THE EFFECTS OF INSULIN-DEPENDENT DIABETES MELLITUS ON COGNITIVE FUNCTIONING, LEARNING DIFFICULTIES, AND BEHAVIORAL PROBLEMS IN CHILDREN

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ABSTRACT

THE EFFECTS OF INSULIN-DEPENDENT DIABETES MELLITUS ON COGNITIVE FUNCTIONING, LEARNING DIFFICULTIES, AND BEHAVIORAL PROBLEMS IN CHILDREN

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The aim of the present study was to investigate the influence of insulin-dependent diabetes mellitus (IDDM) on the cognitive functioning, learning difficulties, and behavioral problems in children between the ages of 7 and 12. The sample was composed of elementary school children living in Ankara, Turkey. Data was collected by administering demographic information form, Children's Depression Inventory (CDI), Strength and Difficulties Questionnaire (SDQ), Wechsler Intelligence Scale for Children–Revised (WISC-R), and Specific Learning Disability Scale. One-way ANOVAs were employed to examine the differences among the levels of parental education, income, school achievement, and child's adherence to IDDM in terms of WISC-R scores, learning difficulty related variables, behavioral problems, and depression. Results revealed that children with low adherence to IDDM were more likely to experience behavioral problems and depression. T-tests were conducted to examine the mean differences between IDDM and control groups in terms of WISC-R scores, and the variables related to learning difficulties, behavioral problems, and depression. As compared to control group, children with

IDDM had lower WISC-R information, similarities, arithmetic, and total scores. Also, children with IDDM had lower achievement in several arithmetic, reading, and writing tasks. Furthermore, hierarchical multiple regression analyses were conducted to test the effect of IDDM adherence, age of onset, and illness duration on cognitive functioning, learning, and behaviors. The results did not reveal any significant effect of IDDM related variables on children's cognitive functioning, learning, or behaviors. Findings were discussed with reference to the relevant literature. Implications of the study were discussed and future research topics were suggested.

Keywords: Children, insulin dependent diabetes mellitus (IDDM), learning difficulties, cognitive functioning, behavioral problems

ÖZ

İNSÜLİN BAĞIMLI DİYABET MELLİTUS'UN ÇOCUKLARDA
BİLİŞSEL FONKSİYONLAR, ÖĞRENME GÜÇLÜĞÜ,
VE DAVRANIŞ PROBLEMLERİNE ETKİSİ

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Bu çalışmanın amacı, insülin bağımlı diyabet mellitus'un (İBDM) 7 ve 12 yaş arası çocuklarda bilişsel fonksiyonlar, öğrenme güçlükleri, ve davranış bozuklukları üzerine etkisini araştırmaktır. Çalışmanın örneklemi Ankara ilinde ilköğretim okullarına devam eden çocuklardan oluşmaktadır. Data toplama aracı olarak demografik bilgi formu, Çocuklar için Depresyon Ölçeği (ÇDÖ), Güçler ve Güçlükler Anketi (GGA), Wechsler Çocuklar için Zeka Ölçeği (WÇZÖ-R), ve Özgül Öğrenme Güçlüğü Bataryası kullanılmıştır. WÇZÖ-R skorları, öğrenme güçlüğüyle alakalı değişkenler, davranış problemleri, ve depresyon açısından ebeveyn eğitim düzeyi, gelir düzeyi, okul başarısı, ve çocuğun İBDM'ye uyum düzeyleri arasındaki farklılıkları değerlendirmek için tek yönlü varyans analizleri uygulanmıştır. Hipotezlerle uyumlu olarak, İBDM'ye uyumu düşük olan çocuklarda İBDM'ye uyumu yüksek çocuklara oranla davranış problemleri ve depresyon düzeylerinin daha yüksek olduğu gözlenmiştir. İBDM hastası olan ve olmayan çocukları WÇZÖ-R skorları, öğrenme güçlüğü, davranış sorunları, ve depresyon açısından karşılaştırmak için t-tesleri uygulanmıştır. Kontrol grubuyla karşılaştırıldığında, İBDM hastası çocukların WÇZÖ-R genel bilgi, benzerlikler, aritmetik, ve toplam puanları düşük

bulunmuştur. Ayrıca sağlıklı çocuklarla karşılaştırıldığında, İBDM hastası çocuklar bazı aritmetik, okuma, ve yazma görevlerinde daha düşük performans göstermiştir. Hastalığa uyum, hastalık başlangıç yaşı, ve hastalık süresinin İBDM hastası çocuklarda bilişsel fonksiyonlar, öğrenme, ve davranışlara etkilerini incelemek için hiyerarşik çoklu regresyonlar uygulamıştır. Regresyon sonuçlarına göre İBDM ile alakalı değişkenlerin bilişsel fonksiyonlar, öğrenme veya davranışlar üzerinde anlamlı bir etkisi bulunmamıştır. Çalışmanın sonuçları mevcut literatür ışığında tartışılmıştır. Araştırmanın katkıları değerlendirilmiş ve ileride yapılabilecek araştırma konuları önerilmiştir.

Anahtar Kelimeler: Çocuklar, insülin bağımlı diyabet mellitus (İBDM), öğrenme zorlukları, bilişsel fonksiyonlar, davranış sorunları

To my loving and supportive family…

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CHAPTER 1

INTRODUCTION

Diabetes is a complex disease characterized by abnormally high and consistent sugar level in blood, which will affect several organs in the body, such as eyes, kidneys, and nerves; as well as affecting cognitive development and psychological well being (Leahy, 2000; Brisco, 1997). Diabetes is a chronic illness that occurs either because of factors that oppose the action of insulin hormone or because of the insufficient amount of insulin in the body that causes glucose not to be processed into energy and remain in the blood in high levels (Watkins, 2003, Brisco, 1997). Majority of IDDM cases are caused by the attack of immune system to insulin producing cells in the pancreas and this attack results in the destruction of these insulin producing cells.

The worldwide prevalence of diabetes was estimated to rise from 2.8% in 2000 to 4.4% in 2030 (Wild et al., 2004). The number of people who has diabetes was projected to rise to 366 million in 2030 from 171 million in 2000. According to the study of Wild et al. (2004), the greatest increases of diabetes prevalence worldwide will occur in Middle Eastern Crescent due to the increase in the population in this area. In Turkey, the prevalence of diabetes for all ages was estimated to rise from 4.4% in 2000 to 7.1% in 2030, approximately from 65,000 people to 90,000 people.

Diabetes is classified into two groups; insulin dependent diabetes mellitus (IDDM) and non-insulin dependent diabetes mellitus (NIDDM) (Masharani, MRCP, & Karam, 2004). The more prevalent form of diabetes, NIDDM, is most commonly associated with insulin resistance related to the impairment in compensatory secretion of insulin. NIDDM was previously called mature-onset diabetes mellitus as it used to occur in overweight middle-aged or elderly adults. However; in recent years, the number of obese children increased and this resulted in an increase in the prevalence of NIDDM in children. As compared to IDDM, NIDDM has higher prevalence rates (Hadley & Levine, 2007). In the United States, about 80% of 10 million diabetic people have NIDDM.

Insulin-dependent diabetes mellitus is the most common endocrine disease in children, with a peak incidence before school age and around puberty. The estimated incidence in childhood is 760,000 worldwide and 10,000 in Turkey (Wild et al., 2004). IDDM is a chronic disease, in which blood glucose concentration chronically rises due to the absolute or relative lack of insulin hormone (Williams & Pickup, 2004). In contrast to non-insulin-dependent diabetes mellitus, which is related to the reduced sensitivity to target tissues to the actions of insulin, insulin dependent diabetes mellitus is characterized by the lack of insulin production (Hadley & Levine, 2007). Hemoglobin A1c (HbA1c) is a unique hemoglobin molecule comprising %5 of the hemoglobin in red blood cell, and it is bound to a glucose molecule (Campaigne & Lampman, 1994). In diabetes patients, HbA1c may be 2 to 4 times higher than the normal levels, decreasing the oxygen transportation ability of the red cell.

In majority of cases, IDDM onset occurs around puberty (Nelson & Israel, 2003). However, the onset of IDDM may range beginning from infancy to early adulthood. Although the etiology of IDDM is still unknown, researchers suggested that genetics is one of the factors that is involved in IDDM occurrence.

IDDM is a disease with serious physical and psychological complications (Campaigne & Lampman, 1994). The life expectancy of the diabetes patients is two thirds of the individuals without diabetes. Of the 2 to 3 million people with IDDM in the United States, approximately 50% will die from renal disease and 20% will become blind. As a result of restrictions in their daily activities, majority of the IDDM patients with early onset experience psychosocial adjustment problems. In addition to these problems, researchers are concerned with the impairment of academic achievement, learning, and intellectual functioning in children with IDDM related to abnormal glycaemic activities in critical developmental periods (Rovet, Ehrlich, Czuchta, & Akler, 1993). This study aims to find out IDDM related learning difficulties, cognitive functioning impairments, and behavioral problems.

1.1 Metabolic Control in IDDM

Metabolic control is the achievement to maintain the blood glucose regulation in normal levels (Gross et al., 2001). The blood glucose level in bloodstream is assessed by HbA1c test, which measures the glycated hemoglobin in the blood. Physicians use HbA1c measures to see how well the patients control their blood glucose level in a long period of time (Hadley & Levine, 2007). The recommended level of HbA1c level is 4.5 - 6.0%. However, 60% of people with diabetes are not successful in meeting this goal

(Bloomgarden, 2006). The importance of metabolic control in IDDM treatment and the difficulties children experience in achieving near normal blood glucose regulation led researchers to investigate the variables related to metabolic control (Gross et al., 2001). Some factors that contributed to difficulties of adherence are inadequate knowledge, negative beliefs about following the regimen, poor social support, difficulty of maintaining lifestyle changes, and patient's relationship with the health care team (Gatchel & Oordt, 2003).

Hyperglycemia is the most common complication of IDDM (Masharani, MRCP, & Karam, 2004), and it is characterized by the increase in blood glucose concentration as a result of insufficient amount of insulin in blood (Watkins, 2003). Hyperglycemia may result in coma, destruction in some physiological processes, and death (Hadley & Levine, 2007). In case of severe hyperglycemia (blood glucose level greater than or equal to 250 mg/dl), it is suggested for the patients to do exercise until the blood glucose level decreases to the normal levels (Campaigne & Lampman, 1994).

Hypoglycemia is another limiting factor in achieving good metabolic control in diabetes management (Wagner, Grabert, & Holl, 2005), and it is characterized by decrease in the concentration of blood sugar (Schneeberg, 1970). Hypoglycemia occurs when the blood glucose concentration is 30 mg. or less per 100 ml. It may result from several factors such as delay in taking a meal, decrease in the dose of insulin, and physical exertion without needed supplemental calories (Masharani, MRCP, & Karam, 2004). Some symptoms of hypoglycemia are anxiety, confusion, irritability, sweating, headache, loss of consciousness, and difficulty in thinking (Schneeberg, 1970; Gatchel

& Oordt, 2003). Prolonged or severe hypoglycemia can result in reactive hyperglycemia, ketoacidosis, coma, permanent brain damage, and death.

In the hypoglycemic state, regulatory mechanisms get activated in order to correct hypoglycemia, causing an increase in the production of ketone bodies (Hadley & Levine, 2007). Ketoacidosis is an acute complication of IDDM that occurs when there is an increase in ketone bodies in the blood as the severe lack of insulin hormone (Watkins, 2003). Before the discovery of the insulin, the IDDM patients usually died as a result of ketoacidosis (Campaigne & Lampman, 1994). Today IDDM patients are still at risk of developing some specific complications of diabetes, and for this reason tight glucose control is needed to prevent these life threatening complications. Most common reason of ketoacidosis is the poor compliance as a result of either psychological reasons or inadequate education about diabetes (Masharani, MRCP, & Karam, 2004). As the ketoacidosis is a life-threatening medical emergency, counseling is needed in youngsters with IDDM in case of recurrent episodes of severe ketoacidosis.

Good metabolic control will lead to delay in complications of IDDM such as hyperglycemia, hypoglycemia, and ketoacidosis (Hinson, Raven, & Chew, 2007). As the insulin treatment is required for the patients with IDDM, the regular insulin injection is an important part of the metabolic control. In addition to the regular insulin injection, in order to maintain blood glucose in normal levels, IDDM patients should monitor their blood glucose regularly. IDDM patients have glucose monitors that can be easily used at home, work, and school in order to read their glucose level in blood from a finger-prick blood sample. Majority of IDDM patients should check their blood four to five times a day to take the necessary action when the glucose level is higher or lower than

recommended level. Testing the blood glucose regularly improves metabolic control and it leads to less long-term complications related to diabetes. In addition, patients can do exercise to regulate their blood sugar (Gatchel & Oordt, 2003). Exercise will improve insulin sensitivity, reduce body fat, and lower blood pressure as well as regulating the blood glucose level. Thus, recommended clinical management of IDDM includes the combination of diet, insulin, and exercise.

In several researches, poor metabolic control was suggested to be associated with longer illness duration and late age of onset (Ruggiero & Javorsky, 1999). There are also psychological and environmental factors that were suggested as risk factors in poor adherence to diabetes such as anxiety, depression, eating disorders, false beliefs about diabetes management, stress, parental anxiety, parents with poor coping skills, poor family relations, and overly critical parenting style.

Diabetes education is an important part of diabetes treatment, helping the newly diagnosed patients to understand the disease and its complications in order to minimize these complications (Gatchel & Oordt, 2003). Ruggiero and Javorsky (1999) suggested that as the cognitive and motor abilities of children become more advanced as the child grows up, the age-appropriate aspects of diabetes management should be taught to the children with IDDM in order to facilitate better self-care.

