate 10 minutes after exercise. During the period of hospitalization these statistics were obtained from the patient's chart and the records kept in the Physical Therapy Department on a daily basis.

Patients were asked to keep records of their resting and exercise heart rates while exercising at home. However, these records were not used as data for this study. The completion of the daily log by the patients assisted in the determination of factors which might result in the patient's inability to continue his exercise program.

Human Subjects Review and Confidentiality

A number was assigned to each patient as he was selected for the study. The patients selected for the study were given the numbers 1 through 10. These numbers were used when referring to any of the patients included in the study. This provided patient confidentiality. The rules of patient confidentiality of the hospital where the study was conducted were also followed. This study was approved by the Texas Woman's University Human Subjects Review Committee.

Treatment of the Data

Data were analyzed to accept or reject each hypothesis using the *t*-Test. The factors used for this analysis were the levels of change observed in the patient's cardiovascular responses when the patients returned on an outpatient basis.

The cardiovascular responses recorded were the resting heart rate, resting blood pressure (systolic and diastolic),

and the heart rate 10 minutes after exercise. The resting heart rate (RHR) on the first day of the study was referred to as R_1 and after 45 days it was referred to as R_{45}. The resting systolic blood pressure on the first day was referred to as S_1 and the systolic blood pressure after 45 days was referred to as S_{45}. The resting diastolic blood pressure on the first day of the study was referred to as D_1 and after 45 days it was referred to as D_{45}. The heart rate 10 minutes after exercise on the first day of the study was referred to as H_1 and the heart rate 10 minutes after exercise at the end of 45 days was referred to as H_{45}.

Increases of any indicators were subtracted from the total decrease of all indicators which declined. This sum was then divided by 10 to determine the average change of each indicator. The following tables provide examples of how the observations were recorded and used to accept or reject the three directional hypotheses.

TABLE 2

CARDIOVASCULAR RESPONSE BY PATIENT

Patient Number	Cardiovascular Responses			
	RHR	SBP	DBP	HR_{10}
1	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$
2	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$
3	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$
4	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$
5	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$
6	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$
7	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$
8	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$
9	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$
10	$R_{45} - R_1$	$S_{45} - S_1$	$D_{45} - D_1$	$H_{45} - H_1$

Key: Resting Heart Rate (RHR)
Systolic Blood Pressure (SBP)
Diastolic Blood Pressure (DBP)
Heart Rate after 10 minutes (HR_{10})

Each observational score was taken and a statistical analysis was run to determine if the average change in each cardiovascular response measured was significant. The level of significance for each hypothesis was 0.05.

CHAPTER IV

FINDINGS

This study was conducted to determine the differences between the resting heart rate, resting blood pressure, and heart rate 10 minutes after exercise of IDDs at discharge from the hospital and these patients after 45 days of performing a prescribed exercise program. Data were collected prior to the beginning of this exercise program and after the 45 days of exercise at home. In this chapter, the findings include the descriptive data of the sample and the statistical results for the research hypotheses.

Description of Participants

All subjects in the sample were IDDs at a Dallas hospital. The convenient sample consisted of 10 IDDs between the ages of 22 and 50 with a mean age of 34.5 years. There were three male (30%) and seven female (70%) subjects. Four of the patients (40%) were newly diagnosed and the remaining patients had diabetes mellitus for $1\frac{1}{2}$ to 27 years. Demographic data are presented in Table 3.

Four subjects (40%) used walking as the aerobic mode of exercise. Four subjects (40%) used stationery biking

as the aerobic mode of exercise. One subject (10%) used a combination of walking and jogging as the aerobic mode of exercise. One subject (10%) used jogging as the aerobic mode of exercise.

TABLE 3

IDD PATIENTS BY SEX, AGE, LENGTH OF DIAGNOSIS, AND MODE AND DURATION OF EXERCISE

Patient Number	Sex	Age	Length of Diagnosis (in years)	Mode	Duration (in minutes)
1	M	42	Newly Diagnosed	Jogging/ Walking	25
2	F	40	Newly Diagnosed	Walking	40
3	F	45	Newly Diagnosed	Biking	20
4	M	50	Newly Diagnosed	Walking	20
5	F	32	$1\frac{1}{2}$	Walking	20
6	M	26	16	Biking	20
7	F	29	$4\frac{1}{2}$	Biking	20
8	F	22	16	Jogging	20
9	F	29	4 mos.	Walking	20
10	F	30	27	Biking	20

The duration of exercise varied: eight subjects (80%) exercised for 20 minutes; one subject (10%) exercised 25 minutes; and one subject (10%) exercised 40 minutes during each exercise session. All subjects exercised a minimum of four times per week.

