# THE RELATIONSHIP BETWEEN PERSONALITY CHARACTERISTICS AND LOW BLOOD SUGAR CONDITIONS WITH IMPLICATIONS FOR COUNSELING PSYCHOLOGY

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# CHAPTER I

## INTRODUCTION

Approximately 2500 years ago the "Father of Medicine," Hippocrates, developed a practice of healing and teaching based on the philosophy that the human body is an interdependent working system, and that the health of a person is determined to a large extent by the quality of the person's diet and its interaction with this system (Adams, 1939). In the twelfth century, the teachings of another great physician, Moses Maimonides, reaffirmed Hippocrates' stance that illnesses which can be treated by diet should not be treated by any other means (Bratton, 1967). But dietary treatment as a science lost for centuries its appeal to the western world. Currently, however, interest in this unique, logical approach to health is being reborn. Slowly, but increasingly, physicians are once again turning to the wisdom of the "Father of Medicine."

Today, the rebirth of this theory is developing into a new discipline called "Orthomolecular Medicine," a term coined in 1968 by Linus Pauling, Ph.D., twice a Noble Prize winner. "Orthomolecular" means "pertaining to the right molecule." Orthomolecular physicians believe that the treatment of degenerative diseases should be a matter of varying the concentrations of "right molecules" (i.e., vitamins, minerals, trace elements, amino acids, enzymes, hormones, etc.) which are normally present in the human body (Pauling, 1968, p. 265). This is

is done to normalize deficiencies or toxicities which developed either genetically or (as in most cases) have been induced by the patient. The orthomolecular belief is based on the idea that the nutritional microenvironment of every cell in the human body is extremely important to optimum health, and that deficiencies in this environment constitute the major cause of disease (Williams & Kalita, 1977).

The growth of this field of thought has brought about the development of a number of prominent organizations and related specialities. For example, organizations within the medical profession include the American Academy of Medical Preventics, Orthomolecular Medical Society, Huxley Institute for Biosocial Research, Society for Clinical Ecology, and the International College of Applied Nutrition, just to name a few. Within the mental health profession, there are organizations such as the Academy of Orthomolecular Psychiatry and the American Society for Clinical Nutrition. Further, a number of mental health specialities are now beginning to utilize this orthomolecular approach in treating various types of psychological problems, such as schizophrenia, criminal behavior, alcoholism, learning disabilities, and others (Williams & Kalita, 1977).

Such treatments are beginning to take form because there also is developing, among mental health professionals, a recognition that just because the mind can affect the body, this sequence of influence is not necessarily always the case. These professionals are beginning to realize that the somato-psycho approach can be, and often is, just as relevant as the traditionally held psychosomatic view. Further, mental health professionals are finding that by utilizing the orthomolecular philosophy in conjunction with traditional treatments

of mental problems, their treatments become more effective (Philpott & Kalita, 1980).

Even Sigmund Freud, with his psychoanalytic view of the mind, understood that the problems involved in mental disorders were really more complex than the way his ideas are usually interpreted. Freud stated that psychoanalysis was not suitable in the treatment of some forms of mental problems. He believed that the causes of these problems would eventually be shown to be biochemical in nature. Therefore, he proposed that treatment modalities should, in some cases, be based on biochemical as well as psychotherapeutic means (Strackey, 1964).

Does such a philosophy of the function of the mind have any real relevancy in the mental health profession? Do problems in mental functioning ability arise from more than just the individual's past psychological experiences? If so, what is the relative effect of such biochemical conditions on a person's mental functioning ability? Consider the following:

A person's thoughts and emotions are not just abstract disembodied happenings; they possess chemical and physical components (Williams, 1956). Williams further stated that when someone feels a rush of emotion--fear, rage, or anxiety--various hormones, neurotransmitters, enzymes, chemicals, minerals, and electrical impulses undergo changes in the nervous system. These changes are produced by the workings of cells. Every cell has a function to perform. To accomplish this function, within each cell, there is a highly ordered, multi-faceted process involving different enzymes. Each enzyme is protein in nature, and is made up of hundreds of amino acids and

some vitamins and minerals, combined in exactly the right way. Something is happening every microsecond. Complex chemical transformations--filtering, emulsifying, dispersing, aggregating, absorbing, blueprinting, duplicating, transporting, sorting, pumping, controlling pollution, disposing of wastes, and communicating via messages and messengers--constantly occur.

Further, according to Williams and Kalita (1977), each cell depends on the raw materials in its immediate environment in order to perform all of these processes properly, and these materials must be present in exactly the right amounts at exactly the right time. Additionally, these authors stated that the supply of these materials is dependent upon the proper functioning of many other cells in many other parts of the body. Therefore, because of the complexity of the cell, proper functioning is subject to disruption in a variety of ways. More specifically, they suggested that if just one necessary raw material is missing, then the cell's entire function may be seriously impaired, and if one deranged cell is multiplied by a hundred million or so others, hindered in a similar way, then the dysfunction of tissues, glands, and/or organs can result.

Finally, since the brain is a part of this vast system, it stands to reason that it is affected in the same way. When its metabolism is disturbed, the brain will tend to express this disorder by exhibiting various peculiarities. These peculiarities may then take on almost any form, such as changes in sensual perception (i.e., illusions, hallucinations); deterioration of ability to concentrate, remember, and reason; changes in socio-ability, mood, and personality; or possibly almost any other disturbance currently being dealt with in

the field of mental health (Philpott & Kalita, 1980).

In light of the above, consider some of the root causes of such disturbances. Mental health professionals are well aware of the consequences that psychological factors, such as anxiety or tension, can have on a person's mental functioning ability. But what of the many other factors of a physiological basis, which can have similar or even more devastating consequences, such as the ingestion of high levels of certain toxic metals or elements (e.g., aluminum, arsenic, cadmium, lead, mercury, etc.) (Adams & Victor, 1981; Lesser, 1980; Pfeiffer, 1975); the growth of parasites or harmful bacterium, viruses, or fungi (Adams & Victor, 1981; Isselbacker, Adams, Braunwald, Petersdorf & Wilson, 1980; Truss, 1978); genetic defects which contribute to glandular, organ, or enzyme system dysfunction (Goodhart & Shils, 1973); or even more, the quality of a person's diet, which may even be the most important of these because it can in turn affect all of the above (Goodhart & Shils, 1973)? This list is by no means all-inclusive, but it does begin to give a more realistic view of the complexity of the biochemical process, and in turn of the mental process. Because, as has been demonstrated, any of the above conditions will hinder the body's ability to function normally, and therefore, can in turn affect the ability of the mind to function normally.

## Need for the Study

As was mentioned previously, there are many factors--biochemical in nature--which may contribute to, or interfere with, the body's ability to function. One factor which can have a significant effect on its ability to function properly is the body's fuel supply (Adams &

Victor, 1981; Pfeiffer, 1975). The brain uses on the average approximately 25% of this fuel (Watson, 1976), and thus, it may be found that the effects of a reduction of fuel below needed amounts are reflected most prominently in the functioning ability of the mind. Therefore, it would follow that the effects of any such reduction on a person's mental functioning ability, should be a topic of interest and importance for research in the field of mental health.

There are many substances which compose the fuel material required by the body for its energy, but two of the most important of these are the amounts of oxygen and glucose (sugar) in the blood (Adams & Victor, 1981; Ezrin, Godden & Volpe, 1979). The effects of oxygen deprivation on the brain are fairly well known and will not be discussed further. It is the effects of blood sugar levels, or more specifically, of low blood sugar levels (hypoglycemia) which is the focus of this study.

In reviewing the literature, this author found reports on the relationship of hypoglycemia to mental functioning ability to be somewhat controversial. The controversy seems particularly prominent in the more specific area of the relationship of hypoglycemia to personality characteristics. For example, some authors suggest that hypoglycemia is a condition which results primarily from the negative personality characteristics of the individual (Rennie & Howard, 1942). Others state that hypoglycemia is a condition that, when existing, is largely responsible for causing those personality characteristics (Anthony, Dippe, Hofeldt, Davis & Forsham, 1973). Still other authors maintain that there is no relationship between hypoglycemia and personality characteristics; both conditions exist, but one is

independent of the other (Ford, Bray & Swerdloff, 1976). And then some choose not to recognize the existence of the condition of hypoglycemia at all (Mundy, 1976).

A possible explanation for the above controversy may be that information in the literature, concerning the relationship of hypoglycemia to mental functioning ability, has thus far been presented mainly in the form of case studies. Also, the amount of investigative research either demonstrating or discounting the significance of this relationship, particularly concerning personality characteristics, is relatively small and inconclusive. Therefore, this lack of sufficient scientific data has left the mental health profession with what appears to be a gap of necessary knowledge in this area. Clearly then, further carefully planned research on the relationship between hypoglycemia and mental function is needed to add to the current body of knowledge in the field, and to help settle the controversy which now exists.

## Purpose of the Study

This study is designed to answer the following question: What is the relationship between low blood sugar conditions and individual personality characteristics? More specifically, this research studies the relationship between personality characteristics as defined by the Minnesota Multiphasic Personality Inventory (MMPI) and the condition of relative hypoglycemia.

## Hypothesis

The following hypothesis was formulated to test for the possible

relationship between personality characterisitics and relative hypoglycemia: A significant difference will be found between the personality characteristics of hypoglycemic and nonhypoglycemic groups when the constructs of personality characteristics are defined as those which are measured by the following clinical scales of the MMPI: Hypochondriasis, Depression, Hysteria, Psychopathic Deviate, Paranoia, Psychasthenia, Schizophrenia, Hypomania, and Social Introversion.

## Definition of Terms

The definitions listed below are presented to provide a better understanding of the concepts and variables of this study.

Personality Characteristics are those used for the clinical scales of the MMPI (Lachar, 1974), which are as follows:

Hypochondriasis (Hs). This scale is a stable "trait" scale which reflects an individual's undue concern about health, and seeking sympathy through exaggeration of vague and nonspecific physical complaints.

Depression (D). This scale measures a state characterized by poor morale, moodiness, and feelings of hopelessness and sorrow.

Hysteria (Hy). This scale was constructed to identify those individuals who are predisposed when under stress to use conversion symptomology as a means of solving conflicts or avoiding responsibilities.

Psychopathic Deviate (Pd). This is a fairly stable trait scale that was developed as an index to measure an individual's predisposition to display characterological features such as impulsivity, low frustration tolerance, and poor social adjustment.