1.2 Learning Difficulties

Learning disabilities (LD) are defined by Learning Disabilities Association of America (LDA) as the neurologically based problems that has effect on basic psychological processes (“Learning disabilities,” n.d., para. 1). In children with LD,

basic skills such as writing, reading, and mathematics can be diminished as well as higher level skills like abstract reasoning and organization. The life time prevalence of reading disabilities among school-aged children in the United States is 9.7%, affecting 2.7 million children (Altarac & Saloha, 2007). According to the study of Erden, Kurdoğlu, & Uslu (2002), 10-20% of the Turkish children between 1st and 5th grade are diagnosed with LD.

Learning disabilities are diagnosed by using standardized achievement tests (Nelson & Israel, 2003). The performance in the achievement test is assessed relative to the age, intelligence, or education level of the person. For the diagnosis of LD, learning problems should significantly interfere with daily life or academic achievement.

American Psychiatric Association (2000) divided LD into three categories: developmental speech and language disorders, academic skills disorders, and other. The specific diagnoses in speech and language disorders category may be articulation disorder, expressive language disorder, or receptive language disorder. The most frequent use of the term "learning disability" by the professionals is for referring to the second category, academic skills disorders, including problems in writing, reading, and arithmetic (Nelson, & Israel, 2003). These subtypes of academic skills disorders are also known as "dysgraphia", "dyslexia", and "dyscalculia" respectively. Third category of LD might include problems in all three areas that significantly interfere with academic achievement. However, in this category the measured individual skills are not significantly below the expected levels.

As the majority of children with LD have reading disorder, it is the most investigated and well-understood learning disorder in the literature (Nelson & Israel, 2003). The Diagnostic and Statistical Manual of Mental Disorders – Revised (DSM-IV-TR; American Psychiatric Association, 2000) described reading difficulty as "reading achievement as measured by individually administered standardized tests of reading accuracy or comprehension is substantially below that expected given the person's chronological age, measured intelligence, and age-appropriate education" (p. 51). According to DSM-IV-TR, the disturbance in reading should significantly interfere with academic achievement or daily life activities in order to give the diagnosis of reading disorders. The main struggles of the children with reading disorder may be in recognition of the words or pronouncing them in the correct way, reading immoderately slowly, having limited vocabulary, not being able to understand the written material, or difficulty to remember the content of what they have read.

Estimated prevalence of reading disorder in the United States is 3-10% in school aged children (DSM-IV-TR; American Psychiatric Association, 2000). It is hard to estimate the prevalence more accurately as a result of inconsistency of the definitions and the co-occurrence of different types of LD.

The findings about gender differences in reading disability are also controversial (Liederman, Kantrowitz, & Flannery, 2005). Some researchers suggested that there is a selection bias in gender related researches that cause the boys to be more often identified with LD than the girls (Nelson & Israel, 2003). In a longitudinal study, children were divided into two groups by a method used to assess reading disability (Shaywitz, Shaywitz, Fletcher, & Escobar, 1990). The group of children who were diagnosed with

LD according to the teacher reports was called “school identified group.” On the other hand, children who were diagnosed with LD by the researchers were called “research identified group.” Results of this study showed that there were no gender differences between research identified girls and research identified boys in terms of the prevalence of reading disability. However, the prevalence of reading disability in school identified boys was significantly higher than school identified girls. Authors interpreted these different findings among two groups as a result of referral bias in school setting. In contrast; Liederman, Kantrowitz and Flannery (2005) stated that even after minimizing the ascertainment biases, the prevalence of reading disability among boys is higher than girls.

Reading skills can be separated into two main categories; reading accuracy and reading comprehension (Hulme & Snowling, 2009). Reading accuracy is assessed by asking the child to read a list of words aloud that are graded in difficulty from easy to hard. Reading accurately and fluently is very difficult for the children with dyslexia. In contrast with dyslexic children, children with reading comprehension impairment recognize the words accurately and read fluently. However, they experience difficulties in understanding the meaning of the passages they read. For the assessment of reading comprehension, children are given some questions about the passages after they are asked to read them either aloud or silently.

According to DSM-IV-TR (American Psychiatric Association, 2000), in writing disability “writing skills are substantially below those expected given the person’s age, measured intelligence, and age-appropriate education.” (pp. 54-55). In the development process of children with writing disability, the task of letter and word production on

paper goes in a slow and laborious way (Nelson & Israel, 2003). In addition, errors in spelling the word, misordered word placement, and poor construction of sentences are some other problems that may be seen in with writing disability. As the appropriate usage of the words and the construction of sentences are significant parts of the meaning creation, children with writing disability do not have adequate levels of skills in areas such as understanding the goal of writing, linking ideas, and developing a plan.

In a longitudinal study using a population-based birth cohort, the prevalence of written-language disorder was estimated between 6.9% and 14.7% in the United States (Katusic, Colligan,Weaver, & Barbaresi, 2009). Authors suggested that written-language disorder was as frequent as reading disorder in US population, and 2 to 3 times more frequent among boys compared to girls.

According to DSM-IV-TR (American Psychiatric Association, 2000), arithmetic disorder is "mathematical ability, as measured by individually administered standardized tests is substantially below that expected given the person's chronological age, measured intelligence, and age-appropriate education" (p. 53). Children of IQ level higher than average are mostly better at mathematic skills compared to children with lower IQ (Hulme & Snowling, 2009). However, good mathematic skills cannot be seen as the indicator of high IQ; in some cases children of very low IQ will have superior calculation skills. The problems that children with arithmetic disorder experience include difficulty in reading the numbers accurately, performing simple tasks of addition and subtraction, understanding the symbols and terms, and understanding the spatial organization (Nelson & Israel, 2003). The prevalence of arithmetic disorder was

estimated as one percent of school-aged children in the United States (American Psychiatric Association, 2000).

In summary, school-aged children are at high risk of being diagnosed with one or more subtypes of learning disability (Altarac & Saloha, 2007; Erden, Kurdoglu, & Uslu, 2002). One of the aims of the present study is to investigate the possible effects of IDDM in learning that may cause higher incidence of writing, reading, and arithmetic difficulties in children with IDDM as compared to the healthy children.

1.2.1 Learning Difficulties in Children with IDDM

IDDM is a chronic illness that affects neuropsychological functioning by influencing the central nervous system (Holmes, Cant, Fox, Lampert, & Greer, 1999). In relation with the impairment in central nervous system, academic achievement scores were stated to be lower for children with IDDM as compared to healthy children. Growing number of studies indicate disturbances in learning among children with diabetes mellitus (Holmes, O'Brien, & Greer, 1995). Poor metabolic control resulting in hypoglycemia or ketoacidosis is stated to be one of the main symptoms of diabetes that give rise to learning deficiencies. Relatedly, it was stated that significantly higher numbers of children with diabetes receive specialized classroom assistance and lower academic achievement scores compared to control groups (Holmes, O'Brien, & Greer, 1995).

In another research, the overall intellectual functioning of children with IDDM was not found to differ from the scores of the control group (Holmes et al., 1992). However, IDDM was stated to increase the risk of learning problems. Holmes et al.

(1992) suggested that learning difficulties were more common in children with IDDM (24%) as compared to the control group (13%). Altarac (2007) calculated the prevalence of learning disabilities in children with diabetes under the age of 18. The prevalence of learning disability among youth with diabetes was found 18.3%, compared to 9.7% prevalence of LD in healthy youth. Based on this finding, the author concluded that learning disabilities are likely to show co-morbidity with diabetes.

Age of onset was suggested to be one of the factors that affect learning in children with diabetes (Holmes, O'Brien, & Greer, 1995). Children with early onset IDDM are suggested to be at greater risk for learning difficulties compared to healthy children and children with late onset IDDM. Thus, the authors suggested early intervention programs or intensive preschool programming for children with early onset diabetes. In another study comparing the effects of late onset (>4 years) and early onset (<4 years) IDDM, higher rates of school difficulties were found among children with early onset IDDM (Rovet, Ehrlich, & Hoppe, 1988). In addition, early onset children were more likely to have special education compared to children with late onset and comparison group. Hagen et al. (1990) also concluded that as compared to the control group children with IDDM had more school related problems. Children with early onset diabetes were reported by their parents to have repeated a grade more than comparison group. Also, children with early onset IDDM were stated to have received remedial services more frequently than children with late onset diabetes mellitus and the control group. However, there were no differences between these three groups in school absence variable. Thus, the literature suggested that early onset IDDM is a higher risk factor for school related problems compared to the late onset IDDM.

In addition to the differences related to age of onset and disease duration, gender was stated to be another risk factor for learning difficulties (Holmes, O'Brien, & Greer, 1995). Compared to girls, boys with insulin-dependent diabetes mellitus were found to be at greater risk for learning difficulties.

According to Erkolahti and Ilonen (2005), the complications of diabetes mellitus can be rare in case of good metabolic control in adolescents. Adolescents who have good adaptation skills were stated to have less problems in learning, positive correlation was found between "mastery of the world" scores and school grades.

Ryan, Longstreet and Morrow (1985) examined the relationship between school absences and learning in adolescents with late onset IDDM. According to the research findings, adolescents with IDDM scored less well than their healthy peers on school achievement tests. In contrast to the explanations of cognitive impairment, the lower performance of adolescents with IDDM on measures of general knowledge such as reading, spelling, and arithmetic was explained by their relatively greater number of school absences. In addition, compatible with most of other researches, no significant difference were suggested in the overall intelligence scores of two groups.

1.3 Psychological Adjustment in Children with IDDM

Strict diets, frequent control of blood glucose, and rigidity of their lifestyle are some difficulties that individuals with IDDM have to cope with (Kanner, Hamrin, & Gray, 2003). For the children, living with a chronic disorder is an important stressor causing psychological adjustment problems, such as internalizing and externalizing problems (Holmes, Yu, & Frentz, 1999). However, there are few data concerning the

effect of IDDM on behavioral and emotional problems in children (Kanner, Hamrin, & Gray, 2003).

"Externalizing problems" are defined as the behaviors that are under-controlled and experienced externally (Phares, 2008), and it is used to define a broad spectrum of behavior problems (Hankin et al., 2005). Within this broad spectrum, there is a distinction between the aggressive, antisocial behaviors, such as conduct disorders and oppositional defiant disorder; and inattentive, impulsive symptoms, such as attention-deficit/hyperactivity disorder. However, as these symptoms can show co-morbidity, in some cases it is not possible to make this distinction.

Children with chronic physical illnesses are at risk of experiencing higher rates of psychological adjustment problems compared to physically healthy children (Wallender et al., 1988). In their research, Wallender et al. (1988) found that mothers perceived their chronically ill children as experiencing more behavioral and social competence problems as compared to the control group.

According to the DSM-IV-TR classification of behavioral problems first diagnosed in infancy, childhood, or adolescence; Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most prevalent diagnoses under the title of Attention-Deficit and Disruptive Behavior Disorders (American Psychiatric Association, 2000). In DSM-IV-TR, ADHD is defined as "a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequently displayed and more severe than is typically observed in individuals at a comparable level of development." Majority of individuals with ADHD have symptoms of both inattention and hyperactivity-

impulsivity. However; in some patients, one of these patterns is more dominant than the other. According to the predominance of the symptoms, there are three subtypes of ADHD; Combined Type, Predominantly Inattentive Type, and Predominantly Hyperactive-Impulsive Type.

As ADHD is a complex syndrome, there is still no agreement about its risk factors and etiology (Nigg & Nikolas, 2008). Researchers suggested that the genetic influence is substantial in development of ADHD. In addition to the genetic heritage, socialization was concluded by researchers as a mediator that results in failure to learn self regulation and cognitive control, which in turn ends up with symptoms of ADHD such as adaptation and regulation problems. In the United States, prevalence of ADHD was estimated to be between 3% and 7% in school-aged children (American Psychiatric Association, 2000). The frequency of ADHD in males is significantly higher than females, with ratios ranging from 2:1 to 9:1. Özcan, Eğri, Kutlu, Yakıncı, Karabiber, and Genç (1998) stated that the incidence rate of ADHD in Turkish children is 2.8%.

Children with attention-deficit may have problems in their academic or social situations as a result of failing to give attention to details, making careless mistakes, attending to trivial stimulus that are easily ignored by others, and frequently shifting from one incomplete activity to another (American Psychiatric Association, 2000). Some symptoms of hyperactivity are; fidgetiness in one's seat, not remaining seated when expected, excessive running or climbing in inappropriate circumstances, or problems in playing quietly in leisure activities. In impulsive children, behavioral problems such as not being able to delay responses, impatience, blurting out answers before the questions are complete, and interrupting others may be seen. As a result of

these behaviors, children with impulsivity often experience school problems and issues in their social environment.

Behavioral problems were defined by Hankin, Abela, Auerbach, McWhinnie, & Skitch (2005) as important law and norm violating behaviors. In DSM-IV-TR, behavioral problems diagnosed in childhood are included under the section of "disruptive behavior disorders" that include Conduct Disorder (CD) and Oppositional Defiant Disorder (ODD) (American Psychiatric Association, 2000). In a study, higher percentages of behavioral problems (14% in girls and 19% in boys) were found in children with IDDM compared to the control group (Holmes, Dunlap, Chen, & Conrwell, 1992).