Statistical Findings

Resting Heart Rate

The first hypothesis stated: There will be no statistically significant difference between the resting heart rate of inpatient IDDs and these same patients after 45 days of performing a prescribed exercise program. This hypothesis was accepted.

The resting heart rate of eight subjects (80%) decreased after the 45 day period while two subjects (20%) showed an increase in resting heart rate. The average decrease in resting heart rate after completion of the 45 day exercise program was 4.8 beats per minute. The p value was 0.239. This was not significant at the 0.05 level; therefore, the hypothesis was accepted (see Table 4).

TABLE 4

PRE- AND POST-EXERCISE RESTING HEART RATE, DIFFERENCE, AND PERCENTAGE CHANGE BY PATIENT

Patient Number	Pre	Post	Difference (beats/min)	Percent of Change
1	92	84	8	8.7
2	112	96	16	14.2
3	100	76	24	24.0
4	80	76	4	5.0
5	88	104	+16	+18.2
6	80	68	12	15.0
7	64	76	+12	+18.8
8	72	72	0	0.0
9	96	88	8	8.3
10	104	100	4	4.0

Resting Blood Pressure

The second hypothesis states: There is no statistically significant difference between the resting blood pressure of inpatient IDDs and these same patients after 45 days of performing a prescribed exercise program. This hypothesis was accepted.

The average increase in systolic blood pressure was 1.2 mmHg. The p value was 0.746, which was not significant at the 0.05 level. The average decrease in diastolic blood pressure was 3.4 mmHg. The p value was 0.319. This was not significant at the 0.05 level; therefore, the hypothesis was accepted (see Tables 5 and 6).

TABLE 5

PRE- AND POST-EXERCISE SYSTOLIC BLOOD PRESSURE, DIFFERENCE, AND PERCENTAGE CHANGE BY PATIENT

Patient Number	Pre	Post	Difference (mmHg)	Percent of Change
1	114	134	+20	+17.5
2	98	94	4	4.1
3	111	104	7	6.3
4	116	108	8	6.9
5	95	98	+3	+3.2
6	118	128	+10	+8.5
7	104	90	14	13.5
8	110	128	+18	+16.4
9	102	100	2	2.0
10	130	126	4	3.1

TABLE 6

PRE- AND POST-EXERCISE DIASTOLIC BLOOD PRESSURE, DIFFERENCE, AND PERCENTAGE CHANGE BY PATIENT

Patient Number	Pre	Post	Difference (mmHg)	Percent of Change
1	80	72	8	10.0
2	60	64	+4	+6.7
3	80	70	10	12.5
4	90	80	10	11.1
5	78	80	+2	+2.6
6	78	84	+6	+7.7
7	84	58	26	31.0
8	88	94	+6	+6.8
9	56	60	+4	+7.1
10	78	76	2	2.6

Four patients had an increase in post-systolic blood pressure and five had an increase in post-diastolic blood pressure. Three of these same patients had an increase in both systolic and diastolic blood pressure.

Heart Rate Ten Minutes After Exercise

The third hypothesis states: There is no statistically significant difference between the heart rate 10 minutes after exercise of inpatient IDDs and these same patients after 45 days of performing a prescribed exercise program. This hypothesis was rejected.

All patients had a decrease in heart rate 10 minutes after exercise except two. The average decrease in heart rate 10 minutes after exercise is 11.8 beats per minute.

The p value was 0.019. This was statistically significant at the 0.05 level; therefore, the hypothesis was rejected (see Table 7).