Paranoia (Pa). This scale evaluates the clinical picture of

paranoia which includes delusional beliefs; ideas of reference; feelings of persecution, influence, and grandeur; pervasive suspiciousness; and interpersonal sensitivity and rigidity.

Psychasthenia (Pt). This scale measures excessive doubt and indecision; unreasonable fears, compulsions, and obsessions; and in general, is a good indicator of anxiety.

Schizophrenia (Sc). This scale reflects the unusual thought processes, lack of deep interest, apathy, feelings of social alienation, poor family relations, peculiarities of perceptions, and reduced efficiency which are characteristic of the schizophrenic process.

Hypomania (Ma). In general, this scale measures the excitement and activity level of the person.

Social Introversion (Si). This scale is designed to differentiate introverted from extroverted people.

The Masculinity-Feminity (Mf) scale is not of interest in this study and will not be used.

Relative Hypoglycemia is the condition of a low level of glucose in the body's circulatory system (low blood sugar) which is demonstrated by one or more of the following criteria: (a) When in the course of a five-hour glucose tolerance test (G.T.T.), the blood sugar level fails to rise more than 50% above the fasting level (Philpott & Kalita, 1980); (b) a blood sugar level which falls during a G.T.T. to 20 milligrams (mg) percent below the fasting level (Salzer, 1966); (c) a G.T.T. in which the blood sugar level falls 50 mg percent or more during any one hour of the test (Salzer, 1966); or (d) a G.T.T. in which the absolute (lowest level) blood sugar level falls in the range of 60 mg percent or lower (Fabrykant, 1955; Pfeiffer, 1975).

## Assumptions and Limitations

The relevance of information presented in this study is subject to the following assumptions and limitations:

1. It is assumed that the sampling procedure resulted in an adequate representative sample of the chosen population. Since a type of random sampling procedure was used, it is further assumed that specific characteristics, such as sex, age, and socioeconomic status, were randomly distributed across the sample, and therefore, will not be covaried for the analyses.

2. Samples were limited to (a) persons of age 18 years or older, (b) people who could be contacted through telephone directory listings (c) people who were not known to have diabetes or hemophelia, and (d) only people who volunteered for the study.

3. The study was limited to measuring a relationship between personality characteristics and blood sugar conditions. It did not attempt to demonstrate cause and effect.

4. Wide generalizability of the results of the research may present some difficulty because of the limited population area studied, and because only volunteer subjects were utilized for the investigation.

## Organization of the Study

Chapter I introduces the study, discussing historical background information, the need for the study, the purpose of the study, the hypothesis, a definition of terms, and the assumptions and limitations of the study. Chapter II contains a review of the literature relevant to the topic of the study. Chapter III is a detailed discussion of

the methodology used to collect and analyze the research data. Chapter IV presents an analysis of the data and the results of that analysis in terms of the stated hypothesis. Chapter V provides a summary, conclusions, possible implications of the research, and recommendations for further study.

# CHAPTER II

# REVIEW OF THE RELATED LITERATURE

This chapter presents a review of the literature and pertinent discussion of the topic under study. The chapter begins with a discussion of the condition of hypoglycemia followed by a presentation of the relationship of psychopathology to hypoglycemia. The chapter concludes by discussing the relationship of the specific area of personality characteristics to low blood sugar conditions.

## Hypoglycemia

### Definition

Hypoglycemia means low blood sugar. Conn and Seltzer (1955) state,

> Hypoglycemia is an indication of a derangement in the overall utilization of carbohydrates in which glucose has been removed from the blood at a rate faster than it has been replenished, with a resultant depression of the blood sugar to an abnormally low level (p. 460).

According to Pfeiffer (1975), hypoglycemia is an abnormality of metabolism that results in a flat curve, precipitous drop, or low fasting level of blood sugar. These states lead to a condition of cellular starvation, depriving tissues of at least part of the fuel required to maintain normal functioning. Additionally, this condition

results in related symptomology which is especially prominent in connection with the brain and central nervous system.

Foster and Rubenstein (1980) commented that hypoglycemia is a high-risk metabolic abnormality because glucose is the primary energy substrate of the brain. The brain is particularly vulnerable to hypoglycemia because it cannot utilize circulating free fatty acids as an alternate energy source, in contrast to most other tissues in the body. Therefore, a drop in blood sugar level can produce not only deranged function and damage to tissue, but also death if the deficit is prolonged.

## Historical Background

The existence of the physical condition of low blood sugar is a fact that has been known since 1849 when Claude Bernard first demonstrated that this abnormality could be induced experimentally in animals (cited in Wauchope, 1933). He did this by preventing the glycogen stores of the liver from reaching general circulation by cutting the nerve supply to the liver. His study led the way for a number of subsequent discoveries concerning carbohydrate metabolism, demonstrating that low blood sugar could be brought about in many other ways. For example, Seegen's study induced hypoglycemia by tying off the aorta and vena cava about the diaphragm; Von Mehring and Minkowski's by administering phlordin which lowers the renal threshold, allows sugar overflow from the kidneys, and reduces glucose stores; Bierry and Malloizel's by removing of the suprarenal glands; Frank and Isaac's by phosphorus poisoning which damaged the liver; Underhill's by alternating the acid base equilibrium; and Mann and Magath's by removing the

liver (all cited in Wauchope, 1933).

In humans, hypoglycemia was first reported in 1910 when Porges observed low blood sugar in three cases of Addison's disease (cited in Wauchope, 1933). Later, Cushing (1912) published a case of a pituitary tumor which also caused low blood sugar levels. Then Joslin (1921) published cases of diabetic patients on a low-carbohydrate diet which resulted in exhaustion of glycogen reserves.

The concept of hypoglycemia, however, did not really begin to come into focus until after the experiments by Banting, Best, Collip, Macleod, and Noble in 1922; and the discovery of insulin, which they showed could induce hypoglycemic reactions. Soon afterwards, insulin was available for the treatment of diabetic patients, and it was then that hypoglycemic symptoms began to be routinely recognized in people (Banting, Campbell, & Fletcher, 1923).

Harris (1924) furthered progress toward the recognition of the concept of hypoglycemia when he reported cases of low blood sugar in nondiabetic patients without the administration of insulin. He called this "hyperinsulinism"--a term which is still used today in some cases.

In 1927, Wilder, Allen, Power, and Robertson reported on an operation at the Mayo Clinic involving a patient who had typical symptoms of hypoglycemia and even convulsions, and whose blood sugar fell as low as 27%. A tumor of the pancreas was found with a secondary tumor in the liver from which insulin was extracted. These tumors had brought about a derangement in the individual's carbohydrate metabolism, and brought on the hypoglycemic condition. It was this case that finally seemed to bring to light hypoglycemia as a definite clinical condition.

## Etiology

According to Walfish (1979), the blood sugar level at any one time depends upon the interrelationship between the rate of entry and removal of glucose from the plasma compartment. Chief factors controlling the rate of entry include (a) the ingestion and absorption of dietary glucose from the gastrointestinal tract, and (b) hepatic (liver) release of glucose by breakdown of glycogen, or the synthesis of new glucose from carbohydrate and amino-acid precursors. Factors regulating the rate of glucose removal include (a) the activity level with exercise-induced increases in glucose utilization, (b) circulating insulin and contrainsulin hormonal levels, and (c) the prandial state, which may determine the preferential utilization of certain energy substrates (i.e., free fatty acid and ketone bodies utilization by skeletal and cardiac muscle with the sparing of glucose uptake in the fasting state).

In the above processes, for example, the liver (and to a lesser extent the muscles) serves as the sugar storage center for a person's system (Campbell & Macleod, 1925). Insulin from the pancreas removes blood sugar from the plasma compartment to storage, and adrenalin from the adrenals liberates it (Wauchope, 1933). Secretions from the pituitary and thyroid play a part on the side of adrenalin, while the ovary, testes, and parathyroids on the side of the pancreas (Wauchope, 1933). Also, the interaction of these hormones is controlled from an area situated in the pons. An increased amount of sugar in the blood reaching the pons, stimulates it to activate a secretion of insulin by way of the vagus nerve (Macleod, 1932), while a low blood sugar level causes an increased secretion of adrenalin by way of the sympathetics

(Burn, 1922). Further, this is only a part of the glucose homeostasis problem. There are also the processes of assimilation of glucose into the system, and then utilization of this glucose on the cellular level involving other glands, organs, and systems.

Therefore, in order for the body to continually supply tissues with adequate fuel or glucose levels, the system as a whole must maintain at least the following (Walfish, 1979): (a) Intact gastrointestinal functioning; (b) intact hepatic enzyme systems for glycogen synthesis, glycogenolysis, and gluconeogenisis; (c) sufficient endogenous substrates (substances which enzyme systems act upon); and (d) proper hormonal regulation of substrate mobilization, hepatic enzyme function, and glucose utilization, as well as many other indirect regulating mechanisms. So it follows that anything that interferes with these systems (i.e., tumors, ulcers, gastrointestinal surgery, toxins, diseases, parasites, drugs, genetic defects, poor diet, and physical and mental stress) will also interfere with glucose metabolism, and so may cause directly and/or contribute indirectly to the development of a hypoglycemic condition (Isselbacher et al., 1980).

## Symptomology

According to Foster and Rubenstein (1980), the symptoms of hypoglycemia fall into two main categories: (a) those induced by an excessive secretion of epinephrine and (b) those due to dysfunction of the central nervous system. The appearance of one pattern or the other, or a combination of the two, is determined not only by the level of blood sugar, but also by the rate at which it has fallen and the duration of the glucose deprivation.

Cori and Cori (1928) stated that if the falling rate of blood sugar is rapid, the predominant early symptoms are those produced by compensatory hyperepinephrine: an attempt by the body to restore normal blood sugar levels by accelerating hepatic glycogenolysis. These symptoms, according to Conn & Seltzer (1955), are those observed during a mild reaction after administration of too much soluble insulin, and consist of sweating, weakness, hunger, tachycardia, and nervousness. Conversely, if the blood sugar falls slowly to low levels over a period of many hours, the manifestations are cerebral in type, such as headaches, visual disturbances, mental confusion, and convulsions. Further, according to Crain and Thorn (1949), if the blood sugar concentration drops to a low level and remains there for most of a 24-hour period, the manifestations of hypoglycemia may be so bizarre as to be completely misleading (a situation which may occur in organic hyperinsulinism). In such a state, any aspect of the entire range and severity of neurologic and psychopathological disorders may be mimicked.