Conduct Disorder (CD) is one of the most frequent psychiatric diagnoses in children (American Psychiatric Association, 2000). CD is a persistent pattern of behaviors that violate the basic rights of other individuals or age-appropriate societal norms. CD that occurs prior to age 10 was defined as childhood-onset type, and most individuals with Childhood-Onset Type CD are male. The rates of prevalence are between 1% and 10% in American population. Some major symptoms of childhood-onset type are disturbed relationship with peers, and frequent physical aggression toward other people. ADHD is seen in many children with CD. Compared to adolescent-onset type, CD that begins in childhood is more likely to turn into antisocial personality disorder (APD) in adulthood. Oppositional defiant disorder (ODD) is characterized by irritable, defiant, oppositional, and angry behaviors that are persistent and age inappropriate. Although ODD has some features similar to CD, individuals with ODD

do not violate the basic rights of others or societal norms. The impulsive behaviors and inattention in ADHD should be distinguished from oppositional behaviors.

Prosocial behavior is considered to be one of the most significant components of psychological adjustment in children (King et al., 2005). Researchers described prosocial behaviors as the voluntary behaviors that are beneficial to others such as sharing, comforting, and helping, and are not performed with the intention of having external reinforcement (Eisenberg, 1982). Studies showed that beginning from the age of 1½ - 2 years, children can perform behaviors that does not have extrinsic reinforcement that will be seen clearly. Development of prosocial behavior is influenced by some important factors such as cognitive development, socialization, and affective motivations. Researchers showed that there are no significant gender differences in prosocial actions. Social behavior influences the peer relationship and predicts acceptance in chronically ill children (Alderfer, Wiebe, & Hartmann, 2002). Among chronic illnesses, diabetes was found to have significantly higher negative impact on children's relationships with their peers. Thus, authors suggested that developing better social skills will be important in order to solve relationship issues in diabetic children. Contrary to the aggressive behaviors that hampers acceptance by others, the prosocial behaviors in chronically ill children were found to enhance social acceptance (Alderfer, Wiebe, & Hartmann, 2001). According to Al-Khurinej (2007), children with diabetes show strong prosocial behaviors, similar to the children without diabetes. In contrast, chronically ill children's perception of the impact of their illness to the aspects of their life such as daily routine and independence was found to have negative effect on social adjustment and peer relationships (Alderfer, Wiebe, & Hartmann, 2002).

In a study, emotional and behavioral problems of children with IDDM were compared with their siblings and peers using parent and teacher questionnaires (Gardner, 1998). As a conclusion, authors suggested that children with IDDM had significantly higher scores from parent questionnaires in subtests of conduct problems, anxiety, disorganization, and hyperactivity compared to their siblings but not peers. In teacher ratings, only hyperactivity subtest scores were significantly higher in children with diabetes compared to their peers.

In a longitudinal study, authors suggested that 37% of the adolescents with IDDM exhibited a broad range of psychological disorders such as anxiety disorders, eating disorders, and behavior disorders. According to the authors, there was continuity in psychological disorders, and the overall rate of the disorders in diabetic adolescents was heightened after 10 years of onset (Northam, Matthews, Anderson, Cameron, & Werther, 2004). In addition, researchers concluded that there was a relationship between poor metabolic control and behavioral problems.

In summary, children with IDDM were suggested to be at higher risk of emotional and behavioral problems compared to their peers (Gardner, 1998). Thus, one of the aims of the current study is to investigate the possible effects of IDDM in emotions and behaviors that may cause higher behavioral and emotional problems in children with IDDM as compared to physically healthy children.

1.3.1 Emotional and Behavioral Problems in Children with IDDM

"Internalizing problems" is a term that was defined as over-controlled feelings or behaviors that are experienced internally (Phares, 2008). Depression, and anxiety are the most common examples of internalizing problems.

Lewin, Storch, Silverstein, Baumeister, Strawser, and Geffken (2005) suggested that there is a significant correlation between having children with IDDM and parenting stress, which leads to increased child internalizing and externalizing problems. The internalizing problems were found to be strongly related to maternal anxiety.

Depressive symptoms in children were categorized into four main parts; problems with thoughts, feelings, behavior, and physiology (Miller, 1999). Depressive children will experience thoughts of being unworthy and being responsible for everyone's problems. Also the abilities of children to concentrate and think diminishes as a result of depression. Thoughts of suicide and death occur with or without a plan to kill themselves. Depressed mood, diminished interest in activities they typically enjoy, and irritability are some important symptoms to consider while diagnosing depression. Weight loss, weight gain, insomnia, hypersomnia, psychomotor retardation are some other symptoms of childhood depression.

Like most of the other chronic illnesses, diabetes mellitus is suggested as a risk factor for depression in children (Grey, Whittemore, & Tamborlane, 2002). However, the relationship between depression and diabetes mellitus is a largely unstudied subject. In a research, adaptation and metabolic control were stated to be negatively correlated with depression level in children with IDDM (Lernmark, 1998). In addition, Curtis and

Luby (2008) stated that as compared to their peers chronically ill preschoolers are at higher risks of developmental and mental implications related to depression. Compared to their healthy peers, children with diabetes were found to have two-fold greater depression prevalence (Grey, Whittemore, & Tamborlane, 2002). Parallel to these studies, Kanner, Hamrin, and Grey (2000) concluded that diabetes will strengthen the severity of psychological problems, especially depression.

Olvera et al. (2007) suggested that there is a significant relationship between depression and glycaemic control. High levels of HBA1c, which is the indicator of poor metabolic control, was found to be indicative of depressive symptoms in Latinos with IDDM. Researchers suggested early identification and intervention for depression in children with diabetes mellitus in order to maintain high levels of metabolic control and adaptation (Lernmark, 1998). Hypoglycemia experience can range from unpleasant to life-threatening, often resulting in emotional difficulties (Irvine, Cox, & Gonder-Frederick, 1992). The aversiveness of the hypoglycemic episodes mostly results in fear. In support of this view, worry and avoidance behaviors were found to be associated with psychological symptoms and perceived stress in diabetic children.

In the situations that individuals anticipate future danger, the mood of strong negative emotion and physical tension is defined as anxiety (Mash & Wolfe, 2002). Anxiety disorders are diagnosed in case of experiencing excessive and debilitating anxiety. According to DSM-IV-TR, the subtypes of anxiety disorders are specific phobias, social anxiety disorder, obsessive compulsive disorder, panic disorder, and posttraumatic stress disorder (American Psychiatric Association, 2000). These subtypes show high rates of comorbidity with each other. There is a high prevalence of anxiety

disorders among children and adolescents (Weems & Silverman, 2008). The short-term (3 months) prevalence of anxiety disorders was estimated between 2% and 4%, as the prevalence rates over 6 months of anxiety disorders were approximately between 10% and 20%. In researches conducted with children below age 12, the prevalence of "any anxiety disorders" varied widely between 2.6% and 41.2% (Cartwright-Hatton, McNicol, & Doubleday, 2006).

Kruse, Schmitz, and Thefeld (2003) showed the association of diabetes with increased risk for anxiety disorders. According to authors, careful evaluation is needed to examine the association between IDDM, glycaemic control, and psychological disorders. Vila, Robert, Jos, and Mouren-Simeoni (1997) assessed 57 diabetic children and adolescents with clinical interviews, and diagnosed the sample according to the criterion of DSM-III-TR. Authors suggested that emotional disorders were frequent among the sample of diabetic children and adolescents; 30 subjects diagnosed with an anxiety disorder, with highest frequency of phobias. In addition, 10 subjects were diagnosed with disruptive behavior disorder, and 7 had writing and reading disability. The subjects with psychological disorders had poor metabolic control. Similarly, Gelfand et al. (2004) conducted psychology consultation in outpatient pediatric diabetes services in order to evaluate psychological well-being of diabetic patients. According to the results of the study, nearly half of the diabetes patients were diagnosed with a psychological disorder such as ADHD, mood disorder, or anxiety.

Thus, there is evidence for higher levels of emotional and behavior problems in children with IDDM compared to healthy children. However, there is no study in Turkey yet related to emotional and behavioral problems of children with IDDM. Therefore, the

present study investigated the externalizing and internalizing problems of the children with IDDM.

1.4 Cognitive Functioning

"Cognitive functioning" is a broad definition that includes mental events and processes such as attention, recognition, memory, organization of knowledge, language, reasoning, and problem solving (Best, 1995). Several studies showed that children and adolescents with IDDM were at greater risk for cognitive impairment in various areas such as memory, attention, visual-spatial skills, speed of cognitive responding, and information processing (Holmes, et al. 1999; Rovet, Ehrlich, Czuchta, & Akler, 1993). However, there are no consistent findings related to the effects of IDDM on cognitive functioning and academic achievement in children.

Recent attempts were done to measure the speed of processing by reaction time tasks such as responding quickly to the onset of a stimulus and by inspection time tasks such as asking the subjects to make a decision in the existence of a visual stimulus (Anderson, 2005). As a conclusion of these studies, researchers suggested that the speed of information processing might be the basic element of general intelligence.

Many researchers stated various cognitive processes as the basis of intelligence (Anderson, 2005). "Intelligence" is the term that cognitive scientists and psychologists use to talk about the entire cognitive system. Other researchers suggested that intelligence involves feeling domain as well as cognitive domain (Sattler, 1983). A brief definition of intelligence is a fluid mental ability that is determined genetically and modified by experiences. The assessment of the independent contribution of heritage

and environment to the intelligence is a very difficult task. The heritability of intelligence was stated to be between 40% and 80% in European and North American Caucasian samples. Some environmental factors that were suggested to play important role in intelligence development were perinatal influences, birth weight, malnutrition, and familial factors. In addition, chronic illnesses were proposed to have negative effect on intellectual functioning (Skenazy & Bigler, 1985). However; majority of researchers suggested that children with diabetes had similar intellectual ability levels with their physically healthy siblings and peers (Hagen, 1990).

Short-term memory is the system between long-term memory and sensory memory, and it holds limited amount of information for a short period of time (Ashcraft, 2006). Digit span/memory span task is used to measure the short-term memory capacity (Reed, 2004). Memory span is described as the longest sequence that an individual can typically recall. For most of the adults, the average memory span is seven letters in a string. In order to retain the information for a long time period, the information should enter into the long term-memory, which is a more permanent store (Reed, 2004). Learning can only occur when the information is transferred from short-term memory to long-term memory.

Researchers suggested that diabetes related symptoms may cause memory deficits in IDDM patients (Weinger & Jacobson, 1998). Several studies were conducted to examine the affects of IDDM on short-term and long-term memory, including the comparison of rehearsal and recalling strategies in children with early onset IDDM, late onset IDDM, and comparison group (Wolters, Yu, Hagen, & Kail, 1996). According to

study results, children with late onset IDDM and physically healthy children had better short term memories compared to children with early onset IDDM.

One of the most studied cognitive functioning in children with IDDM that is suggested to be at risk of impairment is attention (Rovet, 1993). Attention involves selecting some information for processing, while inhibiting other information from receiving (Smith & Kosslyn, 2007). It is the mechanism of selecting the most significant information for processing, so it helps the individuals to cope with excessive information that they are exposed at any given moment. Impairment in this mechanism will cause some important problems such as failure in accomplishing real life goals, failure in solving problems, and not being sensitive to important external information that may be life-threatening. Some authors define attention as a resource that fuels the mental activity (Ashcraft, 2006), which shows the importance of attention in almost every part of cognitive functioning.

In the Dictionary of Psychology (Corsini, 2002), visual-spatial ability is defined as follows “the capacity and ability to comprehend and conceptualize visual representations and spatial relationships in learning and in performance of such tasks as reading maps, navigating mazes, conceptualizing objects in space from different perspectives, and various geometric operations.” Research results suggested the spatial ability as one of the main parts of intelligence (Rosser, 1994).

Another cognitive functioning that children with IDDM were stated to be at risk of experiencing difficulties is verbal ability (Rovet, 1993). Verbal ability is the capacity of using speech for effective communication (Corsini, 2002). Verbalization is a complex

process; the areas of the brain that are essential for normal speech should work simultaneously in order to form complete words and sentences. In a study comparing the cognitive functioning of children with IDDM and their siblings, increased exposure to hyperglycemia was associated with the decrease in verbal ability (Perantie et al., 2008). According to the longitudinal study of Schoenle, Schoenle, Molinari, and Largo (2002), a significant decline in verbal intelligence was found in boys with IDDM between ages 7 and 16 years. Authors suggested that this decline was associated with the onset of IDDM before age of 6 and gender, but not correlated with hypoglycemic episodes. Even though different predictors were suggested to be associated with verbal deficiencies, several studies showed the effect of IDDM on verbal abilities in children.

1.4.1 Cognitive Functioning in Children with IDDM

IDDM was suggested to have negative effect on cognitive functioning in children, especially in memory, attention span, information processing speed, and visual-spatial skills (Holmes et al., 1999). As a result of realizing the possible effect of metabolic abnormalities in brain functions, researchers began to investigate the cognitive functioning of children with chronic illnesses in recent years (Sansbury, Brown, & Meacham, 1997). The researches on cognitive functioning in children with IDDM mostly have focused on metabolic control, onset of IDDM, and IDDM duration.