TABLE 7

PRE- AND POST-EXERCISE HEART RATE TEN MINUTES AFTER EXERCISE, DIFFERENCE, AND PERCENTAGE CHANGE

Patient Number	Pre	Post	Difference (beats/min)	Percent of Change
1	118	88	30	25.4
2	104	96	8	7.7
3	116	80	36	31.0
4	80	76	4	5.0
5	100	104	+4	+4.0
6	80	72	8	10.0
7	76	80	+4	+5.3
8	92	80	12	13.0
9	100	88	12	12.0
10	120	104	16	13.3

Summary

The differences between the resting heart rate, resting blood pressure, and heart rate 10 minutes after exercise of IDDs at discharge from the hospital and these same patients after 45 days of performing a prescribed exercise program were determined. The disposition of the three hypotheses follows (see Table 8).

TABLE 8

DISPOSITION OF HYPOTHESES

	Hypothesis	Disposition
1.	There is no statistically significant difference between the resting heart rate of inpatient IDDs and these same patients after 45 days of performing a prescribed exercise program.	Accepted
2.	There is no statistically significant difference between the resting blood pressure of inpatient IDDs and these same patients after 45 days of performing a prescribed exercise program.	Accepted
3.	There is no statistically significant difference between the heart rate 10 minutes after exercise of inpatient IDDs and these same patients after 45 days of performing a prescribed exercise program.	Rejected

CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Summary

This study was conducted to investigate the compliance of IDDs to a prescribed exercise program. The parameters selected for this study were the resting heart rate, resting blood pressure, and heart rate 10 minutes after exercise. A one group pretest/posttest research design was used. This study was conducted from January 1981 to August 1981 in the Physical Therapy Department in a Dallas hospital. Subjects were selected by the convenience method as they were referred to the Physical Therapy Department for exercise. Only patients who were not actively involved in an exercise program were included in the study.

Data were collected on 10 subjects. The measurements were documented during the patient's treatment in the Physical Therapy Department prior to discharge from the hospital. These same vital signs were documented on a follow-up visit to the department 45 days after discharge from the hospital. The decreased resting heart rate and blood pressure were not statistically significant in the

10 IDDs after following the prescribed exercise program for 45 days. However, the heart rate 10 minutes after exercise did alter significantly at the 0.05 level of significance.

Conclusions

Based on the findings of this study, the following conclusions are offered.

1. The regular aerobic exercise program did not result in a statistically significant change in the pre- and post-resting heart rate and blood pressure of IDDs.

2. The regular aerobic exercise program resulted in a statistically significant decrease in the pre and post heart rate 10 minutes after exercise in the IDDs.

Discussion

A study was conducted to examine the changes in resting heart rate, blood pressure, and heart rate 10 minutes after exercise of IDDs at the end of a 45 day prescribed exercise program. These findings may have implications for the physical therapists who are responsible for the exercise prescriptions of IDDs. The regular aerobic exercise program resulted in a decrease in the heart rate 10 minutes after exercise in the IDD.

In many exercise programs for normals the heart rate 10 minutes after exercise is expected to be within 10 beats

of the resting heart rate prior to the exercise session. After completion of the 45 day exercise program the heart rate 10 minutes after exercise of all subjects was within 10 beats of their resting heart rate prior to the exercise session. This is an indication that the patient recovered from the exercise session more rapidly because his body was physiologically more efficient than prior to the exercise program.

In general, individuals who are in better physiological shape are more likely to survive a myocardial infarction. Since diabetics are at a higher risk for coronary disease, the physiological condition becomes even more significant (Exercise and the Cardiovascular System, 1979). The significant decrease in the heart rate 10 minutes after exercise at the end of the 45 day exercise program supports the findings in the literature which state that an individual who exercises regularly shows a more rapid return of the post-exercise heart rate to the resting rate (Exercise and the Cardiovascular System, 1979).

The average systolic blood pressure actually increased after the exercise program. This is seen in many patients after discharge from the hospital. It is attributed to the fact that the patient does not have the added stresses of daily activity such as the anxiety created by a job. This

may be the reason why a statistically significant difference in blood pressure was not seen.

The other two measurements, resting heart rate and resting diastolic blood pressure did not show a statistically significant change, although they did both show a mean decrease. The fact that only 10 subjects were in the study could have been a factor in the lack of significant findings.