If the decrease in blood sugar is rapid, profound, and prolonged, the hypoglycemic person may present different combinations of symptoms at different times. According to various authors (Blood, 1946; Frostig, 1940; Moersch & Kernohan, 1939; Moorhouse, 1956; Rynearson & Moersch, 1934; Wauchope, 1933), the more common of these psychological symptoms are as follows: apathy, fatigue, anxiety, incorrigibility, negativism, automatic behavior, somnabulism, confusion, excitement, disorientation, "drunken behavior," fugue state, unconscious attacks, delirium, mania, depression, stupor, and suicidal behavior (Physical symptomology is not relevant to this study and so is not presented.)

These authors also stated that in addition to these symptoms, the motor activity in the individual is sometimes decreased or increased. Speech may be disordered; garrulity, dysarthria, or even aphasia may occur. There is emotional instability, and this may range through all forms of anxiousness to querulousness and violence. The speed of thought is usually slow. The mental grasp of the person becomes distorted; there may be disorientation as to time, place, and person, as well as some loss of memory, both short-term and long-term. The trend of thought may remain within reasonable bounds, but obsessions and compulsions are frequent, and even delusions and hallucinations may be present. Further, depending on the length and severity of the low blood sugar condition, permanent damage to the brain may occur. Finally, hypoglycemia in increasing severity will result in a coma and eventually death.

## Psychopathology Versus Hypoglycemia

### Research

Research, concerned with experimentally demonstrating a relationship between low blood sugar and various psychological disorders, developed for the most part, early in the literature on hypoglycemia. Evidence of the above relationship seemed to be clearly demonstrated on a few occasions, but the literature is not without contradictions.

In looking at various emotional states, Bowman and Kasanin (1929) could find no consistent relationship between the mood of patients and blood sugar levels. Also, Diethelm (1936) found no characteristic changes in the blood sugar curve in states of pure elation or depression. However, Rennie and Howard (194?) in their report on

hypoglycemia and tension-depression, demonstrated a relationship between hypoglycemia and these conditions when they showed that abnormal (flat curve in these cases) glucose tolerance curves would return to more normal levels when the patients were able to resolve their emotional difficulties. Similarly, Conn and Seltzer (1955) came to these same conclusions in their discussion of psychosomatic disorders and what they called functional hyperinsulinism.

In studying the neurotic state (and also working with a flat curve), Szondi and Lax (1929) provided evidence of a relationship between this and hypoglycemia. The authors studied a group of 31 neurotics and 26 normals. They began by determining the glucose tolerance curves of individuals in each group; this was done by giving 50 grams of dextrose orally, and measuring the blood sugar at one-half hour, one hour, and two hours after the intake of sugar. They found the average rise in blood sugar for the normal group to be 69%, but a rise of only 31% for the neurotic group. A similar relationship was found when a group of neurotic hypogonadic patients was compared with a group of nonneurotic hypogonadic patients. Then a group of neurotic hyperthyroid patients was compared with a nonneurotic hyperthyroid group; this time the difference was even more pronounced. Based on these findings, the authors postulated that a relationship does exist between neurosis and this one type of hypoglycemia. They further stated that this phenomenon is probably due to some type of disruption of the alimentary process.

Harris (1936) was the first to recognize a definite hypoglycemia symptom complex. He suggested that the emotional symptoms of hypoglycemia are caused by organic malfunction, and reported that dietary

treatment resulted in relief of the symptoms. He further stated that many times patients who are only hypoglycemic are misdiagnosed as neurotic or even psychotic. Additionally, Martin, Hellmuth, and Muth (1937), also interested in this condition, published similar findings. They studied a total of 404 patients and concluded that the symptoms of hypoglycemia and neurosis are so similar that it is often very difficult to distinguish between the two.

Hoffman and Abrahamson (1949) tested the role of functional hypoglycemia as a stimulator of neuroses. They began by administering a six-hour glucose tolerance test to 220 patients diagnosed as neurotic, but who also displayed physical symptoms suggesting the possibility of hypoglycemia. A total of 205 of these patients were found to be hypoglycemic. These patients were then treated for hypoglycemia by dietary methods. After the treatment, the researchers found that as the physical symptoms lessened, the "genuinely" neurotic symptoms also lessened. In all cases, the neurotic symptoms improved. The authors extended their investigations to a group of neurotic patients who did not show signs of hypoglycemia. Of 700 patients treated, more than 600 proved to have hypoglycemia. This group also responded favorably in neurotic symptomology to the dietary treatments. Additionally, these authors reported that after the dietary treatments, as an added benefit, the patients then became more amenable to psychiatric treatment.

In the area of psychoses, Greenwood (1935) reported on a series of cases studied in the psychopathic division of Philadelphia General Hospital. In these cases he found (a) a higher percentage of low blood sugar determinations in the psychiatric patients than in patients in

the general medical and surgical wards; (b) the psychotic episodes generally occurred in the early morning, late at night, or just before meal time; (c) low blood sugar levels were usually found in patients during such episodes; and (d) relief of the psychoses was obtained when glucose was administered to the patient. This led Greenwood to conclude that low blood sugar has a significant effect on the psychotic condition. He further stated that when psychosis is associated with hypoglycemia, as in this case, the psychosis can take on almost any form, it is often violent in nature, and many times it alternates with periods of normal behavior.

Similarly, Kepler and Moersch (1937) stated that hypoglycemic attacks are invariably characterized by some psychiatric phenomena, and they attempted to demonstrate this with a number of case studies. In contrast, Katzenelbogen and Muncie (1935) reported that they could find no correlation between blood sugar and various psychotic conditions. However, in this study these authors focused on the relationship between psychoses and high blood sugar curves, and ignored the possibility of an effect from low blood sugar conditions.

## Case Studies

Most of the available literature, discussing the existence of a possible relationship between low blood sugar and various psychological manifestations, is presented in the form of case studies. For this reason, in addition to the investigative research studies discussed above, a few examples of these cases are presented below.

Interest in studying and publishing cases, concerning the above relationship, seemed to develop in the literature in roughly three

separate phases. The occurrence of psychological changes in cases of diabetic patients who have been treated with insulin, represents more or less the topic of the first of these groupings.

Wilder (1933) provides two cases which fall into this category:

1. A diabetic, but also a person of mild manner, usually quite composed, easily pleased, and polite, came into the office very quarrelsome and indignant over some minor annoyance. Her dosage of insulin proved to be excessive. Upon correcting this, her mood improved considerably.

2. A structural iron worker, also a diabetic, suffered an insulin reaction while on the job. During this period he descended (without injury) from the tenth floor of the steel frame of a building on which he was working, and had no recollection afterward of how he managed to reach the ground.

One of Greenwood's (1935) cases also provides an example of this category: A diabetic patient was admitted to a hospital because of "peculiar mental symptoms" and attacks resembling acute mania. While in the hospital, his symptoms fluctuated considerably. Part of the time he was calm and rational, but on one occasion, he became so violent that he needed restraints. On still another occasion, he talked "thickly" and incoherently, and tossed his arms and legs about. His blood sugar was measured periodically; it ranged from a high of 360 mg. to a low of 37 mg. His symptoms continued in the above manner until his insulin treatment was changed to more appropriate dosages.

The second phase of published hypoglycemic cases tends to center around hypoglycemia caused by some type of organic problem (e.g., tumors, thyroid problems, liver damage, etc.). This is often called

spontaneous hypoglycemia. Attacks can occur almost any time, however, blood sugar levels are usually lowest and attacks are more frequent during the fasting state (Conn & Seltzer, 1955). The symptomology of this group is similar to that of the other groups; but often times psychological manifestations are more profound, violent, and transitory in nature.

The following are two cases from Kepler and Moersch (1937), to illustrate this group.

1. Hysteria versus spontaneous hypoglycemia: A man was bothered by having "spells" of two types. In one, he had fallen to the ground, resisted help, kicked, tore things up, and rolled about (there had not been a real convulsion). In the other type, he became confused, he spoke slowly, and was unable to reason or carry on an intelligent conversation. At first he was diagnosed as an hysteric, but upon further examination he was found to be hypoglycemic.

2. Somnambulism and recurring attacks of acute mania: A man had spells of somnambulism for three years. On several occasions, he had become irrational, and because of a manical state, had been confined in a straight jacket in a hospital. He also had episodes of confusion and delirium. He died five years later. At that time, a necropsy revealed an adenoma in the pancreas. It was then hypothesized that the adenoma had been the cause of his behavior.

The third phase of cases, the most recent group to appear in the literature, centers around what is called reactive hypoglycemia. According to Anderson and Herman (1969), reactive hypoglycemia results from the body responding in an abnormal way to certain quickly absorbed substances, such as alcohol, refined sugar and flour, and different

stimulants. This condition can be caused by an alimentary problem, allowing too rapid absorption of the above substances, or by an overstressed glandular system, resulting from excessive consumption of these substances.

The following are examples of psychological problems associated with this type of hypoglycemia:

1. A man was admitted to a hospital because of persecutory delusions and bizarre behavior lasting four months. Ten years earlier he had a gastrectomy and vagotomy because of a duodenal ulcer. During the next few years, he had episodes of headaches, dizziness, ataxia, and visual blurring. He eventually developed memory lapses, periods of disorientation, threatening visual and auditory hallucinations, and persecutory delusions. He had no history of drug or alcohol abuse, or head trauma. A glucose tolerance test was performed; results showed a hyperglycemia peak followed by a rapid fall to a low blood sugar level. A change in diet and eating habits improved his condition considerably (Hafken, Leichter & Reich, 1975).

2. A talented young actress complained of being very depressed and having frequent crying spells. She had made several suicide attempts. She also had tried various drugs in an attempt to feel better, with no positive effects. She was very irritable and difficult to work with. She was given a glucose tolerance test, and was found to be reactive. She was placed on a hypoglycemic diet, and her condition improved significantly (Saunders & Ross, 1981).

3. A young married woman at the age of 21 gave birth to a baby and subsequently went into postpartum depression. She did not remember having the child, and refused to care for her baby. Further, she

was unable to do her housekeeping, complained of claustrophobia, and was so sensitive to noises that the ringing of a telephone sent her into hysteria. Her attention span grew progressively shorter, and she had uncontrollable outbursts of unprovoked crying and mania. She was eventually diagnosed as hypoglycemic, and on an appropriate diet, she completely recovered (Fredericks & Goodman, 1969).