In a study, researchers examined the relative contribution of age of onset, metabolic control, and duration of illness to the cognitive functioning of children with IDDM (Sansbury, Brown, Meacham, 1997). Instead of only assessing the global intellectual functioning, researchers examined various subtests of Wechsler Intelligence

Scale for Children-Revised (WISC-R), such as arithmetic, vocabulary, picture arrangement, and block design in order to evaluate children's learning, attention, and visual-spatial problems. This study shows that the overall intellectual functioning of children with IDDM was in normal ranges; however, the older children were found to encounter greater difficulty on majority of cognitive tasks compared to younger children. Having the disease for longer period of time was suggested to have negative effect on decision speed under conditions of response uncertainty compared to children with shorter duration of IDDM. In a comparison study of children with and without IDDM (Yu, Kail, Hagen, & Wolters, 2000), children with IDDM had lover scores on vocabulary subtest of WISC-III. Researchers also compared children with early (diagnosed at 5 years of age or younger) and late onset (diagnosed older than 5 years of age). Children with late onset of diabetes had lower scores on vocabulary subtest of WISC-III, which was suggested to be the result of frequent absences at school.

Memory is a complex cognitive functioning that requires different abilities such as perception, storing, and retrieval of information when necessary (Weinger & Jacobson, 1998). Wolters, Yu, Hagen, and Kail (1996) suggested that early onset of IDDM causes some problems in structural features of cognitive functioning in diabetic children, especially in short-term memory. Researchers suggested that children with and without IDDM used similar rehearsal strategies; however, children who have early onset IDDM had lower short-term memory scores of word recalling compared to the children with late onset IDDM and children without IDDM. In addition, better metabolic control was associated with using strategies that improve short-term memory. Although several researches showed the negative influence of IDDM on short-term memory, diabetes was

not found to interfere with retrieval from long-term memory (Weinger & Jacobson, 1998).

Glycaemic control is an important part of IDDM management (Weinger & Jacobson, 1998). Glucose fluctuations caused by chronic hypoglycemia and hyperglycemia may have long term effects and permanent detriments on brain development and cognitive functioning in children. Increased duration, early disease onset, and poor metabolic control were suggested to have negative effect on cognition in children.

Hagen et al. (1990) suggested that children with IDDM are in normal range on academic performance and intelligence; however, they are more likely to face deficiencies in information-processing, and encounter school difficulties compared to control group. Late onset group showed lower performance on vocabulary and information measured by WISC-R, and reading comprehension measured by the PIAT (Peabody Individual Achievement Test). Researchers stated that many children with late onset IDDM will be typified by the deficiency in the verbal area. In addition, early onset children were found to have less efficient use of strategies to organize and recall the information compared to late onset children, which was suggested to reflect cognitive deficiencies associated with use of control processes. Parents of children with early onset IDDM reported their children to have difficulty in completing tasks and poor attention spans.

In a research, children who developed IDDM before the age of 4 were found to be at greater risk for intellectual impairment (Rovet, Ehrlich, & Hoppe, 1988). Authors

suggested that early onset children are especially vulnerable to the effects of IDDM. In contrast to the research results of Hagen et al. (1990), in the research of Rovet et al. (1988), verbal skills of children with IDDM were lower than comparison group for both early and late onset. Poorer spatial ability was found in children with IDDM of shorter duration, earlier onset, and past history of hypoglycemic convulsions. Similarly, in a study that compared the intellectual functioning of physically healthy children with chronically ill children such as children with asthma, migraine, and diabetes showed that chronically ill children had lower scores in intelligence tests compared to their peers (Skenazy, & Bigler, 1985).

An explanation of cognitive deficiencies in children with IDDM is the interaction between onset of IDDM and specific stages of brain maturation (Rovet et al., 1988). In the first years of life, different rates of development and vulnerabilities occur in right and left hemispheres of the brain. Assuming that the verbal functioning is related to left hemisphere, and spatial skills are related to right hemisphere functioning; as the children are acquiring language between ages 2 and 4, the right hemisphere will be less active and so more vulnerable. Thus, children with early onset IDDM perform more poorly than children with late onset in spatial ability as hypoglycemia and hyperglycemia affects their right hemisphere.

In a research, parents of children with early onset IDDM (<5 years) reported more symptoms of inattention and more problems in task completion (Hagen et al., 1990). Two main reasons were suggested to explain the later cognitive problems in children with early onset IDDM (Wolters, Yu, & Kail, 1996). First, central nervous system may be affected by the fluctuations in hormone levels in early years of life, at or

before the critical developmental period. Second, as the young child is more likely to have poor metabolic control, more frequent or severe hyperglycemia or hypoglycemia may occur as a result of poor metabolic control. Not being able to describe or relate to the abnormal blood sugar levels to the parent may cause damage in central nervous system. In addition, children with early onset diabetes have longer duration of IDDM, causing higher probability of having severe hyperglycemia and hypoglycemia episodes.

Holmes et al. (1999) concluded that both chronic and acute metabolic abnormalities may cause poorer metabolic functioning in children with IDDM. According to the researchers, some risk factors such as poor metabolic control, early age of onset, and longer duration of diabetes were related to the lower IQ scores (Holmes, O'Brien, & Grier, 1995; Holmes et al., 1999). In addition, IDDM was stated to magnify the neurodevelopmental vulnerability of boys for learning problems; and thus the boys are more likely to experience IDDM related learning difficulties than the girls (Holmes et al., 1999).

Duration of illness is another important risk factor for learning difficulties in children with IDDM (Holmes, 1992). In their longitudinal study, Kovacs, Goldston, and Iyengar (1992) assessed children with IDDM over their first 6 years of diabetes. At the initial diagnosis, both verbal and non-verbal intellectual functioning levels of diabetic children were similar to their healthy peers. However, their verbal performance has declined over time.

Thus, there is evidence for higher risk of cognitive functioning problems in children with IDDM compared to their peers such as deficiencies in memory, attention

span, and spatial skills. Therefore, another aim of the current study is to investigate the possible effects of IDDM on cognitive functioning of children with IDDM as compared to physically healthy children.

There is lack of studies in Turkey that examine cognitive functioning, learning, and behaviors of children with IDDM. Several studies showed that children with IDDM are high risk group for impairments in these areas. Current study examined the effects of IDDM in children, as well as the factors that might be associated with impaired cognitive functioning, learning, and behaviors such as age of IDDM onset, duration of illness, and metabolic control.

1.5 Aim of the Study

The literature points out that there will be a link between IDDM and the learning difficulties, cognitive deficiencies, and behavioral problems in children. Thus, the aims of the current study are:

1. To examine the effect of IDDM on several dimensions of the cognitive functioning (i.e. memory, attention span, visual-spatial skill) in children.
2. To search for the association between late onset IDDM (>5 years) and the reading difficulties in children.
3. To investigate the relationship between late onset IDDM (>5 years) and the deficits in children's verbal ability.
4. To examine the association between early onset IDDM (<5 years) and arithmetic difficulties in children.

5. To search for the relationship between early onset IDDM (<5 years) and the deficits in children's cognitive functioning.
6. To investigate the association between longer duration of IDDM and the increased risk of cognitive functioning deficits in children.
7. To examine the link between longer duration of IDDM and the increased risk of learning problems in children.
8. To investigate the effects of IDDM on behavioral problems in children.
9. To examine the link between poor metabolic control and the increased risk for cognitive functioning deficits in children with IDDM.
10. To investigate the association between poor metabolic control and the increased risk for learning difficulties in children with IDDM.
11. To search for the relationship between poor metabolic control and the increased risk for behavioral problems in children with IDDM.

CHAPTER II

METHOD

2.1 Participants

For the study group, 69 children with Insulin Dependent Diabetes Mellitus who were out-patients in the Child Endocrinology Clinic of Atatürk Education and Research Hospital and Sami Ulus Child Hospital with ages ranging through 7 to 12 were recruited. In order to be accepted as a participant, the children should have received Insulin Dependent Diabetes Mellitus (IDDM) diagnosis by a child endocrinologist and should have continued their treatments of daily insulin shots. In addition, no other physiological or psychological diagnosis excluding IDDM that would have impact on learning, cognition, and behaviors of these children had to be present for participation to the study.

For the comparison group, 69 children with ages ranging through 7 to 12 were chosen for the study. The sample was selected from low socio-economic status (SES) districts of Ankara in order to match with the IDDM sample that was mostly with low SES. Like the study group, for these children to be accepted as participants they had to have no diagnosis of any kind of physiological or psychological disorders that would have effect on their learning, cognition, and behavior.

The full scale IQ scores of the children in both study group and comparison group were assessed by the Wechsler Intelligence Scale for Children-Revised (WISC-R). The inclusion criterion of having full scale IQ score above 70 was used to verify none of the participants had mental retardation.

For the IDDM group and the control group, a demographic form and a battery of tests were administered to the children and their parents. The categorical demographic variables, school related variables, and IDDM related variables are summarized in Table 3 and Table 4.

2.1.1 Children with IDDM

The children were elementary school students attending grades 1 through 5. There were 35 females (50.7%) and 34 males (49.3%) in IDDM group. The ages of the children with IDDM ranged between 7 and 12 with a mean of 9.43 (*SD* = 1.52). Fourteen point five percent (*n* = 10) of the children were 7 years old, 15.9% (*n* = 11) were 8 years, 17.4% (*n* = 12) were 9 years, 21.7% (*n* = 15) were 10 years, 24.6% (*n* = 17) were 11 years, and 5.8% (*n* = 4) were 12 years old. Fifteen point nine percent (*n* = 11) of the children were attending first grade, 15.9% (*n* = 11) were second grade, 15.9% (*n* = 11) were third grade, 24.6% (*n* = 17) were fourth grade, and 27.5% (*n* = 19) were attending fifth grade.

Two parents (2.9%) did not give information about how many children they had. According to the data collected from 67 parents (97.1%), only 11.6% children had no siblings (*n* = 8), and the rest 85.5% (*n* = 59) had at least one sibling. According to 98.6% parents (*n* = 68), who gave information about their marital status, 91.3% of the children

(*n* = 63) were living with both their father and mothers, whereas 7.3% of the children were living with a single parent (*n* = 5). Three children with single parents were living with their mothers, and two children were living with their fathers.

Parent evaluations indicated that the school achievement levels of 1.4% children (*n* = 1) were low, 2.9% (*n* = 2) were medium, 20.3% (*n* = 14) were high, and 37.7% (*n* = 26) were very high. Only 2.9% children (*n* = 2) repeated a grade, whereas 97.1% children (*n* = 67) never failed to pass to the next grade at school. According to parents' rating of course achievements, 44.9% of the children (*n* = 31) had low performance in math class, as well as 26.1% of the children (*n* = 18) in Turkish class, 13.0% (*n* = 9) in foreign language class, 13.0% (*n* = 9) in social studies class, and 2.9% (*n* = 2) in science class.

Three parents (4.3%) did not respond to the question about the number of their children's absent days at school. The absent days in a semester ranged from 0 to 40 days with a mean of 8.78 (*SD* = 7.95). According to the information received from 98.6% (*n* = 68), a family member or a person in the social environment helped 66.7% of the children (*n* = 46) with their studies, whereas 33.3% of the children (*n* = 23) did not get any assistance with their school works. With respect to the information provided by 98.6% (*n* = 68) of the parents, 66.1% of the children (*n* = 46) did not attend either kindergarten or nursery, 27.5% (*n* = 19) attended only nursery, 2.9% (*n* = 2) attended only kindergarten, and 1.4% (*n* = 1) attended both nursery and kindergarten.

None of the children with IDDM had comorbid psychological or physiological disorders that would have an effect on their cognitive functioning, learning, or behaviors.

Four point three percent parents (n = 3) did not respond to the question about adherence to their children's diabetic regimen. 5.8% children (n = 4) had no adherence to their diet, whereas 18.8% (n = 13) had low, 44.9% (n = 31) had moderate, and 30.4% (n = 21) had high adherence. In addition, according to the data collected from 94.2% parents (n = 65), 23.2% children (n = 16) did not work out, 31.9% (n = 22) worked out regularly, and 44.9% (n = 31) worked out occasionally in order to balance their blood pressure.

According to the information gathered from 98.6% (n = 68) of the parents, 52.2% of the children (n = 36) had late onset IDDM, while the children with early onset IDDM constituted 46.4% (n = 32) of the sample. While the age of onset ranged between 6 months and 11 years old with a mean of 5.78 (SD = 2.34); the duration of IDDM ranged between 1 and 10 years (M = 3.64, SD = 2.05).

According to the information received from 95.7% parents (n = 65), the number of insulin shots the children had ranged between 2 and 6 (M = 3.83, SD = 0.85). Seven point two percent of the parents (n = 5) did not provide information about the number of hypoglycemia, and 8.7% of the parents (n = 6) did not respond to the question about the number of hyperglycemia experienced by their child in a week. According to the report of 92.8% parents (n = 64), the frequency of hypoglycemia ranged between 1 and 7 times a week with a mean of 2.86 and standard deviation of 1.27. According to 91.3% parents

(*n* = 63), the frequency of hyperglycemia ranged between 0 and 8 times a week (*M* = 3.23, *SD* = 1.47).

The minimum, maximum, and average hemoglobin level data of 78.3% children (*n* = 54) were collected from the patient files at the hospitals. The mean of the minimum hemoglobin levels was 6.30 (*SD* = 1.00), the mean of the maximum hemoglobin levels was 10.80 (*SD* = 2.87), and the mean of the average hemoglobin levels was 8.12 (*SD* = 1.23). The hemoglobin levels of children varied between 3.5 and 19.7.

Forty nine point three percent of the children (*n* = 34) did not have any relatives with diabetes, whereas 50.7% children (*n* = 35) had one or more relatives being diagnosed with either type 1 or type 2 diabetes. Children who had more than one relatives with diabetes were 14.5% (*n* = 10). Only 1.4% of the children had a sister (*n* = 1), and 1.4% had a brother (*n* = 1) diagnosed with diabetes.