The decrease in resting heart rate was not significant statistically. However, the decrease of resting heart rate by 4.8 beats per minute may be significant clinically. This means the individual's heart is beating 6912 fewer times every day. This should lead to a decreased demand on the heart.

It is also important to note that 80 percent of the subjects had a decrease in their resting heart rate. This decrease in resting heart rate after completion of a regular exercise program is indicative of a favorable training effect on the cardiovascular system (Exercise and the Cardiovascular System, 1979).

The majority of the patients stated that the exercise made them feel better. This is a benefit of exercise which is important, although it is difficult to measure, thus, compliance was measured by change in the physiological indicators.

A factor which was scrutinized but showed no bearing on the results was the mode of exercise. The two subjects who showed an increase in resting heart rate after the program used two different modes of exercise--walking and biking. Walking and biking were also used by those subjects who showed decreases in their resting heart rates.

Those individuals showing increases in blood pressure also used a variety of exercise modes. Each mode (jogging/walking, jogging, walking, and biking) used in the study was utilized by one of the subjects who showed an increase in blood pressure at the end of the program. The mode of exercise chosen did not seem to have a direct effect on the results of the study.

Many different variables existed in this study. The major ones included the age and sex of the subjects, the number of years each patient had diabetes prior to this study, and the mode and duration of exercise chosen by each subject. The existence of each one of these variables alone might have affected the outcomes of the study. When all of these variables are included together in one study interactions of these variables may cause an even greater effect on its outcome. In future studies of the IDD and exercise, every attempt should be made to control as many of these variables as possible.

The findings of this study are also important to physical therapy educators who plan to implement a course of study. The student should be taught the scientific principles and parameters necessary for the treatment of IDDs. Development and revision of a curriculum should be carried out with knowledge of existing research, new ideas, and alteration of concepts that presently exist in physical therapy.

These findings have implications for physical therapy research which is important to the profession. Improvements in writing of exercise prescriptions for IDDs should be researched to determine the best physical therapy prescription that will provide the patient with safe, effective, and lifelong compliance.

Recommendations

Based on the findings of this study, it is recommended that similar studies be conducted:

1. utilizing a larger population.
2. studying IDDs who have been diagnosed for varying lengths of time.
3. studying other aspects of IDD compliance.

4. comparing IDDs being treated and tested as outpatients.

5. comparing the response of inpatient IDDs and outpatient IDDs to an aerobic exercise program.

APPENDIXES

APPENDIX A

OUTLINE OF PATIENT EDUCATION

OUTLINE OF PATIENT EDUCATION

I. Goals of Physical Therapy
   A. Stimulate home energy expenditure
   B. Increase activity level
   C. Patient education

II. Benefits of Exercise
   A. Decrease blood sugar levels
   B. Aids in weight loss
   C. Peripheral circulation is improved
   D. Quantity of insulin may decrease
   E. Increased sensitivity to insulin
   F. Decreased triglycerides and increased high density lipids
   G. Increased efficiency of cardiovascular system
   H. Diabetes is better controlled

III. Possible Complications of Diabetes Mellitus

   A. Blindness
   B. Paralysis
   C. Kidney Failure
   D. Heart Attack
   E. Stroke

IV. How To Take Your Pulse
   A. How to find pulsation
   B. Length of time

V. How to Determine Target Heart Rate
   A. Definition of target heart rate
   B. Formula

VI. Comparison of Hypoglycemic and Hyperglycemic Reactions
   A. Hypoglycemia (low blood sugar)
      1. Hunger
      2. Nausea
      3. Trembling
      4. Weakness
      5. Sweating
      6. Confusion
      7. Tingling of mouth and fingertips

B. Hyperglycemia (high blood sugar)
    1. Excessive thirst
    2. Frequent urination
    3. Dry mouth
    4. Nausea
    5. Vomiting
    6. Abdominal pain is common

VII. Location of Injection Site Before Exercise
    A. Best location
    B. Purpose

VIII. Conditions to Consider Prior to Exercise Session
    A. When meals and insulin were taken last
    B. Intensity of exercise
    C. Duration of exercise
    D. Frequency of exercise
    E. Injection site
    F. Insulin dosage regulation for exercise