## Personality Characteristics Versus Hypoglycemia

The first work to appear in psychological literature, concerning the relationship between low blood sugar and personality characteristics, was presented in 1946 when Houk and Robertson published an experimental hypoglycemic scale. This was an instrument purported to be useful in detecting cases of hypoglycemia. They utilized the MMPI, and designed their scale based on deviate responses given by hypoglycemics. They postulated that there is a definite relationship between neuroses and hypoglycemia, and attempted to build a scale based on the assumption that MMPI test profiles of people with hypoglycemia form a definite pattern of response.

The next work to appear in the literature was by Landmann and Sutherland (1950). In their study of psychosomatic patients, which included a high percentage of hypoglycemics, they could find no relationship between personality and hypoglycemia. This is in contrast to Houk and Robertson (1946). Similarly, Herzberg, Cooper, and Marks (1968), looking only at depression, could find no relationship between this and blood sugar.

Anthony et al. (1973), however, arrived at different conclusions. These authors studied a group of 37 patients, previously diagnosed by

various methods as reactive hypoglycemics, and compared them to a group of 21 patients with various endocrine disorders (without hypoglycemic symptoms). The 37-patient group was given a 100 gram oral G.T.T. with measurements of blood glucose at 30-minute intervals for five hours. In addition, hydroxycorticosteroid measurements were taken as further indication of reactivity. Based on these measurements, 31 of these patients were again diagnosed as hypoglycemic. Patients in the new 31-member group and the 21-member group were administered MMPIs. The authors' findings from the MMPI results are summarized as follows: (a) 27 of the 31 hypoglycemic patients had abnormal MMPI profiles; (b) the hypoglycemic group's mean scores were above 70 (which is two standard deviations above the norm) on the Hypochondriasis and Hysteria scales; (c) definite, probable, and possible hypoglycemics did not differ significantly from each other; and (d) the hypoglycemic group did differ significantly from the group of mixed endocrine patients on the Hs and Hy scales.

Based on the above, Anthony et al. (1973) concluded that there does exist a relationship between hypoglycemia and certain personality characteristics. They also concluded that since patients with hypoglycemia of varying etiology show the same personality patterns, the results suggest that the personality disorder in this relationship is caused by the hypoglycemia.

In response to the above conclusions, Ford et al. (1976) published a study concerning this relationship. They reported MMPI scores for hypoglycemics similar to those of Anthony et al. (1973), but presented differing conclusions. Ford et al. (1976) studied a group of 30 volunteers. All subjects were administered a five-hour oral G.T.T.

and an MMPI. Serum glucose was determined by the glucose oxidase method. Hypoglycemia was defined solely on the basis of a drop in blood sugar to a low level. They divided their original sample into two groups--hypoglycemic and nonhypoglycemic. The results from comparing these groups revealed that (a) 18 of the 30 subjects had abnormal MMPI profiles (i.e., their T scores exceeded 70); (b) another nine subjects had elevation of greater than 65 on at least one T score; and (c) ten subjects of the 21-member hypoglycemic group, and two of the nonhypoglycemic group had significant elevations on the Hs and Hy scales. However, these authors reached a conclusion which differed from Anthony et al. (1973). They reported that averaged MMPI T scores failed to distinguish any significant difference between the two groups.

Johnson, Dorr, Swenson, and Service (1980) also reviewed this relationship. These authors compared the MMPI results of a group of patients, diagnosed as hypoglycemic, to Swenson, Pearson, and Osborne's (1973) general medical patients. This comparison was part of a broader attempt to determine the clinical characteristics of reactive hypoglycemia and to assess the relative values of diagnostic criteria. Results of this study were in contrast to the study by Ford et al. (1976). Johnson et al. (1980) reported statistically significant elevations on all clinical scales by the hypoglycemic group over the control group. This supported one of Anthony et al.'s (1973) conclusions, however they did not also agree with Anthony et al. (1973) that the hypoglycemia had caused the personality disorders.

## Critique

Since the topic of the previous section is also the subject of investigation of this dissertation, a closer review of these studies is in order to help determine if there is sufficient justification for proposing further research in this area. Therefore, in this regard, the following observations, concerning these studies, are noted:

1. In regard to subject selections in the studies by Anthony et al. (1973), Ford et al. (1976), and Johnson et al. (1980), there was no attempt made at any type of random sampling. Subject populations were simply the patients who, for whatever reason, came to the medical centers for treatment.

2. In the studies published by Anthony et al. (1973) and Ford et al. (1976), only a relatively small number of subjects were examined, 58 and 30 respectively.

3. In regard to the control groups presented for comparison study by Anthony et al. (1973) and Johnson et al. (1980), consideration was not given to the possibility that there may have also been a number of hypoglycemic patients in their "nonhypoglycemic" groups (Anthony et al., 1973, did specify that their group presented no typical physical hypoglycemic symptoms, but, as previously noted, a person may be suffering mentally from a hypoglycemic condition without any of the outward indications.) None of these authors administered any test designed to determine this.

4. In regard to the diagnosis of hypoglycemia, none of these studies considered all of the currently accepted blood sugar criteria (see Definitions, p. 9) (Johnson et al., 1980, came closest to these, however, they did not also consider the possibility of "flat curve"

hypoglycemia. As has been demonstrated, this is also a factor which must be considered.)

To conclude, the relatively small, select, and improperly defined samples in these studies suggest that research thus far, concerning the relationship between hypoglycemia and personality characteristics, could be improved methodologically. The small number of studies to date and the controversies, which have developed, indicate that more research in this area is needed. As has been demonstrated, the relationship between personality characteristics and hypoglycemia is relevant to the field of mental health. Therefore, there is justification for this dissertation to further examine this relationship.

## Summary

In the first section of this chapter, hypoglycemia was defined as a condition of low blood sugar, and literature was reviewed which explained why maintaining adequate blood sugar levels is important to normal brain functioning. Next, the development of research on hypoglycemia was briefly traced to demonstrate that hypoglycemia does exist as a definite clinical problem. Then, different conditions, contributing to the development of hypoglycemia, were discussed. This was to demonstrate the general susceptibility of people to this condition, which may also give some indication of the possible prevalence of this problem in society. Finally, the symptomology of hypoglycemia was discussed from a psychological standpoint to introduce the reader to the significance of the effect of low blood sugar on a person's mental functioning ability.

The second section of the chapter discussed in more detail the

possible role hypoglycemia plays in various psychological disorders. Psychoses, neuroses, and various emotional conditions were examined. Evidence from research was found to be controversial concerning the relationship of low blood sugar to these various pathologies. Some authors stated that there is no relationship between the two; other authors maintained that there is a relationship between the two, but disagreed on causality. Examples of case studies from the literature were also presented. When examining these individual cases, however, it becomes evident that low blood sugar is related to certain pathological conditions, and further, that in some cases it may even be the most significant factor in the development of these pathologies.

The third section of this chapter discussed research in the more specific area of the relationship of low blood sugar problems to personality characteristics. Again, research findings were somewhat controversial. For example, using the MMPI, Johnson et al. (1980) found significant differences on all clinical scales between their hypoglycemic group and their control group. Ford et al. (1976) did not find significant differences on any of the scales. Anthony et al. (1973) found significant differences, but only on the Hy and Hs scales.

To conclude the chapter, a critique was presented discussing the shortcomings of research to date concerning the relationship between personality characteristics and low blood sugar conditions. The section ended with a comment on the justification of the intent of this study.

# CHAPTER III

# METHODOLOGY

This research was designed to study the relationship between personality characteristics and low blood sugar conditions. This chapter presents the methodology and instruments used in gathering and analyzing the data.

## Subject Selection

The subject sample for this study was drawn from a southeastern metropolitan area in Texas. Subjects were selected according to the following sampling procedures: (a) A systematic random sampling procedure was employed utilizing residential listings in the metropolitan telephone directory. (b) Selected subject candidates were contacted initially by an introductory letter which briefly explained the nature and purpose of the study, why they were selected, and that they would be contacted again to discuss their possible participation (See Appendix A). (c) Next, subject candidates were contacted by telephone to explain the research more fully, including its procedures and commitments, to ask if they would be willing to participate in the study, and to assign them to test groups. (d) Then on testing days, subjects candidates were asked to sign disclaimer statements (see Appendix B), prior to their participation in the research, to ensure that they fully understood their commitments and possible risks, and for liability

considerations.

Research data were collected on 160 subjects. The number of participants represents approximately 15% of the subject candidate sample that was originally contacted by letter. Subjects ranged in age from 20 to 64 years. Participation was voluntary, and no attempt was made to limit the sample according to specific characteristics such as sex, ethnicity, or socieconomic status. The only restrictions imposed were that the subjects be above age 18, and not have diabetes or hemophilia. A total of 98 of the subjects were determined by testing to be hypoglycemic (60 females, 38 males), and 62 were nonhypoglycemic (30 females, 32 males).

## Instrumentation

Two types of instruments were used to collect the data for this study--the Minnesota Multiphasic Personality Inventory (MMPI) and an oral Glucose Tolerance Test (G.T.T.). The MMPI was chosen because it is an instrument which has undergone a significant amount of investigation, and is currently the most widely used instrument for determining personality characteristics (Anastasi, 1982). Additionally, the MMPI was the instrument of choice in most of the previous research investigating relationships between hypoglycemia and various psychological problems (Ch II, pp. 25-27). An oral G.T.T. was chosen for determining blood sugar levels because, according to Seltzer (1983) and Gorman (1979), this is the most satisfactory method available for determining blood sugar fluctuations, thereby allowing most accurately for diagnoses of diabetes and hypoglycemia. Additionally, the oral G.T.T. is the most common test for these conditions which is currently

utilized by the American Medical Association. The following two sections describe the psychometric characteristics and practical use of these two instruments.

## Minnesota Multiphasic Personality Inventory

The MMPI was developed by Hathaway and McKinley (1967). The test provides scores on ten "clinical scales"--Hypochondriasis, Depression, Hysteria, Psychopathic Deviate, Masculinity-Feminity, Paranoia, Psychasthenia, Schizophrenia, Hypomania, Social Introversion; as well as four "validity scales"--?, L, F, and K. These 14 scales are those which are typically used, but actually over 450 different scales are now available.

The MMPI can be administered individually or in groups, and consists of 550 affirmative statements to which the examinees must give the response "True" or "False" ("cannot say" may also be included). The content of MMPI items covers a fairly wide range, such as items relating to health, psychosomatic symptoms, neurological disorders, and motor disturbances; sexual, religious, political, and social attitudes; and educational, occupational, family, and marital questions. Additionally, many well-known neurotic or psychotic behavior manifestations, such as obsessive and compulsive states, delusions, hallucinations, ideas of reference, phobias, and sadistic and masochistic trends are assessed in the test.