Seventy eight point three percent of the children (*n* = 54) were hospitalized before the interview, and 21.7% children (*n* = 15) did not have any hospitalization experiences. According to parents' reports, 61.1% (*n* = 33) of hospitalizations were related to the onset of IDDM. On the other hand, 20.3 % (*n* = 14) of the hospitalizations were related to the IDDM but not to the onset of the IDDM. Only 10.1% (*n* = 7) of the children were hospitalized for a reason other than IDDM.

Based on the WISC-R application, the mean full IQ scores of 69 children with IDDM was 97.00 (*SD* = 13.95). While the mean verbal IQ score was 95.26 (*SD* = 13.49), the mean performance IQ was 99.35 (*SD* = 14.30). Means and standard deviations of the tests and subtests are shown in Table 1.

Table 1 WISC-R Subtest Scores of Children with IDDM (*n* = 69)

Test/Subtest	Mean	*SD*
Information	7.43	2.8
Similarities	10.78	2.77
Arithmetic	9.06	3.10
Vocabulary	9.12	2.65
Comprehension	10.04	2.74
Digit Span	8.93	2.17
Picture Completion	10.09	2.67
Picture Arrangement	9.33	2.89
Block Design	10.33	2.66
Object Assembly	9.40	2.46
Digit Symbol	10.99	3.56
Verbal Score	95.26	13.49
Performance Score	99.35	14.20
Total Score	97.00	13.95

2.1.2 Parents of the Children with IDDM

Sixty three point eight percent (*n* = 44) of the parents that participated in the study were mothers, and 36.2% (*n* = 25) of the parents were fathers. The mean age of

the mothers of the children with IDDM was 39.84 (*SD* = 5.69), and the mean age of the fathers was 35.80 (*SD* = 6.79).

a. Education

One point four percent (*n* =1) of the fathers was illiterate, 1.4% (*n* = 1) was only literate, 43.5% (*n* = 30) were primary school graduates, 26.1% (*n* = 18) were secondary school graduates, 21.8% (*n* = 15) were high school graduates, and only 5.8% (*n* = 4) were university or 2-year college graduates. On the other hand, 7.2% of the mothers (*n* = 5) were illiterate, 2.9% (*n* = 2) were only literate, 65.3% (*n* = 45) were primary school graduates, 7.2% (*n* = 5) were secondary school graduates, 15.9% (*n* = 11) were high school graduates, and 1.4% (*n* = 1) was university or 2-year college graduate.

b. Job Status

Only 4.3% of the parents (*n* = 3) did not respond to the question about their working status. According to their responses, the working fathers of the children with IDDM constituted 92.8% (*n* = 63) of the sample, as the non-working fathers were only 4.3% (*n* = 3) of the sample. Two fathers, who did not work, were retired (2.9 %). Fifty five point one percent of the fathers (*n* = 38) were self-employed, 27.5% (*n* = 19) were laborer, and 5.8 % (*n* = 4) were governmental officials.

In contrast to the employment statuses of the fathers, most of the mothers of the children with IDDM were not working (*n* = 62, 89.9%). According to the information that was gathered from 98.6% of the participants (*n* = 68), only 8.7% were working

mothers (*n* = 6). Five point eight percent of the working mothers were self-employees (*n* = 4) and 2.9% were governmental officials (*n* = 2).

c. Economic Status

The economic statuses of the families of children with IDDM were as follows: 27.5% of the families (*n* =19) had monthly income of less than 500 Turkish Liras (TL), 53.6% (*n* =37) had income between 500 and 1000 TL, 7.2% (*n* = 5) earned between 1000 and 1500 TL, 1.4% (*n* = 1) earned between 1500 and 2000 TL, and 7.2% (*n* = 5) had income higher than 2000 TL.

2.1.3 Children without IDDM

The children in control group were also elementary school students attending grades 1 through 5. There were 42 females (60.9%) and 27 males (39.1%) in this group. Ages of the children without IDDM ranged from 7 to 12 with a mean of 9.35 (*SD* =1.55). 13% of the children (*n* = 9) were 7 years old, 23.2% (*n* = 16) were 8 years, 15.9% (*n* = 11) were 9 years, 20.3% (*n* =14) were 10 years, 18.8% (*n* = 13) were 11 years, and 8.7% (*n* = 6) were 12 years old. 13.0% (*n* = 9) of the children were attending the first grade, 21.7% (*n* = 15) were in the second grade, 20.3% (*n* = 14) were in the third grade, 17.4% (*n* = 12) were in the fourth grade, and 27.5% (*n* = 19) were attending fifth grade in an elementary school.

According to the report of 97.1% parents (*n* = 67), children with no siblings were 10.1% (*n* = 7) of the sample. The rest 87% (*n* = 60) of the children had one sibling or more. The children with single parents were 4.3% (*n* =3), whereas 92.8% (*n* = 64) were

living with both of their parents. Two children (66.7%) with single parents were living with their fathers, and one child (33.3%) with single parent was living with his/her mother.

School achievement data collected from 95.7% parents (n = 66). Results showed that the achievement levels of 2.9% children (n = 2) were low, 10.1% (n = 7) were average, 46.4% (n = 32) were high, and 36.2% (n = 25) were very high. Ninety seven point one percent of the parents (n = 67) provided information about repeating the grade at school. None of the children without IDDM were reported to repeat a grade. As rated by the parents, the course achievements were as follows: 37.7% of the children (n = 26) had low performance in math class, as well as 27.5% children (n = 19) in Turkish class, 11.6% (n = 8) in social studies class, 8.7% (n = 6) in science class, and 8.7% (n = 6) in foreign language class.

Information on school absenteeism of the children gathered from 94.2% parents (n = 65). Number of absent days at school in one semester ranged from 0 to 20 days with a mean of 3.6 (SD = 3.50). Seventy five point four percent of the parents (n = 52) answered the question related to the help their children get with their school works. Fifty three point six percent of the children (n = 37) got help with their studies from a family member or a person in the social environment, whereas 21.7% of the children (n = 15) did not get any help. Forty seven point eight percent of the children (n = 33) did not attend either kindergarten or nursery, 24.6% (n = 17) attended only nursery, 1.4% (n = 1) attended only kindergarten, and 1.4% (n = 1) attended both nursery and kindergarten.

According to the reports of 97.1% parents (*n* = 67), 2.9 % of the children (*n* = 2) in the control group previously diagnosed with a psychological disorder. However, parents stated that these children were not continuing to their treatments at the time study was conducted as they did not have the symptoms anymore. None of the children were stated to have a physical illness that might have effect on their cognitive functioning, learning difficulties, or behavioral problems.

WISC-R scores of 69 children in control group were as follows: the mean for the verbal IQ score was 101.46 (*SD* = 11.77); the mean of the performance IQ score was 103.33 (*SD* = 12.43), and the mean of full IQ score was 102.69 (*SD* = 12.42) (See Table 2).

2.1.4 Parents of the Children without IDDM

Two point nine percent of the parents (*n* = 2) did not state their gender in the demographic form. 62.3 % (*n* = 43) of the mothers participated in the study, and 34.8 % of the participants were fathers (*n* = 24). The mean age of mothers of children without IDDM was 35.70 (*SD* = 5.81). In addition, the mean age of fathers of children without IDDM was 39.52 (*SD* = 5.95).

a. Education

According to the reports of 94.2% (*n* = 65) of the participants, 1.4% of the fathers was illiterate (*n* = 1), 1.4% (*n* = 1) was only literate, 56.6% (*n* = 39) were primary school graduates, 8.7% (*n* = 6) were secondary school graduates, 15.9% (*n* = 11) were high school graduates, 10.2% (*n* = 7) were university or 2-year college

graduates. According to the information gathered from 97.1% parents (*n* = 67), 4.3% (*n* = 3) of the mothers were illiterate, 7.3% (*n* = 5) were only literate, 52.2% (*n* = 36) were primary school graduates, 15.9% (*n* = 11) were secondary school graduates, 14.5% (*n* = 10) of the parents graduated from high school, and 2.9% (*n* = 2) were university or 2-year college graduates.

Table 2 WISC-R Subtest Scores of Children without IDDM (*n* = 69)

Subtest	**Mean**	***SD***
Information	8.59	2.31
Similarities	12.39	2.36
Arithmetic	10.26	2.51
Comprehension	9.81	10.48
Digit Span	9.38	2.23
Picture Completion	10.58	2.21
Picture Arrangement	9.75	2.84
Block Design	10.70	2.92
Object Assembly	9.97	2.54
Digit Symbol	11.45	2.48
Verbal Score	101.46	11.77
Performance Score	103.20	12.26
Total Score	102.58	12.25

b. Job Status

According to the reports of 95.7 % of the parents (*n* = 66), 94.2% of the parents (*n* = 65) were working fathers. Only 1.4% (*n* = 1) of the fathers was not working as he was retired. Ninety two point eight percent (*n* = 64) of the parents indicated that 49.3% (*n* = 34) of the fathers were self-employed, 37.7% (*n* = 26) were laborer, 4.3% (*n* = 3) were government employees.

The working statuses of 5.8 % (*n* = 4) of the mothers were not indicated in the demographic forms. Similar to the IDDM sample, the mothers of the children without IDDM consisted highly of non-working mothers (84.1%, *n* = 58). Four point three percent (*n* = 3) of the working mothers were self-employees, 2.9% (*n* = 2) were laborers, and 2.9% (*n* = 2) were government employees.

c. Economic Status

According to the reports of 94.2% (*n* = 65) of the parents, the economic statuses of the families of children without IDDM were as follows: 21.7% of the families (*n* =15) had monthly income of less than 500 TL, 55.1% (*n* = 38) had an income between 500 and 1000 TL, 13% (*n* = 9) earned between 1000 and 1500 TL, and 4.3% (*n* = 3) had an income higher than 2000 TL.

Table 3 Comparisons of IDDM and Control Samples for Demographic and School Related Variables

Variable	IDDM Sample *N*	Control Sample *N*
Gender		
Female	35	42
Male	34	27
Age		
7	10	9
8	11	16
9	12	11
10	15	14
11	17	13
12	4	6
Grade		
1	11	9
2	11	15
3	11	17
4	17	12
5	19	19
Number of siblings		
No siblings	8	7
One or more sibling(s)	59	60
Parent's marital status		
Living with both parents	63	64
Living with one parent	5	3
Mother	3	1
Father	2	2
School Achievement		
Low	1	2
Average	2	7
High	14	32
Very high	26	25
Unsuccessful Class		
Mathematics	31	26
Turkish	18	19
Foreign language	9	6
Social studies	9	8
Science	2	6
Assistance with school work		
Do not receive assistance	23	15
Receive assistance	46	37
Gender		
Female	35	42
Male	34	27

Table 3 (Cont.) Summary Comparisons of IDDM and Control Sample Sizes for Demographic and School Related Variables

Variable	IDDM Sample *N*	Control Sample *N*
Kindergarten/nursery attendance		
None	46	33
Kindergarten	2	1
Nursery	19	17
Kindergarten and nursery	1	1
Education of mothers		
Illiterate	5	3
Literate	2	5
Primary school	45	36
Secondary school	5	11
High school	11	10
University	1	2
Education of fathers		
Illiterate	1	1
Literate	1	1
Primary school	30	39
Secondary school	18	6
High school	15	11
University	4	7
Working status of mothers		
Nonworking	62	56
Working	6	7
Working status of fathers		
Nonworking	3	1
Working	63	65

Table 4 Sample Sizes for IDDM Related Variables

Variable	*N*
Diabetic regiment adherence	
No adherence	4
Low	13
Moderate	31
High	21
Physical exercise	
No exercise	16
Occasional	31
Regular	22
Age of onset	
Early (<5 years)	32
Late (>5 years)	36
Hospitalization	
No hospitalization	15
One or more hospitalization(s)	54
Relatives	
Without diabetes	34
With diabetes	35

2.2 Measures

The Wechsler Intelligence Scale for Children-Revised (WISC-R) and the Specific Learning Disability Scale were administered to the children by the researcher. In addition, children completed the Children's Depression Inventory. Prior to test administration, the researcher interviewed with the children about their school achievements in order to confirm the information obtained from parents in the demographic form.

Parents were given a group of self-report questionnaires including demographic information form, and Strengths and Difficulties Questionnaire (SDQ). Parents of the

children with IDDM completed the questionnaires at the hospitals concurrently with their children, and the parents of the control sample completed the questionnaires at their homes.

2.2.1 Demographic Information Form

Demographic Information Form was used to obtain information about participants' demographic characteristics such as education of the parents, socio economic status of the family, and the number of siblings. In addition, the form contained questions on IDDM, psychological and physiological state, and school achievement of the children (See Appendix A).

2.2.2 Children's Depression Inventory

The assessment of children's depressive symptoms was conducted by using the Children's Depression Inventory (CDI). The CDI was developed by Kovacs (1980/1981) to assess the depression levels of the children between ages 6 and 17. CDI is a 27 item self-report inventory appraising cognitive, motivational, affective, and somatic depression symptoms that occurred in the previous two weeks (see Appendix B). Each item has 3 statements scored 0 through 2, as the scores get higher the level of depression symptoms increase. Scores will vary between 0 and 54. For the healthy children between ages 8 and 14, the mean of the normative data was 9.1 with a standard deviation of 7. The alpha coefficient of the test was found .86. The four-week test-retest reliability was .72.