IX. Precautions for exercise and the diabetic
    A. Hypoglycemia
    B. Illness

APPENDIX B

CHECKLIST FOR PATIENT EDUCATION

CHECKLIST FOR PATIENT EDUCATION

_____
Patient Number

#	Topic	Date	PT's Initials	Understanding/ Demonstration
I	Goals of PT			
II	Complications of Diabetes			
III	Benefits of Exercise			
IV	Pulse Taking			
V	Determine Target Heart Rate			
VI	Abnormal Reactions			
VII	Injection Site for Exercise			
VIII	Before Exercise Preparations			
IX	Precautions With Exercise			

APPENDIX C

WARM UP AND COOL DOWN EXERCISES

WARM UP AND COOL DOWN EXERCISES

CALISTHENICS

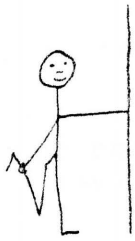
1. Airplane circles with arms.
2. Jumping jacks.
3. Leg raises while leaning against wall.

4. Leg raises in sidelying.
5. Knee raises
6. Half knee bends.
7. Toe raises.

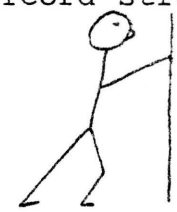
STRETCHING

1. Waist twists.
2. Side bends
3. Toe touches in long sitting (no bouncing)

4. Quad and hip flexor stretch (be sure to:
   1) grasp ankle, not foot
   2) knee points straight down, not out
   3) avoid arching back or leaning forward
   4) feel stretch in front of thigh

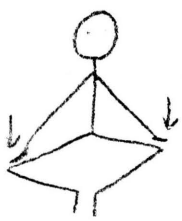


5. Heelcord stretch



(should feel stretch at back of leg)

6. Abductor stretch--sitting on floor, turn bent knees out towards floor, so that soles of feet face each other. Apply gentle pressure downward to inside of knees. Hold to count of 6, then relax. Do Not Bounce.



INSTRUCTIONS

A. Begin with calisthenics for warm up (5-7 minutes). Do each one (1-7) approximately 15 reps. in rapid succession. Indication of adequate warm up is to produce light sweat.

B. Follow these with the stretching exercises above. These should take you another 5-7 minutes.

Remember:
- no bouncing.
- hold stretch to count of 6, relax, repeat.
- each exercise should be done to each side X 3-4 reps. (except for #1 & 2 which should be X 10 reps.)

C. Begin regular exercise program (20-30 minutes)

D. Cool down exercises: Walk around at a slow pace until you feel your heart rate has slowed back down. (You should have taken your pulse rate prior to your cool down.)
Finish up with stretching exercises 1-6.

Key: Reps. = Repetitions

APPENDIX D

CONSENT FORM

Consent Form
TEXAS WOMAN'S UNIVERSITY
HUMAN SUBJECTS REVIEW COMMITTEE

Title of Project: Compliance to an Exercise Program by Insulin Dependent Diabetics

Consent to Act as A Subject for Research and Investigation

I have received an oral description of this study, including a fair explanation of the procedures and their purpose, any associated discomforts or risks, and a description of the possible benefits. An offer has been made to me to answer all questions about the study. I understand that my name will not be used in any release of the data and that I am free to withdraw at any time. I further understand that no medical service or compensation is provided to subjects by the university as a result of injury from participation in research.

Signature _____ Date _____

Witness _____ Date _____

Certification by Person Explaining the Study

This is to certify that I have fully informed and explained to the above named person a description of the listed elements of informed consent.

Signature _____ Date _____

Position _____

Witness _____ Date _____

One copy of this form, signed and witnessed, must be given to each subject. A second copy must be retained by the investigator for filing with the Chairman of the Human Subjects Review Committee. A third copy may be made for the investigator's files.