In developing the MMPI scales, the authors used an empirical approach which utilized criterion groups composed of individuals manifesting a common psychiatric syndrome according to traditional psychiatric diagnosis. Each group was systematically contrasted with

self-descriptions on component items provided by normal volunteers. Only those items showing stable differences between criterion groups and normal adults were retained for inclusion in a tentative scale for a particular disorder. These tentative scales were then subjected to various statistical checks, corrective weightings, and cross-validational analyses before final acceptance into the standard test profile (Dahlstrom & Dahlstrom, 1979).

The fundamental assumption underlying the use of the MMPI is that people behave consistently. For example, depressed people will tend to express their depression, among other ways, in facial expressions, conversations, social behavior, and the way they answer MMPI items. In responding to the MMPI, it does not matter whether the examinee says things which are objectively true, because it is sufficient that depressed people will typically respond in much the same way as clinically depressed patients (King & Brantner, 1974). Additionally, the level of elevation on a given scale correlates well with the rated severity of that particular disorder (Endicott, Jartner, & Abramoff, 1969). Further, as research on the MMPI proceeded (more than 6,000 references are available), it became clear that the test profile has many implications for personality measurement beyond the clinical syndromes on which they were originally constructed (Anastasi, 1982), thus contributing to some of its current popularity.

Norming data

The MMPI scales were developed by contrasting "normal" groups with carefully studied clinical cases. The clinical cases were taken from a group of over 800 patients who were available from the

neuropsychiatric division of the University of Minnesota Hospitals. The "normal" groups consisted of a sample of 700 nonpatients who responded to items while waiting in the corridors of these hospitals. Sampling was said to be adequate for males and females ages 15 to 50. Additionally, further norming information was also collected from a sample of 250 college and precollege students (Hathaway & McKinley, 1967).

## Reliability

McKinley and Hathaway (1942 & 1944), using the Card Form of the MMPI, reported test/retest coefficients ranging from .57 to .83 for six of the clinical variables on the MMPI. The time between testing varied from three days to more than a year. Cottle (1950) reported test/retest coefficients ranging from .46 to .91 for people who took the Card Form twice in one week. Holzberg and Alessi (1949) reported test/retest coefficients for psychiatric patients who took both the complete version and a shortened version of the Card Form within three days, results ranged from .52 to .93. Faschingbauer (1973) reported test/retest coefficients on male and female college students using the standard form with a one-day interval between tests. These coefficients ranged from .73 to .97 and .71 to .96 respectively. Appendix C presents the complete listing of correlation coefficients for each of these studies.

## Validity

Profile scores above a T score of 70 have been found to predict positively the corresponding final clinical diagnosis or estimate in

more than 60% of new psychiatric admissions (McKinley & Hathaway, 1943). These authors stated that this percentage is derived from differentiation among various kinds of clinical cases, which is considerably more difficult than obtaining differentiations between abnormal and normal groups. Further, even in cases in which a high score is not followed by a corresponding diagnosis, the presence of the trait to an abnormal degree was said to be usually noted in the patient's symptomatic picture.

This is not to say that the validity of the MMPI has not been subject to some criticism. Levitt and Duckworth (1984) stated that the validity of the MMPI varies with the population examined, and seems to work best with diagnosing those who are severely disturbed and are demographically most like the original Minnesota normative samples (i.e., white and middle-class). However, even with its possible shortcomings, the MMPI still remains one of the most valid of all objective testing instruments currently available for assessing psychopathological conditions (King, 1978).

## Glucose Tolerance Test

A G.T.T. involves loading a person's system with a specified amount of sugar (usually 100 grams of carbohydrates at one time) and then measuring blood sugar levels at various intervals to determine how the person's system is reacting to that load (Seltzer, 1983). From those measurements, a profile can be plotted, and utilizing certain criteria (see Definitions, p. 9), a diagnosis can then be made from the profile to determine the presence or absence of hypoglycemia.

In this study, the whole blood glucose oxidase/peroxidase

measurement method was employed for determining the blood sugar levels (Marks & Dawson, 1964; Piepho, Kloepfer & Suther, 1980). Blood sugar samples were secured as follows: (a) Subjects were instructed in the procedure for drawing their own samples; (b) subjects were supplied with the necessary materials--alcohol, cotton balls, auto-click device, and test strips; (c) samples were collected from the subjects and placed into a Glucoscan for measurement; (d) samples were secured from each subject eight different times; and (e) all measurements were made by an experienced medical technologist.

## Test Procedures

Subjects were assigned to testing groups of 6 to 12 members each. Consideration was given to test-week preferences of subjects in the group member assignments. Testing sessions were conducted on Saturdays, and took approximately five and one-half hours per session. The test groups met at 7:15 a.m. Test time could have varied, but it was believed that consumption of the required food groups at that time would coincide more closely with the subjects' usual daily routine. Both testing instruments were administered to each subject on the same day. Only one group of subjects was tested per week, requiring a total of 18 weeks for data collection. Specific administration procedures for these tests are described below.

### G.T.T.

Test subjects were instructed to consume a 150 to 300 grams of carbohydrate diet each day for three days prior to testing (Walfish, 1979). Subjects were instructed to eat their Friday evening meal

between 7:30 and 8:00 p.m. (allowing for 12 hours of fasting prior to testing), and to consume nothing further except water until the time of the test. They were also instructed to bring with them to the testing site one of the several food groups selected by the researcher (each equivalent to 100 grams of carbohydrates) to be consumed during the test (see Appendix D) .

The first blood samples were collected at 7:45 a.m. on the day of the testing. Immediately following this, subjects were instructed to consume the foods they brought with them; they were allowed 20 minutes to complete this. Subjects were not allowed to consume anything further except water until the end of the testing. Also, smoking was not allowed. The second blood sample was collected at 8:15 a.m. The third blood sample was taken at 8:45 a.m. The fourth blood sample was taken at 9:15 a.m.; the fifth at 10:15 a.m.; and so on until the eighth sample at 1:15 p.m. (Gorman, 1979; Porte, Jr. & Halter, 1981; Seltzer, 1983).

MMPI

The MMPI was administered according to standard instructions presented in the test manual. Test instructions and materials were given to subjects prior to securing the seventh G.T.T. blood sample. The subjects began taking the test immediately following their seventh sample.

## Research Design

Since the nature of this study deemed it inappropriate to randomly assign subjects to groups, or to experimentally create differences in

the sample, a casual-comparative type of design was used for the collection of data. The outline of the design as it applies to this research is as follows: Results of the G.T.T. were analyzed according to criteria presented in Chapter I, page 9. Based on the results of that analysis, the subject sample was divided into two groups: a hypoglycemic group and a nonhypoglycemic group. Blood sugar level (hypoglycemic versus nonhypoglycemic) was determined as the independent variable. Average scores on nine clinical scales of the MMPI were determined as the dependent variables. The dependent variables of the hypoglycemic group were compared statistically to the dependent variables of the nonhypoglycemic group. Results of the comparisons were then measured for significant differences.

## Analyses of Data

The Hotelling's $T^2$ statistical test was used for comparison of the variables in this study. The Student's t test has been used in previous studies to examine the relationship between personality characteristics and low blood sugar conditions (Anthony et al., 1973). However, the use of Hotelling's $T^2$ multi-variate analysis is a more powerful test, allowing the researcher to test for significant differences between groups on multiple dependent variables simultaneously (Huck, Cormier & Bounds, 1974). Correlations among variables are corrected for, and only one over-all test for significance is made initially. This lowers the probability of making a Type I error. Also, the use of this statistic helps to lower the risk of finding a significant difference by chance alone as the number of dependent variables increases substantially from one.

Upon finding a significant difference, separate univariate follow up F-tests were employed to determine which particular dependent variables were significant. Also, the Wilks Lambda F approximation ($\lambda$) was utilized to determine the proportion of variability between groups ($1 - \lambda$) accounted for by group differences; Eta square was utilized to determine the proportion of variability between like dependent variables in different groups accounted for by group differences. All computations were completed using the SPSS$^X$ computer package (Nie, 1983). The minimum requirement for statistical significance was set at an experimental error rate of $\underline{p} < .05$.

# CHAPTER IV

## RESULTS OF THE STUDY

This study was designed to answer the following question: What is the relationship between low blood sugar conditions and individual personality characteristics? Low blood sugar conditions were determined by testing individuals for relative hypoglycemia, utilizing a G.T.T., and evaluating the tests according to certain criteria (Ch I, p. 9). Individual personality characteristics were determined by testing individuals with an MMPI and utilizing subscores on the nine clinical scales as the constructs of personality. The relationship between low blood sugar and personality characteristics was determined by first dividing the subject population into two groups--hypoglycemic and nonhypoglycemic--then comparing the personality characteristics of individuals in one group with those in the other.

In considering the above relationship, the following hypothesis was formulated: A significant difference will be found between the personality characteristics of hypoglycemic and nonhypoglycemic groups when the constructs of personality characteristics are defined as those which are measured by the following scales of the MMPI: Hypochondriasis, Depression, Hysteria, Psychopathic Deviate, Paranoia, Psychasthenia, Schizophrenia, Hypomania, and Social Introversion.

To test the hypothesis of a difference between hypoglycemic and nonhypoglycemic groups, the Hotelling's $T^2$ multivariate analyses of

variance (MANOVA) statistical test was used. However, in order to employ any type of MANOVA technique in data analyses, as opposed to separate univariate statistical methods, some justification must exist for using these techniques. Thus, there must be some correlation among dependent variables. If there were no correlations, then separate univariate analyses might work equally well (Huck, et al., 1974). In this study, the Bartlett's Test of Sphericity was employed to test for such correlations (Norusis, 1985).

Results from the Bartlett's test were equal to 911.5 (df = 36, $p < .05$). The determinant of the within-cells correlation matrix was equal to .0027. Such a small determinant is significant, allowing a rejection of the hypothesis that the dependent variables were not correlated. Therefore, a construct was formed. Specific correlations are presented in Table 1.