CDI was adapted to Turkish population by Öy (1990). Three hundred and eighty children between 6 to 17 years-old participated for the reliability study. In the study, the one-week test-retest reliability coefficient was assessed to be .80. Fifty nine students were participated in construct validity research. According to DSM-III diagnostic criteria, the correct diagnosis ratio of the CDI was found 84.75 %.

The present study used CDI in order to measure the level of depressive symptoms among children with and without IDDM. The Cronbach Alpha coefficient of the inventory for the present sample was .79.

2.2.3 Strengths and Difficulties Questionnaire

The Strengths and Difficulties Questionnaire (Goodman, 1997) is a behavioral screening questionnaire designed to assess the prosocial behavior as well as the emotional and behavioral problems in children aged between 4 and 16. It consists of 25 positive and negative attributes, and has 5 subscales; namely emotional symptoms, conduct problems, hyperactivity-inattention, peer problems, and prosocial behavior. The questionnaire can be completed by the teachers, as well as the parents. The convergent validity of SDQ was assessed by Goodman and Scott (1999) by comparing the correlation coefficients of SDQ with Child Behavior Checklist (CBCL; Achenbach, 1991) which is a well-known and frequently used scale all over the world. As a result, SDQ was proven to be as efficient as CBCL in assessing the internalizing and the externalizing problems of the children (Goodman & Scott, 1999).

SDQ was adapted to Turkish culture by Eremsoy (2007) (See Appendix C). Turkish version of the scale also has 25 likert-type items. The original version measures

five dimensions of positive and negative attributes. However, in the adaptation study, the Cronbach alpha reliability of the peer problems subscale was found low in both parent and teacher scales. As a result of factor analysis, the inattention related items of the hyperactivity-inattention subscale was found to be under the same factor with behavioral problems. In addition, the peer problems factor was not occurred as a separate factor; the items under this subscale were distributed in other subscales. As a result, Turkish version of SDQ was found to measure 4 dimensions of positive and negative attributes: conduct problems/hyperactivity, prosocial behavior, emotional symptoms, and inattention problems. The internal consistency reliabilities of the subscales were found to be .72, .73, .68, .75, and .83 in SDQ-Mother form; and .89, .92, .81, and .91 for SDQ-Teacher form, respectively.

The current study used SDQ in order to assess the behavioral problems among children with and without IDDM. The Cronbach Alpha coefficient of the inventory for the present sample was .79.

2.2.4 Wechsler Intelligence Scale for Children – Revised (WISC-R)

The Wechsler Intelligence Scale for Children was developed by Wechsler (1974) to assess the intelligence quotient of the children and the adolescent ages between the ages of 6 and 16. The scale is administered individually by a trained health care professional. The administration of the scale takes approximately 60 to 70 minutes. The scale is divided into two parts, a verbal scale and a performance scale. Each scale has 5 core subtests and two supplemental subtests. The subtests that verbal scale includes are information, similarities, arithmetic, vocabulary, comprehension, and digit span that is a

supplement subscale. Performance scale includes other five subscales named as picture completion, picture arrangement, block design, object assembly, coding, and mazes, which is a supplement subscale.

The original scale standardization study sample included 2200 children with Caucasian and African-American heritage, ages ranging between 6 years 0 months and 16 years 11 months (Wechsler, 1974). The Spearman-Brown two-half split coefficients were found .94 for the verbal intelligence quotient (verbal IQ), .90 for the performance IQ, and .96 for the total IQ. The construct validity varied between .34 and .78 for the verbal scale, and between .38 and .74 for the performance scale.

WISC-R was adapted to Turkish culture by Savaşır and Şahin (1994). The norm study was conducted with 1638 children between the ages 6 years 0 months and 16 years 3 months. Spearman-Brown two-half split coefficients were .98 for the verbal intelligence quotient, .96 for the performance intelligence quotient, and .98 for the total intelligence quotient. The reliability coefficients of the object assembly and comprehension subscales were below .70, and the rest of the subscales were above .70. The construct validity coefficients between WISC-R subtests were varied between .51 and .86. The criterion validity was assessed with a sample of 124 children. The raw scores of the children were converted to the standard scores and the intelligence quotients using both the American and Turkish norms. This study showed no significant difference between two assessments of intelligence quotient.

WISC-R was used in the present study in order to assess the overall intelligence quotient of the children, as well as examining cognitive functioning and learning in children with and without IDDM.

2.2.5 Specific Learning Disability Scale

The Specific Learning Disability Scale is designed by Erden, Kurdoğlu, & Uslu (2002) to assess the learning disabilities in elementary school children between 1st and 5th grade (See Appendix D). The scale can be used to assess the difficulties a child experiences in wide range of areas. The scale includes the following tests and assessments; Ankara Reading and Reading Comprehension Test, writing test, writing alphabet letters, summation and multiplication table questions.

Ankara Reading/Reading Comprehension Test. The test was designed to assess the reading speed and reading comprehension skills of the elementary school children between 1st and 5th grades (Erden, Kurdoğlu, & Uslu, 2002). The test includes reading texts with varying difficulty levels for each grade. The reading texts were developed by the assistance of the experts in structure of the Turkish language. The number of the words each text consists of varies between 19 and 338. Following each text, there are 5 multiple-choice questions to assess the reading comprehension.

Reading abilities of the children are assessed with scoring the following mistakes: mixing rows in text, following the rows with finger, syllabification, adding letters to words, adding syllables to words, mixing letters, reverse reading, changing the word, skipping letter, skipping syllable, skipping word, and making up the word (Turgut, 2008). In addition, inability to read, reading time, number of words read in one minute,

total number of words read correctly, number of mistakes in one minute, and number of total mistakes are calculated in order to assess the reading ability in general. Ankara Reading/Reading Comprehension Test was administered in the present study in order to assess the reading skills of the children with and without IDDM.

Writing Test. This test was developed and standardized by Erden, Kurdoğlu, and Uslu (2002) to assess the writing abilities of the elementary school children. The opinions of the experts were asked to develop grade-appropriate sentences that are easily understandable. It original test consists of 3 sentences that include some letters more frequently (i.e. p-b-d-t-m-n-v-f) that are suggested to be easily mixed by children with learning disabilities. Researchers added 3 more sentences to the test in order to evaluate writing ability more efficiently. Children are given 3 sentences verbally to assess their ability to write down the sentences they heard. Other half of the sentences are given in a written text in order to evaluate their ability to write the words they see.

Writing test includes scoring of the following mistakes: skipping letters, skipping syllables, adding letters, adding syllables, adding words, mixing capital and small letters (Erden, Kurdoğlu, & Uslu, 2002). In addition, the scores of slow writing, inability to write, and punctuation mistakes are calculated. In the present study writing test was administered in order to assess the difficulties in writing in children with and without IDDM.

Writing Alphabet Letters. The test includes writing 29 letters of the alphabet in the right order and with small letters (Turgut, 2008). It assesses the ordering abilities of the children that was suggested to be one of the LD symptoms, as well as assessing the

number of letters they write correctly. Standardization study of the test is still in progress. This test was used in the current study to examine the ordering skills and learning abilities of the children with and without IDDM.

Summation and Multiplication Table Questions. The test assesses the difficulties in arithmetic skills that are seen in children with LD (Turgut, 2008). The questions were developed according to Ministry of Education curriculum and teachers' opinions to be appropriate for the grades between 1 and 5. The summation and multiplication operations were asked to the child verbally to assess the difficulties in writing the numbers correctly. There are five summation questions for each grade, and each correct answer is scored 1 point. The multiplication table questions are asked to 3rd grade, 4th grade, and 5th grade children. Multiplication table questions bases 2, 3, 4, and 5 are asked to children in third grade. For children in fourth and fifth grades, test includes multiplications bases 2, 3, 4, 5, 6, 7, 8, and 9. The validity and reliability studies of the tests are still in progress. In current study, summation and multiplication questions were used to assess arithmetic ability of the children with and without IDDM.

2.3 Procedure

Permission was taken from Ankara Directorship of Health for the administration of the questionnaires to the children with IDDM and their parents. Written informed consent was taken from ethical committees of the hospitals. Parents of the children with and without IDDM signed an informed consent form before participating in the study. Confidentiality was assured. The parents of children in the control group received all the questionnaires and the demographic form in a file folder, and they sealed the folders

before returning them with their children. The parents of children with IDDM were handed the questionnaires and the demographic form to fill out while their children were administered the questionnaires at the hospitals.

The children in both IDDM group and control group were assessed by the researcher in a private room using WISC-R, Specific Learning Disability Scale, and Child's Depression Inventory. Information, comprehension, arithmetic, similarities, and digit span subscales of WISC-R were administrated to assess the verbal IQ, and picture completion, picture arrangement, block design, object assembly, and coding subscales were administered to assess the performance IQ, which are the subscales mainly used by the psychologists at child psychiatry clinics to estimate the verbal, performance, and total intelligence quotients of the clients. For a better assessment of verbal learning difficulties in children, vocabulary subscale of WISC-R was administrated in addition to the subscales mentioned above. The approximate time to complete all the assessments was between 2 hours 30 minutes and 3 hours for each child.

2.4 Statistical Analysis

In the present study, the variables were examined through SPSS programs for accuracy of data entry, missing values, and the multivariate analysis. Before conducting descriptive statistics, correlations, t-tests, analyses of variance (ANOVAs) and hierarchical regressions, missing variables were replaced with the means of the sample in order to conduct more accurate analyses.

CHAPTER III

RESULTS

This chapter was presented in different sections. In the first section descriptive statistics of the variables are presented. The second section includes correlations among the variables. In the third section, one-way ANOVA results are summarized. And in the last section, results of to hierarchical regression analyses are presented.

3.1 Descriptive Analyses of the Variables of the Study

Descriptive statistics of the all variables included in the present study were presented separately for the children with IDDM in Table 5, and children without IDDM in Table 6.

3.2 Bivariate Correlations among Variables

Bivariate correlation coefficients among school-related variables (i.e. school performance, number of absent days at school, receiving assistance with school work, attendance to kindergarten and/or nursery), scores of the questionnaires (WISC-R, SDQ, CDI, Specific Learning Disability Scale), and insulin-related variables (i.e. blood glucose level, adherence, average hemoglobin levels, diabetes onset, diabetes duration, physical exercise) are presented in Table 7 and Table 8.

Table 5 Means, and Standard Deviations of the Variables in IDDM Sample

Variables	*N*	Mean	*SD*	Min-Max
Age of parent	66	37.14	7.18	23-53
Number of children	67	2.58	1.17	1-7
Age of child	69	9.43	1.52	7-12
Grade of child	69	3.32	1.44	1-5
Repeating grade	69	.03	.17	0-1
Absence at school	66	8.77	8.13	0-40
Age of onset	68	5.77	2.36	5-11
Blood glucose control	68	4.43	1.41	2-10
Frequency of insulin shots	65	3.89	.71	2-6
Hypoglycemia	64	2.86	1.27	1-7
Hyperglycemia	63	3.25	1.53	0-8
Duration	68	3.64	2.05	1-10
Hemoglobin average	54	8.12	1.23	6.3-11.4
SDQ total	69	12.17	6.40	2-30
CDI total	69	9.46	5.93	1-30
WISC-R information	69	7.43	2.80	1-15
WISC_R similarities	69	20.78	2.77	5-16
WISC_R arithmetic	69	9.06	3.10	1-16
WISC-R vocabulary	69	9.12	2.65	3-15
WISC-R comprehension	69	10.04	2.74	2-16
WISC-R digit span	69	8.93	2.17	5-14
WISC-R picture completion	69	10.09	2.67	3-15
WISC-R picture arrangement	69	9.33	2.89	2-16
WISC-R block design	69	10.33	2.66	6-17
WISC-R object assembly	69	9.40	2.46	6-15
WISC-R digit symbol	69	10.99	3.56	4-24
WISC-R verbal score	69	95.26	13.49	67-126
WISC-R performance score	69	99.35	14.30	72-133
WISC-R total score	69	97.00	13.95	70-130
Summation	67	4.21	1.18	0-5
Multiplication for basis two	51	4.47	1.38	0-5
Multiplication for basis three	51	4.18	1.57	0-5
Multiplication for basis four	51	3.88	1.71	0-5
Multiplication for basis five	51	3.75	1.87	0-5
Multiplication for basis six	33	3.85	1.64	0-5
Multiplication for basis seven	32	3.16	1.80	0-5
Multiplication for basis eight	32	3.16	1.82	0-5
Multiplication for basis nine	32	2.81	1.73	0-5
Mixing rows in reading	65	.17	.38	0-1
Following with finger	65	.26	.44	0-1
Syllabification in reading	65	.42	.50	0-1
Adding letter in reading	65	.62	.86	0-4