APPENDIX E

DAILY RECORD SHEET

DAILY RECORD SHEET

Name_____

Day After Discharge	Resting Pulse	Maximum Pulse During Exercise	Pulse Ten Minutes After Exercise	Type of Exercise	Length of Exercise
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Day After Discharge	Resting Pulse	Maximum Pulse During Exercise	Pulse Ten Minutes After Exercise	Type of Exercise	Length of Exercise
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					

Day After Discharge	Resting Pulse	Maximum Pulse During Exercise	Pulse Ten Minutes After Exercise	Type of Exercise	Length of
44					
45					

APPENDIX F

INSTRUCTIONS FOR USE OF DAILY RECORD SHEET

INSTRUCTIONS FOR USE OF DAILY RECORD SHEET

1. Record each of the items listed, on a daily basis.

2. Resting Pulse--Your resting pulse should be taken after you have been sitting at rest for at least five minutes, and have not done strenuous activity within the last thirty minutes. Take your resting pulse at the same time each day.

3. Maximum Pulse During Exercise--Just before you stop exercising, take your pulse for fifteen seconds.

4. Pulse Ten Minutes After Exercise--This pulse rate should be taken 10 minutes after you have stopped exercising.

5. Type of Exercise--List the type of exercise you do each day. If you do the same exercise, such as jogging, each day, you may list it only on the first day.

6. Length of Exercise--List the number of minutes you carry out your exercise. This should not include warm up, or cool down exercises.

SELECTED BIBLIOGRAPHY

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Alogna, Maria. "Perception of Severity of Disease and Health Locus of Control in Compliant and Noncompliant Diabetic Patients." Diabetes Care 3 (July-August 1980):533-534.

Berg, Kris. "The Insulin-Dependent Diabetic Runner." The Physician and Sportsmedicine 7 (November 1979): 71-75, 79.

Bille, Donald A. "A Study of Patients' Knowledge in Relation to Teaching Format and Compliance." Supervisor Nurse 8 (March 1977):55-62.

Bloom, Kathy A. and Hart, Laura K. "The Relationship Between the Health Belief Model and Compliance of Persons with Diabetes Mellitus." Diabetes Care 3 (September-October 1980):594-597.

"Calendar of Continuing Education." Progress Report, American Physical Therapy Association 8 (1979).

Cerami, Anthony; Stevens, Victor J.; and Monnie, Vincent M. "Role of Nonenzymatic Glycosylation in the Development of the Sequelae of Diabetes Mellitus." Metabolism 28 (April 1979):431-437.

Davidson, John K. "Diabetes Patient Education, Third Party Players, and the Veterans Administration." Diabetes Care 1 (September-October 1978):326-327.

Deckert, Torsten; Poulsen, Jacob E., and Larsen, Mogens. "Importance of Outpatient Supervision in the Prognosis of Juvenile Diabetes Mellitus: A Cost/Benefit Analysis." Diabetes Care 1 (September-October, 1978): 281-284.

"Diabetes and Exercise, A Round Table." The Physician and Sportsmedicine (March 1979):49-64.

Duncan, Theodore G. The Good Life With Diabetes. Philadelphia: The Garfield G. Duncan Research Foundation, Inc., 1973.

Engle, Veronica. "Diabetic Teaching, How to Win Your Patient's Cooperation in His Care." Nursing (December 1975).

Etzwiler, D. D. "Education of the Patient With Diabetes." Medical Clinic of North America 62:857-66, 1978.

"Exercise and the Cardiovascular System, A Round Table." The Physician and Sportsmedicine 7 (September 1979): 55-68, 71.

Felig, Philip, and Koivisto, Veikko. "The Metabolic Response to Exercise: Implications for Diabetes." The Fifty-first Hannemann Symposium, Therapeutics Through Exercise, 1979.

Felts, Philip W., and Marshall, William F. "What's New In Exercise." Diabetes Forecast (March-April 1979).

Fylling, Carelyn P.; Griffin, Judy A.; and Findley, Dee Ann E. "Education of the Diabetic Patient." Minnesota Medicine 59 (November 1976):789-93.

Julius, Stevo; Amery, Antoon; Whitlock, Leigh S.; and Conway, James. "Influence of Age on the Hemodynamic Response to Exercise." Circulation 34 (August 1967): 222-229.

Koenig, R. J.; Peterson, C. M.; and Jones, R. D. "The Correlation of Glucose Regulation & Hemoglobin A_{1c} in Diabetes Mellitus." New England Journal of Medicine 295:417-420, 1976.