Data analyses with MANOVA techniques also require that the data adhere to certain underlying assumptions. The assumptions, which are relevant to the Hotelling's $T^2$, are as follows:

1. Even though there must be some correlations among dependent variables, the variables cannot be too highly correlated. A condition known as multicollinearity occurs when scores are too highly (near perfectly) correlated. Also, scores on the dependent variables cannot be linear (or nearly linear) combinations of scores on other dependent variables. In such cases singularity occurs. If either multicollinearity or singularity occurs, the determinant in data analyses will be close to zero. In analyses, division by a near-zero determinant results in a highly unstable inverted matrix, which will cause data results to fluctuate with only small changes in the determinant

Table 1

Pooled Within-Cell Correlations Among Nine Subscales of the MMPI

| Subscale | Hs | D | Hy | Pd | Pa | Pt | Sc | Ma | Si |
|---|---|---|---|---|---|---|---|---|---|
| Hypochondriasis (Hs) | 11.76 | | | | | | | | |
| Depression (D) | .58 | 15.24 | | | | | | | |
| Hysteria (Hy) | .80 | .62 | 10.34 | | | | | | |
| Psychopathic Deviate (Pd) | .53 | .55 | .53 | 12.18 | | | | | |
| Paranoia (Pa) | .57 | .57 | .55 | .63 | 11.74 | | | | |
| Psychasthenia (Pt) | .51 | .59 | .43 | .62 | .50 | 10.95 | | | |
| Schizophrenia (Sc) | .62 | .51 | .48 | .72 | .62 | .77 | 12.47 | | |
| Hypomania (Ma) | .34 | -.04 | .08 | .37 | .28 | .26 | .44 | 11.24 | |
| Social Introversion (Si) | .14 | .52 | .08 | .12 | .27 | .41 | .25 | -.12 | 10.87 |

Note. Standard deviations are on the diagonal

Tabachnick & Fidell, 1983). This means that results of the analyses may be unreliable.

The determinant in this study, as previously indicated, was small (.0027). However, this value was still almost 27 times as large as that which is necessary to produce multicollinearity or singularity (Tabachnick & Fidell, 1983). This fact, together with a careful examination of correlations in Table 1, indicated that the assumptions of multicollinearity and singularity were met for data analysis in this study.

2. The sample data must have been drawn from multivariate normal populations (Huck, et al., 1974). The following tests were conducted to determine if this assumption had been met: (a) Tests for skewed distributions were made for scores on each dependent variable to determine if skewness for that variable differed significantly from zero. A z value in excess of ± 2.58 would have led to rejection of the assumption of normality of the distribution (Tabachnick & Fidell, 1983). No variable in this study scored higher than .73. (b) Extreme scores on individual dependent variables were measured as possible significant outliers. All such scores were compared to standardized scores of ± 3.00 (Tabachnick & Fidell, 1983). No outliers were discovered. Therefore, this assumption was met by this study.

3. The population from which the sample data was drawn must have equal dispersion matrices (Huck et al., 1974): This assumption was tested using the Bartlett's - Box F test for homogeneity of variance. Results from these tests are presented in Table 2. Test results indicated that this assumption was not met by this study. However, because the larger of the two groups in this study (hypoglycemic)

Table 2

Bartlett's - Box F Test of Univariate Homogeneity of Variance Between Groups by Subscales of the MMPI

| Subscale | F Value | Significance Level |
|---|---|---|
| Hypochondriasis | 20.089 | .000 |
| Depression | 20.821 | .000 |
| Hysteria | 35.370 | .000 |
| Psychopathic Deviate | 3.501 | .061 |
| Paranoia | 6.055 | .014 |
| Psychasthenia | 8.046 | .005 |
| Schizophrenia | 16.627 | .000 |
| Hypomania | .023 | .879 |
| Social Introversion | 5.865 | .016 |

generated the larger variances, a conservative alpha level was produced. Therefore, when the tests of mean differences were rejected, they were rejected with confidence (Tabachnick & Fidell, 1983). If the smaller of the two groups had generated the larger variances, the alpha level would have been liberal. Since that was not the case, violation of this assumption did not affect the validity of the results of this study.

In addition to some justification and the need to meet certain assumptions, MANOVA statistical techniques also require that the user follow two basic rules: (a) There should not be fewer dependent variables than there are treatment groups (independent variables) being compared, and (b) the total number of subjects in the study must be at least twice as large as the number of dependent variables (Huck et al., 1974). This study tested the effects of one independent variable on nine dependent variables, and employed a total of 160 subjects. Therefore, these requirements also presented no problem to this study.

Data analyses for this study on the MMPI tests scores revealed an overall mean of 68.17 and a standard deviation of 13.26 for the hypoglycemic group sample. A mean of 56.4 and a standard deviation of 9.06 were found for the nonhypoglycemic group. The means and standard deviations for individual personality scales are presented in Table 3.

Results of the Hotelling $T^2$ test were found to be significant: $F(9, 150) = 13.97$, $p < .05$. This means that a significant difference was found between the hypoglycemic and nonhypoglycemic groups. Therefore, the null hypothesis of no difference between the two groups was rejected, while the research hypothesis was accepted. Findings from the separate univariate F-tests, as presented in Table 4, revealed that

Table 3

Means and Standard Deviations of Nine Subscales of the MMPI by Groups

| Subscales | Hypoglycemic n=98 | | Nonhypoglycemic n=62 | |
|---|---|---|---|---|
| | $\bar{X}$ | SD | $\bar{X}$ | SD |
| Hypochondriasis | 64.92 | 13.66 | 51.01 | 7.86 |
| Depression | 76.34 | 17.72 | 52.42 | 10.09 |
| Hysteria | 68.87 | 12.36 | 57.05 | 5.81 |
| Psychopathic Deviate | 74.67 | 13.12 | 63.96 | 10.52 |
| Paranoia | 67.44 | 12.89 | 60.90 | 9.62 |
| Psychasthenia | 67.72 | 12.18 | 52.27 | 8.67 |
| Schizophrenia | 70.83 | 14.33 | 56.32 | 8.70 |
| Hypomania | 60.49 | 11.16 | 62.15 | 11.36 |
| Social Introversion | 62.24 | 11.93 | 51.48 | 8.94 |

Table 4

Univariate F - Tests of Nine Subscales of the MMPI

| Subscale | F Value | Significance Level* |
|---|---|---|
| Hypochondriasis | 53.149 | .000 |
| Depression | 93.581 | .000 |
| Hysteria | 49.640 | .000 |
| Psychopathic Deviate | 29.280 | .000 |
| Paranoia | 11.774 | .001 |
| Psychasthenia | 75.535 | .000 |
| Schizophrenia | 51.414 | .000 |
| Hypomania | .824 | .365 |
| Social Introversion | 37.164 | .000 |

Note.* $p < .05$; df = 1,158

eight of the dependent variables--Hypochondriasis, Depression, Hysteria, Psychopathic Deviate, Paranoia, Psychasthenia, Schizophrenia, and Social Introversion--contributed significantly to the differences between the two groups.

To further examine the relationship between the hypoglycemic and nonhypoglycemic groups, scores on dependent variables were also analyzed with the Wilk's Lambda F Approximation. One minus the value of lambda is equal to the proportion of the variability between groups that is explained by group differences. The value of lambda was found to be .544 ($1 - \lambda = .456$). Therefore, approximately 46% of the variability between the two groups was explained by group differences. The proportions of variability accounted for by individual dependent variables are presented in Table 5. The personality characteristic of Depression contributed most significantly to differences between the hypoglycemic and nonhypoglycemic groups, while the Hypomania characteristic produced the least effect.

Table 5

Proportion of Variability of the Difference Between the Hypoglycemic and Nonhypoglycemic Groups Accounted for by Nine Subscales of the MMPI

| Subscale | Eta Square |
|---|---|
| Hypochondriasis | 25% |
| Depression | 37% |
| Hysteria | 24% |
| Psychopathic Deviate | 16% |
| Paranoia | 7% |
| Psychasthenia | 32% |
| Schizophrenia | 25% |
| Hypomania | .6% |
| Social Introversion | 19% |

# CHAPTER V

# DISCUSSION

This chapter presents a summary of the study, conclusions and an interpretative analysis of the findings of the study, implications of the research for the field of Counseling Psychology, and some recommendations for further study.

## Summary

Glucose (blood sugar) is one of the most important substances which compose the fuel material used by the body for its energy (Adams & Victor, 1981). On the average, the brain requires approximately 25% of this fuel in order to function effectively, which give some indication that the brain may be especially sensitive to glucose deprivation (Watson, 1976). Literature in the fields of Psychology and Medicine has been growing in support of a relationship between low blood sugar levels and mental functioning ability, demonstrating among other things, the possible role of hypoglycemia in neuroses and psychoses (Hafken et al., 1975; Harris, 1936; Hoffman & Abrahamson, 1949; Kepler & Moersch, 1937).

More recently in the literature, some studies have focused their attention upon examining the possible relationship between low blood sugar conditions and individual personality characteristics (Anthony et al., 1973; Ford et al., 1976; Johnson et al., 1980). However,

findings from this research have been inconclusive. A possible explanation for the contradictions in these findings may be that the methodology, utilized by these studies to define and measure the relationship between hypoglycemia and personality characteristics, has been problematic.

This study was also designed to examine the relationship between low blood sugar conditions and individual personality characteristics. However, it was the intention of this study to attempt to improve upon previous research designs. Therefore, the following methods, which had not been utilized in previous research, were employed here:

1. This study attempted to define more adequately the condition of hypoglycemia. No previous research had examined all of the factors involved in blood sugar profiles which are currently recognized as necessary for the diagnosis of hypoglycemia: (a) The blood sugar level failed to rise more than 50% above the fasting level (Philpott & Kalita, 1980), (b) the blood sugar level fell during the test, to 20 mg percent below the fasting level (Salzer, 1966), (c) the blood sugar level fell 50 mg percent or more during any one hour of the test (Salzer, 1966), or (d) the lowest blood sugar level fell in the range of 60 mg percent or lower (Fabrykant, 1955; Pfeiffer, 1975).

2. This study attempted to randomly select a relatively large subject sample from an entire community. Data was collected on 160 subjects from the population at large in a metropolitan area. Subject samples utilized by previous research were very select and usually small. Subjects consisted of medical patients receiving treatments for a variety of diseases. Also, some studies had no clearly defined nonhypoglycemic groups for comparison.

3. This study utilized the Hotelling's $T^2$ MANOVA statistical test to determine statistical differences on personality characteristics between the hypoglycemic and nonhypoglycemic groups. Previous research had employed the Student's t test. However, the Hotellings $T^2$ is a more powerful test, allowing for testing significant differences between groups on multiple dependent variables simultaneously. It controls for possible correlations between variables, and it reduces the risk of finding a significant difference by chance alone when the number of dependent variables increases substantially from one (Huck, et al., 1974).