Adding syllable in reading	65	.75	1.03	0-5
Adding word in reading	65	.12	.42	0-2
Mixing letter in reading	65	.66	.97	0-4
Reverse reading	65	.05	.37	0-3
Changing the word in reading	65	1.22	1.98	0-13
Skipping letter in reading	65	.94	1.26	0-6
Skipping syllable in reading	65	1.75	1.99	0-10
Skipping word in reading	65	.40	.73	0-3
Making up the word in reading	65	1.63	1.83	0-6
Inability to read	65	.02	.12	0-1
Reading time	64	209.75	85.21	73-426
Words read in one minute	65	76.46	29.15	73-426
Correct words read in one minute	63	73.02	29.59	17-131
Mistakes in reading in one minute	65	2.63	2.07	0-10
Number of mistakes in reading	65	8.23	6.80	0-30
Reading text questions	65	3.63	1.14	1-5
Number of written alphabet letters	59	19.47	9.60	2-29
Mixing sequence of alphabet letters	59	1.14	2.93	0-18
Mixing capital and small alphabet letters	59	.86	2.02	0-12
Inability to write alphabet letters	59	.07	.25	0-1
Skipping letter in writing	64	.73	1.58	0-7
Skipping syllable in writing	64	.19	.50	0-3
Skipping word in writing	64	.17	.61	0-4
Reverse writing	64	.11	.48	0-3
Mixing letter in writing	64	2.83	4.01	0-19
Combining words in writing	64	.52	2.33	0-17
Splitting syllables in writing	64	.11	.40	0-2
Adding letter in writing	64	.52	1.61	0-12
Adding syllable in writing	64	.06	.24	0-1
Adding word in writing	64	.02	.13	0-1
Punctuation mistakes	64	1.53	1.55	2-16
Slow writing	64	.03	.18	0-1
Mixing capital and small words in writing	64	2.16	4.41	0-25
Inability to write	64	.08	.63	0-5

Table 6 Means, and Standard Deviations of the Variables in Control Sample

Variables	*N*	Mean	*SD*	Min-Max
Age of parent	66	36.6	5.93	27-52
Number of children	67	2.81	2.20	0-14
Age of child	69	9.35	1.56	7-12
Grade of child	69	3.25	1.41	1-5
Repeating grade	67	.03	.24	0-2
Absence at school	65	3.60	3.50	0-20
SDQ total	69	11.85	5.97	1-34
CDI total	69	8.80	5.79	1-26
WISC-R information	69	8.59	2.32	2-12
WISC_R similarities	69	12.39	2.36	5-17
WISC_R arithmetic	69	10.26	2.51	5-15
WISC-R vocabulary	69	9.81	2.64	4-17
WISC-R comprehension	69	10.48	2.41	6-18
WISC-R digit span	69	9.38	2.23	6-16
WISC-R picture completion	69	10.58	2.21	6-18
WISC-R picture arrangement	69	9.75	2.84	3-16
WISC-R block design	69	10.70	2.92	5-19
WISC-R object assembly	69	9.97	2.54	4-17
WISC-R digit symbol	69	11.45	2.45	6-16
WISC-R verbal score	69	101.46	11.77	74-123
WISC-R performance score	69	103.20	12.26	79-131
WISC-R total score	69	102.58	12.54	80-129
Summation	68	4.31	1.23	0-5
Multiplication for basis two	59	4.92	.34	3-5
Multiplication for basis three	59	4.73	.94	0-5
Multiplication for basis four	59	4.71	.89	0-5
Multiplication for basis five	59	4.80	.78	0-5
Multiplication for basis six	30	4.73	.74	2-5
Multiplication for basis seven	30	4.23	1.22	0-5
Multiplication for basis eight	30	4.33	1.27	0-5
Multiplication for basis nine	30	4.30	1.09	1-5
Mixing rows in reading	66	.11	.31	0-1
Following with finger	66	.20	.40	0-1
Syllabification in reading	66	.23	.42	0-1
Adding letter in reading	66	.33	.81	0-5
Adding syllable in reading	66	.61	.84	0-4
Adding word in reading	66	.05	.27	0-2
Mixing letter in reading	66	.71	1.25	0-8
Reverse reading	66	.02	.12	0-1
Changing the word in reading	66	.39	.84	0-4
Skipping letter in reading	66	.55	.88	0-4
Skipping syllable in reading	66	1.02	1.51	0-6
Skipping word in reading	66	.26	.73	0-5

Making up the word in reading	66	.88	1.13	0-6
Inability to read	66	.02	.12	0-1
Reading time	67	173.31	77.50	60-346
Words read in one minute	65	84.32	23.54	30-148
Correct words read in one minute	65	82.66	23.57	30-147
Mistakes in reading in one minute	67	1.61	1.82	0-9
Number of mistakes in reading	67	4.75	4.73	0-28
Reading text questions	66	3.71	1.27	1-10
Number of written alphabet letters	65	24.02	7.81	1-29
Mixing sequence of alphabet letters	65	.46	1.34	0-7
Mixing capital and small alphabet letters	65	.52	1.09	0-6
Inability to write alphabet letters	65	.11	.36	0-1
Skipping letter in writing	68	.21	.41	0-1
Skipping syllable in writing	68	.15	.36	0-1
Skipping word in writing	68	.22	.54	0-2
Reverse writing	68	.00	.00	0-0
Mixing letter in writing	68	1.22	1.31	0-7
Combining words in writing	68	.12	.37	0-2
Splitting syllables in writing	68	.01	.12	0-1
Adding letter in writing	68	.16	.41	0-2
Adding syllable in writing	68	.10	.31	0-1
Adding word in writing	68	.04	.21	0-1
Punctuation mistakes	68	.63	.99	0-4
Slow writing	68	.00	.00	0-0
Mixing capital and small words in writing	68	.74	.99	0-3
Inability to write	68	.19	1.58	0-13

Table 7 Pearson Correlations of the School Related Variables, IDDM Related Variables, SDQ total, CDI total, WISC-R scores, and Specific Learning Disability Test Scores in IDDM Sample

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. School achievement		-.29**	.12	.04	.04	.01	.05	-.11	.35**	-.18	-.35**	-.12	.33**
2. Absence			-.11	.01	.13	-.62	.09	.13	-.15	.17	.17	.08	.16
3. School work assistance				.14	-.13	.06	.05	-.32*	.12	-.10	-.02	-.15	.01
4. Kindergarten/nursery					-.05	.13	.01	-.12	-.01	-.10	.05	.10	.02
5. Physical activity						-.07	.22	.07	-.12	.05	.04	.23	-.02
6. Age of onset							.42**	-.14	-.12	-.13	.05	-.78**	-.02
7. Insulin shot frequency								-.17	-.22	-.03	.19	-.37**	.03
8. Average hemoglobin									-.05	.07	-.01	.23	-.11
9. Adherence										-.16	-.32**	-.04	-.45**
10. Hypoglycemia number											.43**	.06	.28*
11. Hyperglycemia number												.14	.18
12. Duration													.08
13. SDQ total													
14. CDI total													
15. WISC-R information													
16. WISC-R similarities													
17. WISC-R arithmetic													
18. WISC-R vocabulary													
19. WISC-R comprehension													
20. WISC-R digit span													
21. WISC-R picture completion													
22. WISC-R block design													
23. WISC-R object assembly													
24. WISC-R digit symbol													
25. WISC-R verbal													
26. WISC-R performance													
27. WISC-R total													
28. Summation													
29. Reading time													
30. Mistakes in reading													
31. Written alphabet letters													
32. Mixing letters													
33. Reverse letters													

Table 7 (Cont.) Pearson Correlations of the School Related Variables, IDDM Related Variables, SDQ total, CDI total, WISC-R scores, and Specific Learning Disability Test Scores in IDDM Sample

Variables	14	15	16	17	18	19	20	21	22	23
1. School achievement	-.17	.36**	.38**	.38*	.33**	.06	.18	.28*	.26*	.28*
2. Absence	.12	-.18	-.18	-.18	-.07	-.13	-.00	-.06	-.16	-.14
3. School work assistance	-.11	.14	.17	.14	.18	.14	.31**	.26*	-.03	-.13
4. Kindergarten/nursery	-.11	.06	.12	.03	.11	.05	.04	.02	-.07	-.03
5. Physical activity	-.01	-.05	.34**	.14	.08	.13	.20	-.07	.22	.03
6. Age of onset	.02	.04	.12	-.05	-.14	-.07	-.02	-.03	.07	.25*
7. Insulin shot frequency	.02	.05	.18	-.01	-.03	.12	.06	-.01	.08	.03
8. Average hemoglobin	-.11	-.24	-.30*	-.06	-.17	.06	-.30*	-.04	-.06	-.04
9. Adherence	-.33**	.08	.09	.15	.12	.20	.09	.10	.11	.20
10. Hypoglycemia number	-.04	-.21	-.25	-.21	-.33**	-.29	-.18	-.04	-.03	.05
11. Hyperglycemia number	.06	-.33**	-.28*	-.38**	-.29*	-.14	-.25*	.01	-.06	-.11
12. Duration	-.05	-.28*	-.13	.03	-.02	.02	-.03	.02	-.09	-.29*
13. SDQ total	.23	-.15	-.11	-.14	-.11	-.10	-.09	-.17	-.02	-.16
14. CDI total		-.04	-.07	-.29*	-.09	-.07	-.09	-.03	.01	-.21
15. WISC-R information			.61**	.46**	.66**	.43**	.36**	.46**	.40**	.58**
16. WISC-R similarities				.42**	.63**	.52**	.42**	.37**	.36**	.40**
17. WISC-R arithmetic					.61**	.40**	.57**	.34**	.29**	.38**
18. WISC-R vocabulary						.57**	.47**	.42**	.36**	.46**
19. WISC-R comprehension							.30*	.44**	.27*	.39**
20. WISC-R digit span								.21	.26*	.30*
21. WISC-R picture completion									.35**	.58**
22. WISC-R block design										.50**
23. WISC-R object assembly										
24. WISC-R digit symbol										
25. WISC-R verbal										
26. WISC-R performance										
27. WISC-R total										
28. Summation										
29. Reading time										
30. Mistakes in reading										
31. Written alphabet letters										
32. Mixing letters										
33. Reverse letters										

Table 7 (Cont.) Pearson Correlations of the School Related Variables, IDDM Related Variables, SDQ total, CDI total, WISC-R scores, and Specific Learning Disability Test Scores in IDDM Sample

Variables	24	25	26	27	28	29	30	31	32	33	34
1. School achievement	.08	.27*	.39**	.34**	.39**	.15	-.44*	-.28*	.42**	-.22	-.19
2. Absence	-.15	.01	-.18	-.11	-.15	.04	.10	.14	-.11	-.07	-.09
3. School work assistance	.06	.05	-.32*	.12	.22	.03	.06	-.04	-.00	-.04	.08
4. Kindergarten/nursery	.13	.01	.07	.02	.05	-.05	-.19	-.14	.06	-.09	-.09
5. Physical activity	-.20	.17	.21	.04	.13	.18	-.14	-.05	.25	.04	-.08
6. Age of onset	.14	.03	.01	.18	.10	-.01	.04	.03	.28*	-.35**	.23
7. Insulin shot frequency	.12	.31*	.11	.15	.14	.05	-.14	.11	.08	-.20	.05
8. Average hemoglobin	-.11	-.04	-.20	-.08	-.15	.11	.01	.12	.04	.00	-.22
9. Adherence	.04	.06	.16	.14	.15	.15	-.24	-.00	.06	.04	.05
10. Hypoglycemia number	.05	-.17	-.28*	-.07	-.20	-.01	.27*	.20	-.32*	.27*	-.03
11. Hyperglycemia number	.10	-.12	-.36**	-.06	-.23	-.15	.25	.20	-.28*	.28*	-.03
12. Duration	-.28*	-.04	-.11	-.22	-.17	.07	.09	.04	.06	.15	-.19
13. SDQ total	-.07	-.15	-.16	-.13	-.16	-.03	.29*	-.06	-.25	-.09	-.04
14. CDI total	-.22	.01	-.14	-.11	-.13	-.16	-.01	-.04	-.15	-.06	.08
15. WISC-R information	.45**	.34**	.77**	.63**	.77**	-.01	-.26*	-.34**	.20	-.19	-.14
16. WISC-R similarities	.31*	.49**	.80**	.53**	.72**	.13	-.23	-.31*	.43**	-.22	-.06
17. WISC-R arithmetic	.23	.38**	.75**	.48**	.67**	.36**	-.26*	-.34**	.38**	-.19	-.16
18. WISC-R vocabulary	.39**	.44**	.78**	.55**	.73**	.16	-.27*	-.40**	.21	.06	-.19
19. WISC-R comprehension	.30*	.39**	.69**	.47**	.64**	.30*	-.15	-.26*	.17	.01	-.21
20. WISC-R digit span	.27*	.29*	.67**	.42**	.59**	.39**	-.11	-.29*	.31*	-.18	-.09
21. WISC-R picture completion	.48**	.33**	.52**	.77**	.71**	.13	-.08	-.06	.22	-.13	-.26*
22. WISC-R block design	.39**	.31**	.43**	.72**	.62**	.24	-.07	.06	.12	-.11	-.11
23. WISC-R object assembly	.48**	.29*	.56**	.77**	.72**	.29*	.00	-.13	.32*	-.15	-.13
24. WISC-R digit symbol		.17	.43**	.72**	.63**	.17	.05	-.05	.08	-.02	-.17
25. WISC-R verbal			.49**	.52**	.55**	.28*	-.28*	-.15	.29*	-.03	-.23
26. WISC-R performance				.69**	.92**	.26*	-.26*	-.40**	.38**	-.22	-.19
27. WISC-R total					.91**	.31*	-.08	-.11	.30**	-.22	-.27*
28. Summation						.31*	-.18	-.27*	.37**	-.23	-.24
29. Reading time							-.12	-.05	.32*	-.12	-.32*
30. Mistakes in reading								.39**	-.36**	.20	.06
31. Written alphabet letters									-.30*	.07	.41**
32. Mixing letters										-.50**	-.06
33. Reverse letters											.01

Table 8 Pearson Correlations of the School Related Variables, IDDM Related Variables, SDQ total, CDI total, WISC-R scores, and Specific Learning Disability Test Scores in Control Sample