Koivisto, Veikko; Soman, Vijay; Nadel, Ethan; Tamborlane, William V.; and Felig, Philip. "Exercise and Insulin: Insulin Binding, Insulin Mobilization, and Counter-regulatory Hormone Secretion." Federation Proceedings 39 (April 1980).

Krall, Leo P. Joslin Diabetes Manual. Philadelphia: Lea & Febiger, 1978.

Kucha, Delores H. "An Evaluation of Methods of Patient Instruction." Supervisor Nurse (March 1972):32-33.

Lawrence, Patricia A., and Cheely, Jean. "Deterioration of Diabetic Patients' Knowledge and Management Skills as Determined During Outpatient Visits." Diabetes Care 3 (March-April 1980):214-218.

Linn, Margaret W.; Linn, Bernard S.; Skyler, Jay S.; and Harris, Rachel. "The Importance of Self-Assessed Health in Patients With Diabetes." Diabetes Care 3 (September-October 1980):599-606.

Long, Dorn. Texas Woman's University, Presbyterian Campus, Dallas, Texas. Interview, 30 April 1980.

Lowenthal, David; Bharadwaja, Krishan; and Oaks, Wilbur. Therapeutics Through Exercise (New York: Grune & Stratton, 1979).

Marston, Mary-Vesta. "Compliance With Medical Regimens: A Review of the Literature." Nursing Research 19 (1970): 312-323.

McDonald, Janet. "Alcohol and Diabetes." Diabetes Care 3 (September-October 1980):629-635.

Miller, Leona V.; Goldstein, Jack; and Nicolaisen, Gary. "Evaluation of Patients' Knowledge of Diabetes Self-Care. Diabetes Care 1 (September-October 1978): 275-280.

Notkins, Abner Louis. "The Causes of Diabetes." Diabetes Care 3 (March-April 1978):62-73.

Pedersen, Oluf; Beck-Nielsen, Henning; and Heding, Lise. "Increased Insulin Receptors After Exercise In Patients With Insulin-Dependent Diabetes Mellitus." The New England Journal of Medicine (April 1980): 886-892.

Skyler, Jay S. "Diabetes and Exercise: Clinical Implications. Diabetes Care 2 (May-June 1979):307-310.

Snyder, Stuart. "Effect of Age on Exercise Performance." The Fifty-first Hannemann Symposium, 1979.

Soman, V. R.; Veikko, A. K.; Deibert, D.; Felig, P.; DeFronzo, R. A. "Increased Insulin Sensitivity and Insulin Binding to Monocytes After Physical Training." The New England Journal of Medicine 301:1200-4, 1979.

Somers, Anne R. "Preventive Maintenance Care in a Diabetes Clinic." Diabetes Care 1 (September-October 1978):327-328.

Stubbs, S. M.; Brudenell, J. M.; Pyke, D. A.; and Watkins, P. J. "Management of the Pregnant Diabetic: Home or Hospital, With Or Without Glucose Meters?" The Lancet (May 24, 1980):1122-1124.

Taber's Cyclopedic Medical Dictionary, 1973 ed. "Diabetes Mellitus," "Insulin." Philadelphia: F. A. Davis Company.

Vranic, Mladen and Berger, Michael. "Exercise and Diabetes Mellitus." Diabetes 28 (February 1978): 147-160.

Vranic, Mladen; Horvath, Steven, and Wahren, John. "Exercise and Diabetes: An Overview." Diabetes 28 (January 1979):107-110.

Wahren, J. "Glucose Turnover During Exercise in Health and in Diabetes." Diabetes 28:82-88, 1979.

Whitehouse, Fred W. "Get Wise--Exercise!" Diabetes Forecase (March-April 1978):20-23.

Whitehouse, Fred W.; Whitehouse, Joellen Smith; and Hohl, Richard D. "Teaching the Person with Diabetes: Experience with a Follow-up Session." Diabetes Care 2 (January-February 1979):35-38.

Young, Karen. Methodist Hospital of Dallas, Dallas, Texas. Interview, April 1980.

Zinman, Bernard; Vranic, Mladen; Albisser, A. Michael; Leibel, Bernard S.; and Marliss, Errol B. "The Role of Insulin in the Metabolic Response to Exercise in Diabetic Man." Diabetes 28 (January 1979):76-81.