To examine the relationship between personality characteristics and low blood sugar conditions, this study hypothesized that a significant difference would be found between the personality characteristics of hypoglycemic and nonhypoglycemic groups when the constructs of personality characteristics are defined as those which are measured by the following scales of the MMPI: Hypochondriasis, Depression, Hysteria, Psychopathic Deviate, Paranoia, Psychasthenia, Schizophrenia, Hypomania, and Social Introversion.

The hypoglycemic and nonhypoglycemic groups were determined by testing subjects with a five-hour G.T.T., then assigning individuals to one of the two groups based on the results of the tests. A total of 98 subjects were determined to be hypoglycemic and 62 were nonhypoglycemic. Statistically significant differences between the groups on various personality characteristics were determined by first testing for an overall difference between the two groups with the Hotelling's $T^2$, then utilizing univariate F-tests to determine which of the particular personality characteristics were significant. Also,

the Wilk's Lambda F Approximation was utilized to determine the proportion of variability between the two groups accounted for by the overall group differences, and Eta square for like individual personality characteristic differences between groups.

Test results demonstrated that there was clearly a difference between the MMPI profiles of individuals in the hypoglycemic group and those in the nonhypoglycemic group. The overall mean for the hypoglycemic group was 11.77 T scores higher than the nonhypoglycemic group. All individual personality characteristics were found to be statistically significant between the two groups, with the one exception of Hypomania. The strength of association tests indicated that a large proportion (47%) of differences in personality characteristics may be caused by differences in blood sugar levels. Also, the personality characteristics most prominently affected by blood sugar levels seem to be Depression, Psychasthenia, Hypochondriasis, Schizophrenia, and Hysteria, in that order.

## Conclusions

The object of this section is to discuss the significant findings which resulted from the statistical techniques employed to analyze the data in this study. The most important finding from this analysis was that results indicated that the personalities of people who have problems with low blood sugar conditions are generally different from those of people who do not have such problems. Moreover, for hypoglycemic individuals, one can even predict with a degree of confidence the direction of certain particular personality characteristics.

Data analyses in this study indicated that Depression and

Psychasthenia were the characteristics most likely to be recognized in individuals with low blood sugar problems. These findings are in support of Johnson et al. (1980) who also found significant elevations on these scales. However, in the study by Johnson et al., Hypochondriasis and Hysteria were the scales found to be the most significant. Anthony et al. (1973) also found elevations on the D and PT scales. However, these authors reported the differences to be nonsignificant. Findings in this study are in contrast to those of Herzberg et al. (1968) and Ford et al. (1976), who found no relationship between Depression and hypoglycemia.

Data analyses in this study indicated that Hypochondriasis, Schizophrenia, and Hysteria are also characteristics likely to be recognized in individuals with low blood sugar problems, although not as prominently as Depression and Psychasthenia. These findings are in support of those by Anthony et al. (1973), as well as Johnson et al. (1980). To some extent, they also support Ford et al. (1976), who found hypoglycemics to have elevations on these scales, however, they reported the differences to be insignificant.

Other significant differences found in this study were with the personality characteristics of Social Introversion, Psychopathic Deviate, and Paranoia. Hypomania was the one characteristic not found to be distinguishable between hypoglycemic and nonhypoglycemic individuals.

The findings of this study would seem to follow logically from what one might expect when considering the personality profiles of hypoglycemic individuals. For example: When a person's blood sugar level is low, feeding less fuel to the brain, one would expect to find

brain functions somewhat depressed. The person might have trouble remembering things and trouble concentrating. He or she might also experience a clouded state of consciousness, and possibly even delirium. In any event, the person would probably feel depressed. Obviously then, elevations on the Depression scale may be an expression of these feelings by hypoglycemics. The other MMPI scales examined in this study are discussed below.

Psychasthenia, considered to be a good indicator of anxiety, is another characteristic which one would expect to be expressed by hypoglycemic individuals. A reason for this may be that when a person's blood sugar level drops below normal, the adrenal glands are activated. This is a bodily response to try to restore the blood sugar back to a normal level. If people have excess adrenalin flowing in their systems, they may feel more nervous and anxious than normal, and may then tend to express this as Psychasthenia.

Hypochondriasis is a characteristic that reflects concern about health problems. People who score high on this scale usually have a number of vague and nonspecific physical complaints. Since hypoglycemic individuals may have several actual physical problems, and may experience a fairly wide range of symptoms, it is easy to understand why hypoglycemics may score significantly higher on this scale than nonhypoglycemics.

Schizophrenia is a characteristic which reflects unusual thought processes, lack of deep interest, apathy, feelings of social alienation, poor family relations, peculiarities of perception, and reduced efficiency. This fits well with the hypoglycemic individual because hypoglycemics also tend to express apathy or a lack of interest and

experience reduced efficiency or productivity because of a general lack of energy and the dulling effect that glucose deprivation has on the mind. Additionally, hypoglycemics may sometimes have problems with perception because of a disturbed mental functioning ability. They may reduce their number of social contacts because of their low energy level and a need to reduce the additional stress in their lives. Also, hypoglycemics may experience poorer social and family relations because of the inhibiting effect that these problems have upon their ability to interact appropriately with others.

Hysteria is a characteristic which is normally typical of people who are predisposed to use conversion symptomology as a means of solving conflicts or avoiding responsibilities when under stress. For hypoglycemic individuals, high scores on this scale, as with the Hs scale, may simply be the expression of actual physical problems that they may have developed as a result of the hypoglycemic illness.

Social Introversion is a characteristic which simply differentiates people who are introverted from those who are more extroverted. Possible explanations for hypoglycemics scoring significantly higher on this scale are presented adequately under Schizophrenia.

Psychopathic Deviate is a characteristic of individuals who have a predisposition to display features such as impulsivity, low frustration tolerance, and poor social adjustment. Hypoglycemics typically display a low tolerance for frustration, and are sometimes quick to anger because of a high anxiety level caused by their reduced ability to function effectively and their increased sensitivity to stress. Hypoglycemics may express a reduced ability to delay gratification because of their anxious and stressful condition. Also, they may

have experienced a poor social adjustment, as explained above under Schizophrenia.

Paranoia is a characteristic of individuals who tend to have delusional belief systems; ideas of reference; feelings of persecution, influence, and grandeur; pervasive suspiciousness; and interpersonal sensitivity and rigidity. In this study, hypoglycemics also scored significantly higher on this scale than nonhypoglycemic individuals. However, the differences here were much lower than on any of the other scales. Hypoglycemia accounted for only 7% of the variability of the differences between the two groups on this scale. Elevations on the Paranoia scale may evolve from the possible expression of feelings from some hypoglycemics that their world is against them. These feelings may stem from their increased levels of anxiety, frustration, and irritability. Hypoglycemic individuals may also feel increased interpersonal sensitivity. However, as for other aspects of this characteristic, any conclusions, concerning possible relationships, would be too speculative, and indeed there may not be any such relationships.

Hypomania is a characteristic which demonstrates the excitement and activity level of the person. Hypomania was the only personality characteristic in this study not found to be significantly higher for hypoglycemic than nonhypoglycemic individuals. In some cases, it was even found to have slight negative correlations with other characteristics. This makes sense when one considers what this scale measures in relation to hypoglycemia. People who score high on this scale are relatively more active and excited than those who do not. Hypoglycemics often have a relatively low energy level and experience somewhat depressed mental functioning ability. When viewed from this

perspective, one might even expect to find this characteristic significantly lower for hypoglycemic than nonhypoglycemic individuals. However, this was not found to be the case. A possible explanation for this may be, as stated earlier, that there is a period of time in the hypoglycemic blood sugar curve when the adrenal glands are pumping adrenalin into the bodily system in an effort to restore normal blood sugar levels. At such a time, they may feel nervous or anxious, and their level of excitation may rise. At other times, hypoglycemics may feel relatively normal. This can occur for a short time immediately after having consumed some type of stimulant such as caffine or tobacco, or quickly absorbed carbohydrates such as alcohol, sugar, and refined flour; and for somewhat longer times after meals. Therefore, what one may actually find with hypoglycemic individuals is that at different times, hypoglycemics feel different. They may actually feel depressed, excited, or normal, depending upon the cause and severity of the hypoglycemia and the eating habits of the individual.

Upon concluding this discussion of the findings of this study, the following should also be noted: It cannot be stated from this research that the significant elevations found here on certain personality characteristics in hypoglycemic individuals were necessarily caused by low blood sugar problems. It may be that hypoglycemia does cause or at least contribute to the development of these characteristics. However, it must be remembered that people who are typically depressed, anxious, physically sick in other ways, introverted, or prone to conversion reactions; or who have perceptual problems, a low frustration tolerance, feelings of persecution, or poor social adjustment and family relations, etc., may tend to develop hypoglycemia at

some later time simply because of the additional stress that these conditions place on bodily functions, causing them to eventually weaken and malfunction. However, the manner in which the relationship evolved is not really important here. The fact that the relationship may exist is important.

## Implications

Results from this study indicated that there is a relationship between low blood sugar conditions and certain personality characteristics. The review of the literature discussed a variety of mental symptoms which have been known to accompany hypoglycemia, and indicated that hypoglycemia may be a factor sometimes involved in the development of neuroses, as well as psychoses.

Some authors have stated that hypoglycemia may occur in as many as 30 to 70% of psychiatric patients (Hawkins, 1973; Meiers, 1973) and in 90% of alcoholics (Hoffer & Osmond, 1962; Meiers, 1973). Other authors have stated that because of the effect of glucose deprivation on the thalamic area of the brain (the emotional center), that hypoglycemia may also be at the root of many antisocial emotional problems, including juvenile delinquency and criminal behavior (Williams & Kalita, 1977; Barns & Barnes, 1978).

Unfortunately, psychologists and psychiatrists predominantly seem to view emotions as separate from the human body. The methods currently utilized for treating clients with emotional problems or mental diseases consist mainly of psychotherapy, chemotherapy, and sometimes convulsive shock therapy. However, consider the following summary from concluding observations by Williams and Kalita (1977):

Scientists are aware that for every effect, there must be a cause(s). But too often, and tragically so for some people, some doctors center their attention only on the effect. They try to repress, tranquilize, ignore, shock, or talk it away. In this process, they sometimes create mental, emotional, and spiritual vegetables who are often shunned by society and locked up in wards of our now overcrowded mental institutions. What is far more serious, these institutions create a hostile environment for their patients' already overly sensitive, malfunctioning body chemistries. For instance, they feed schizophrenics high carbohydrate dinners because it is inexpensive. Compounding the problem, they permit potential allergens, such as caffine, tobacco, sugar, etc., to literally abound for consumption. Cerebral allergies are not even tested. A glucose tolerance test is rarely utilized for diagnoses. Amino acids, vitamins, minerals, and glucose--substances normally present at the cellular level--are ignored, and the diet is enough to destroy any healthy biochemical mechanism, given enough time.

Psychotherapy is obviously necessary in the treatment of mental health problems, as is the judicious use of psychotropic medications. However, one cannot help but wonder from the above what some of those clients or their families might have thought if after years of psychotherapy, medications, and institutions, they discovered that the majority of their original symptoms might have been caused simply by a misdiagnosed and mistreated physical or dietary problem. Think how much different their lives other wise might have been.

Obviously, these observations and the findings presented in this study hold theoretical implications of some significance in the field

of mental health. However, the main interest here involves the practical and specific implications of this research for the field of Counseling Psychology. Consider the following:

Counseling psychologists typically work with people who are troubled by tension, anxiety, irritability, headaches, insomnia, depression, etc. They deal with social withdrawal, poor social adjustment, feelings of paranoia, conversion reactions, perceptual difficulties, alcholism, and many other types of problems. However, are they aware that these conditions are frequently precipitated by, or at least associated with, some type of physiological problem? Further, as professionals in helping people, do they give consideration enough to this relationship in diagnoses, treatments, and referrals?

Findings from this study, together with a review of the literature, have demonstrated that hypoglycemia is a condition which may be associated with all of the above problems and more. If counselors choose to work with these problems without considering their possible physiological bases, of what service are they really being to their clients? In fact, in some cases, are they not providing a disservice, or possibly being detrimental to their clients? They may be treating only some of the symptoms of the real problem, ignoring the cause, and allowing it to continue or even become worse.

The implications presented here are not that counseling psychologist should attempt to treat people on a medical basis. But, what is important is that counseling psychologists simply become aware that there are other factors which may be contributing to the client's problems. The client's mental health is a function of his or her whole environment, internal as well as external. Further, counseling

psychologists should be knowledgeable enough to be able to provide some constructive help to clients about the more complete nature of their problems, and to make referrals, as appropriately as possible, to where the clients may find other necessary help as an adjunct to the counseling process. Consider the following from the American Psychological Association's Ethical Principles of Psychologists (1981, principle 7a):

> Psychologists understand the areas of competence of related professions. They make full use of all the professional, technical, and administrative resources that serve the best interests of consumers. The absence of formal relationships with other professional workers does not relieve psychologists of the responsibilities of securing for their clients the best possible professional service nor does it relieve them of the obligation to exercise foresight, diligence, and tact in obtaining the complimentary or alternative assistance needed by clients.

The Orthomolecular philosophy of treatment, discussed in the first chapter, is one such complimentary assistance which is receiving growing recognition as important in the field of mental health (Philpott & Kalita, 1980; Williams & Kalita, 1977). Dietary treatment (the wisdom of the father of medicine, Hippocrates) is one aspect of this theory which some counselors are beginning to utilize (Reed, 1983; Snetselaar, 1983). These treatments are used in conjunction with traditional psychotherapy. These authors view such an approach to treatment as important in the field of mental health, not only because it takes into account a more complete view of the person and his

or her problems, but also because these authors have found that by utilizing this approach to the treatment of mental health problems, they are often able to reduce the number of psychological symptoms which must be dealt with in therapy; achieve a higher percentage of what seems to be faster, more effective, and lasting treatment results; as well as contribute to the development of more cost-effective operation of mental health facilities (Pfeiffer, 1975; Philpott & Kalita, 1980; Williams & Kalita 1977).

In conclusion, it is apparent from the preceding that a more reasonable understanding of the relationship between a person's physical health and his or her psychological health is an important concern for the field of counseling psychology. A thorough understanding of this relationship would obviously be an unreasonable expectation for psychologists, and in fact may even represent a field of study unto itself (well beyond the scope of psychology or traditional psychiatry). However, a better understanding is necessary, and the process toward developing this knowledge could begin simply with psychology training programs. Such programs could incorporate in their curriculum a course specifically designed to provide an introduction to the many factors, such as nutrition, toxins, allergies, infections, drugs, genetic defects, and different bodily processes, which are basic to a person's health and general ability to function; and to demonstrate the possible role that these factors play in affecting the person's ability to function mentally and his or her psychological health. Thus, providing psychologists with a more complete understanding of their clients' mental health problems, and enabling psychologists to more effectively deal with such problems.

## Recommendations

The following are recommendations for further research, based upon the outcome of this study:

1. The population sampling procedure employed in this study was a relatively lengthy process. The number of subjects who consented to participate in the study represents approximately only 15% of the sample that was originally contacted. Additionally, all participants were volunteers. Volunteer subjects limit somewhat the external validity of the results of the study because of the possibility of different characteristics in people who choose to volunteer than those in the population as a whole. For these reasons, it is recommended that future research utilize different sampling procedures. However, it is not recommended that subjects be limited to the kinds of select samples utilized by the previous research in this area. (Anthony et al., 1973; Ford et al. 1976)

2. It is recommended that further study be conducted to determine how the relationship between low blood sugar conditions and personality characteristics may differ between males and females.

3. It is recommended that further study be conducted to attempt to determine a possible cause-and-effect relationship between low blood sugar conditions and personality characteristics.

4. It is recommended that further study be conducted to determine the relationship between hypoglycemia and a more complete range of mental functioning ability. A full battery of psychological tests might be administered to subjects. These might include intelligence, objective and projective personality, and possibly neuropsychological tests.

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# APPENDIXES

Appendix A

## Letter of Introduction

The following correspondence is in regard to a research study which is currently in progress in the Corpus Christi area. This research is being conducted in association with a major university--Oklahoma State University--and is the focus of a dissertation study in the field of Counseling Psychology.

The general nature of the research is concerned with studying the relationship of physical health to psychological health. The specific focus of the study is on comparing possible hypoglycemic conditions to various personality characteristics.

The purpose of this letter is to let you know that your name has been chosen from many in this area, as a person whom I am considering asking to become part of this study. I may be contacting you soon to explain more fully the content of the research, and to discuss your possible participation in this important project. I am looking forward to talking with you.

Michael Stephen
Project Director

Appendix B

Disclaimer

This research project has been designed to study the relationship between personality characteristics and low blood sugar conditions. Participants will be guided in taking an oral Glucose Tolerance Test (G.T.T.). During the course of the test, participants will be administered a Minnesota Multiphasic Personality Inventory. Testing sessions will take place on a Saturday. Sessions will begin at 7:30 a.m., and will last approximately 5½ hours.

The research procedure involves the following risks: Due to the nature of the G.T.T., it is possible that people with diabetes may develop severely abnormal blood sugar levels. Extreme blood sugar levels can be harmful. For this reason, people who are known to be diabetic will not be allowed to participate in the study. Also, people who have hemophilia will not be allowed to participate. Further, the G.T.T. may precipitate slight anxiety reactions in even relatively normal subjects. Therefore, if at any time during the test, it is discovered through measurements or reactions that the test is potentially harmful to the participant (i.e., the person's blood sugar is approaching potentially harmful high or low levels), the test will be discontinued for that person.

All information collected in this research is confidential and

will remain with the researcher. The only exception to this would be if the participant wishes to obtain a copy of the results of his or her G.T.T. Copies will be supplied to participants if desired; however, in such an event, the participant is encouraged to seek interpretation of the test from his or her physician.

Participants will receive no compensation, monetary or otherwise, for participation in the research.

Statement of Consent and Agreement:

I, _____, hereby request permission to participate in the research described above, and related incidental procedures. The nature and purpose of this research and the possible risks have been explained to me so that I understand them.

If I am not satisfied with my participation, I will immediately inform the research director.

I understand that the research investigator may be legally liable for the obviously negligent conduct of this research or any acts intentionally done to harm me. I also understand that harm may occur in the absence of any clearly negligent or intentionally harmful act. Therefore, in return for being accepted as a research participant, I release the research investigator from all liability and waive all my rights and claims against him, except those claims arising directly from clearly negligent or intentional harmful acts by him. This release from liability and waiver is made by me for myself, my heirs, and any person who might claim through me or on my behalf. It applies not only to the research investigator but also his assistants, agents and to the research institution and its employees.

I am freely requesting participation without duress or coercion. I understand that I may withdraw my consent at any time, and may stop participation as soon thereafter as it is safe to do so.

Authorizing Signature:

All matters and issues mentioned above have been discussed to my satisfaction and agreement. My signature indicates that I have read, understand and agree to all of the above.

_____

(Signature of the research participant)

Appendix C

Test-Retest Reliability Coefficients Reported for the MMPI

| | Hathaway & McKinley Normals | Cottle Normals | Holzberg & Alessi Psychiatric Patients | Faschingbauer College Students | |
|---|---|---|---|---|---|
| | | | | Male | Female |
| Scale | N=40-47 | N=100 | N=3 | N=28 | N=33 |
| L | -- | -- | .75 | .73 | .85 |
| F | -- | .46 | .85 | .97 | .82 |
| K | -- | .75 | .93 | .89 | .87 |
| Hs | -- | .76 | -- | .79 | .92 |
| D | .80 | .81 | .67 | .88 | .96 |
| Hy | .77 | .66 | .80 | .81 | .85 |
| Pd | .57 | .72 | .87 | .95 | .91 |
| Mf | .71 | .80 | .52 | .91 | .77 |
| Pa | -- | .91 | .76 | .89 | .71 |
| Pt | -- | .56 | .78 | .93 | .93 |
| Sc | .74 | .90 | .72 | .95 | .95 |
| Ma | -- | .86 | .89 | .96 | .85 |
| Si | .83 | .76 | .59 | .94 | .96 |

Appendix D

Food Groups Equivalent to 100 Grams of Carbohydrates

(a) 1 banana
3 oranges
6 dates

(b) 1 banana
2 apples
1 orange
1 cup seedless grapes

(c) 2 bananas
6 dates
1 apple

(d) 3 oranges
1 apple
1 cup seedless grapes

(e) 8 dates
1 cup seedless grapes
2 apples

(f) 2 oranges
1 cup seedless grapes
6 dates

(g) 2 bananas
1 orange
1 cup seedless grapes

(Farr, 1984)

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# VITA

Michael Stephen

Candidate for the Degree of

Doctor of Philosophy

Thesis: THE RELATIONSHIP BETWEEN PERSONALITY CHARACTERISTICS AND LOW BLOOD SUGAR CONDITIONS WITH IMPLICATIONS FOR COUNSELING PSYCHOLOGY

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