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. School achievement		-.04	.22	-.03	-.33**	-.12	.28	.22	.24	.23	.26*	.22	.18
2. Absence			-.04	-.13	.03	-.18	-.08	-.04	.01	-.01	.22	.13	.03
3. School work assistance				.02	-.28*	-.26	.16	.16	.11	.10	.35	.19	.04
4. Kindergarten/nursery					.30*	-.05	-.05	.00	.01	.14	.07	-.08	-.00
5. SDQ total						.30*	-.02	.04	-.18	.06	.01	-.16	-.03
6. CDI total							.24*	.30*	-.03	.05	.06	.05	.23
7. WISC-R information								.56**	.63**	.54**	.40**	.50**	.37**
8. WISC-R similarities									.30*	.42**	.43**	.38**	.45**
9. WISC-R arithmetic										.42**	.19	.52**	.23
10. WISC-R vocabulary											.62**	.45**	.43**
11. WISC-R comprehension												.36**	.41**
12. WISC-R digit span													.21
13. WISC-R picture completion													
14. WISC-R block design													
15. WISC-R object assembly													
16. WISC-R digit symbol													
17. WISC-R verbal													
18. WISC-R performance													
19. WISC-R total													
20. Summation													
21. Reading time													
22. Mistakes in reading													
23. Written alphabet letters													
24. Mixing letters													

Table 8 (Cont.) Pearson Correlations of the School Related Variables, IDDM Related Variables, SDQ total, CDI total, WISC-R scores, and Specific Learning Disability Test Scores in Control Sample

Variables	14	15	16	17	18	19	20	21	22	23	24	25
1. School achievement	.04	.16	.16	.33**	.32**	.27*	.32**	.18	.09	-.15	.23	-.05
2. Absence	.15	-.15	-.02	-.01	.08	.00	.04	-.13	-.13	-.12	.04	-.14
3. School work assistance	.30*	.08	.36**	.36**	.26	.35*	.33*	-.10	-.38**	-.05	-.01	.19
4. Kindergarten/nursery	.05	-.04	-.01	.28*	-.03	.09	.03	.04	-.08	-.11	.07	.05
5. SDQ total	-.00	-.13	-.08	-.16	-.08	-.11	-.11	-.06	.10	-.03	-.17	-.04
6. CDI total	.10	.20	.11	-.11	.17	.15	.20	-.12	.39**	-.05	-.19	-.04
7. WISC-R information	.43**	.47**	.39**	.25**	.84**	.58**	.78**	-.00	-.00	-.21	.10	-.09
8. WISC-R similarities	.42**	.32**	.31**	.17	.73**	.50**	.66**	-.09	-.04	-.27*	.16	-.06
9. WISC-R arithmetic	.46**	.46**	.32**	.42**	.72**	.57**	.70**	.10	-.13	-.31**	.39**	-.24
10. WISC-R vocabulary	.49**	.41**	.40**	.31**	.66**	.62**	.70**	.03	-.37**	-.34**	-.00	-.07
11. WISC-R comprehension	.48**	.17	.36**	.15	.65**	.47**	.60**	-.01	-.28*	-.19	.10	-.17
12. WISC-R digit span	.52**	.46**	.31**	.28*	.74**	.56**	.70**	-.01	-.34**	-.36**	.11	-.03
13. WISC-R picture completion	.38**	.30*	.43**	.13	.46**	.65**	.60**	-.08	.12	-.03	.11	-.12
14. WISC-R block design		.35**	.44**	.30*	.63**	.76**	.76**	.13	-.19	-.27*	.14	.06
15. WISC-R object assembly			.42**	.06	.51**	.68**	.64**	.00	-.02	-.10	-.07	.11
16. WISC-R digit symbol				.12	.46**	.74**	.64**	-.07	-.13	-.10	-.09	.06
17. WISC-R verbal					.34**	.47**	.44**	-.01	-.24*	-.33**	.21	.02
18. WISC-R performance						.73**	.93**	.00	-.22	-.37**	.24	-.15
19. WISC-R total							.93**	.01	-.17	-.26*	.09	.05
20. Summation								-.00	-.19	-.39**	.16	-.06
21. Reading time									.03	-.01	.42**	.05
22. Mistakes in reading										.33**	.02	-.13
23. Written alphabet letters											-.20	.10
24. Mixing letters												-.33**

3.2.1 Pearson Correlation Coefficients for School-Related Variables in IDDM Sample

For the IDDM sample, school achievement was positively correlated with adherence to IDDM ($r(65) = .35$, $p < .01$), the number of alphabet letters written correctly ($r(59) = .42$, $p < .001$), and words read in one minute ($r(65) = .30$, $p < .05$).

There was also a positive association between school achievement and WISC-R information ($r(69) = .36$, $p < .05$), WISC-R similarities ($r(69) = .38$, $p < .001$), WISC-R arithmetic ($r(69) = .38$, $p < .001$), WISC-R vocabulary ($r(69) = .33$, $p < .01$), WISC-R picture completion ($r(69) = .28$, $p < .05$), WISC-R picture arrangement ($r(69) = .26$, $p < .05$), WISC-R block design ($r(69) = .28$, $p < .05$), WISC-R digit symbol ($r(69) = .27$, $p < .05$), WISC-R verbal score ($r(69) = .39$, $p < .001$), WISC-R performance score ($r(68) = .34$, $p < .01$), and WISC-R total score ($r(69) = .29$, $p < .05$). These results reveal that higher level of school achievement was associated with better cognitive functioning in children with IDDM. Also children with higher school achievements had better adherence to IDDM. In addition, there was a negative correlation between school achievement and absent days at school ($r(66) = -.29$, $p < .05$), number of mistakes in reading ($r(65) = -.28$, $p < .05$), reading time ($r(64) = -.44$, $p < .001$), and total SDQ scores ($r(69) = -.33$, $p < .01$). In other words, children with higher school achievement were more successful at passing to the next grade at school, as well as having less behavioral problems. The results also revealed that children with high levels of school achievement were better in reading and writing tasks.

Receiving assistance with school work was negatively associated with the average hemoglobin levels ($r(53) = .32$, $p < .05$).Receiving assistance with school work was also positively correlated with WISC-R digit span ($r(68) = .31$, $p < .05$), WISC-R picture completion ($r(68) = .26$, $p < .05$), WISC-R object assembly ($r(67) = .32$, $p < .01$), and WISC-R verbal score ($r(68) = .24$, $p < .05$). Thus, higher levels of cognitive functioning were positively associated with the higher levels of help received by children with their school work.

3.2.2 Pearson Correlation Coefficients for Scores of WISC-R, SDQ, CDI, and Specific Learning Disabilities Scale in IDDM Sample

Pearson correlation results revealed that total SDQ scores were negatively correlated with school achievement ($r(69) = -.33$, $p < .01$), and adherence to IDDM ($r(65) = -.45$, $p < .001$). There were negative correlations between total CDI score and WISC-R arithmetic score ($r(64) = -.28$, $p < .05$), as well as adherence to IDDM ($r(69) = -.29$, $p < .05$). As expected, lower adherence to IDDM was associated with increased behavioral problems and higher levels of depression.

The Pearson correlation results for WISC-R subtests and total scores, and Specific Learning Disability Scale subtest scores were listed in Table 7.

3.2.3 Pearson Correlation Coefficients for IDDM-Related Variables in IDDM Sample

According to Pearson correlation results, working out was positively associated with WISC-R similarities scores ($r(65) = .34$, $p < .01$), and the number of words read in a

minute ($r(65) = .34$, $p < .01$). There was a positive association between frequency of insulin shots and age of onset ($r(65) = .34$, $p < .01$), WISC-R block design ($r(68) = .25$, $p < .05$), number of words read in a minute ($r(64) = .36$, $p < .01$), and number of written alphabet letters ($r(59) = .28$, $p < .05$). Frequency of insulin shots was negatively associated with mixing letters in writing ($r(64) = -.35$, $p < .01$). Results revealed that the more the children had insulin shots, the better they were in reading and writing tasks.

Pearson correlation results revealed that average hemoglobin level was negatively correlated with WISC-R similarities ($r(54) = -.30$, $p < .05$) and WISC-R digit span ($r(54) = -.30$, $p < .05$). There was a positive association between adherence of children to IDDM and school achievement ($r(65) = .35$, $p < .01$). Adherence was negatively correlated with average number of hyperglycemia experienced in a week ($r(65) = .35$, $p < .01$), total CDI score ($r(65) = -.33$, $p < .01$), and total SDQ score ($r(65) = -.45$, $p < .001$). Consistent with expectations, children with better adherence to IDDM had higher levels of school achievement, as well as having lower depression levels and less behavioral problems. Adherence was also negatively associated with the ages of children ($r(65) = -.25$, $p < .05$).

As expected, average number of hypoglycemia experienced in a week and total SDQ score were positively correlated ($r(65) = -.25$, $p < .05$), indicating the association between poor metabolic control and behavioral problems. Number of hypoglycemia was also correlated positively with reading time ($r(60) = .27$, $p < .05$), mixing capital and small letters in writing ($r(59) = .27$, $p < .05$), and mixing letters in writing ($r(59) = .27$, $p < .05$). There was negative association between hypoglycemia number and words read in one minute ($r(60) = -.28$, $p < .05$), number of alphabet letters written ($r(54) = -.32$, p

<.05), WISC-R similarities ($r(64) = -.25$, $p < .05$), WISC-R vocabulary ($r(64) = -.33$, $p < .01$), WISC-R comprehension ($r(64) = -.29$, $p < .05$), and WISC-R verbal score ($r(64) = -.28$, $p < .05$). Hyperglycemia and hypoglycemia numbers had highly significant positive correlation ($r(64) = -.28$, $p < .05$). In addition to significant correlation results of hypoglycemia number, hyperglycemia number was significantly associated with variables related to cognitive functioning and learning. There were negative correlations between hyperglycemia number and school achievement ($r(63) = -.35$, $p < .01$), WISC-R information ($r(63) = -.33$, $p < .01$), WISC-R similarities ($r(63) = -.28$, $p < .05$), WISC-R arithmetic ($r(63) = -.38$, $p < .01$), WISC-R vocabulary ($r(63) = -.29$, $p < .05$), WISC-R digit span ($r(63) = -.25$, $p < .05$),and WISC-R verbal score ($r(63) = -.36$, $p < .01$). All these results were consistent with expectations of children with poor metabolic control having lower scores from cognitive functioning and learning tests. Also, as expected, hyperglycemia level was negatively correlated with adherence ($r(62) = -.32$, $p < .01$).

Duration of IDDM was negatively correlated with age of onset ($r(68) = -.77$, $p < .001$) and frequency of insulin shots ($r(65) = -.37$, $p < .01$). It was also negatively associated with WISC-R information ($r(68) = -.28$, $p < .05$), WISC-R block design ($r(68) = -.29$, $p < .05$), and WISC-R object assembly ($r(67) = -.28$, $p < .05$). Consistent with expectations, longer duration of IDDM was negatively associated with high levels of cognitive functioning.

3.2.4 Pearson Correlation Coefficients for School-Related Variables in Control Sample

For the control group, results indicated that absent days at school was not significantly associated with any variables. Receiving assistance with school work was positively correlated with WISC-R comprehension ($r(52) = .35$, $p < .05$), WISC-R picture arrangement ($r(52) = .30$, $p < .05$), WISC-R object assembly ($r(52) = .36$, $p < .01$), WISC-R digit symbol ($r(52) = .36$, $p < .01$), WISC-R performance score ($r(51) = .35$, $p < .05$), and WISC-R total score ($r(51) = .33$, $p < .05$). Similar to IDDM group results, higher levels of cognitive functioning were positively associated with the higher levels of help received by children with their school work. Receiving assistance with school work was negatively associated with total SDQ score ($r(52) = -.28$, $p < .05$). There was a positive correlation between attending to kindergarten or nursery and total SDQ scores ($r(52) = .30$, $p < .05$). WISC-R digit symbol was also positively correlated with kindergarten or nursery attendance ($r(52) = .28$, $p < .05$).

3.2.5 Pearson Correlation Coefficients for Scores of WISC-R, SDQ, CDI, and Specific Learning Disabilities Scale in Control Sample

Pearson correlation results revealed that total SDQ score was positively correlated with total CDI score ($r(69) = .30$, $p < .05$) and attendance to kindergarten and/or nursery ($r(52) = .30$, $p < .05$). According to this result, children with higher level of depression had more behavioral problems. There was also a negative correlation between total SDQ score and assistance with school work ($r(52) = -.30$, $p < .05$).

According to the Pearson results, total CDI score was positively correlated with WISC-R information ($r(69) = -.24$, $p < .05$), WISC-R similarities ($r(69) = .30$, $p < .05$), reading time ($r(67) = .40$, $p < .001$), and mixing capital and small letters in writing ($r(68) = .37$, $p < .01$). In addition, there was negative correlation between CDI and number of words read in one minute ($r(65) = -.28$, $p < .05$). Higher depression level in physically healthy children was associated with lower cognitive functioning as well as problems in reading and writing. Correlation coefficients of WISC-R subtests and total scores, and Specific Learning Disability Scale subtest scores were listed in Table 8.

3.3 Differences among the Levels of Parental Education, Income, and Children's Adherence to IDDM in terms of Cognitive Functioning, Learning Difficulties, Behavioral Problems, and Depression

In this section separate one-way ANOVAs were conducted in order to investigate the differences among the levels of parents' education, income, school achievement, and children's adherence to IDDM in terms of WISC-R scores (information, similarities, arithmetic, comprehension, digit span, picture completion, picture arrangement, block design, object assembly, digit symbol, verbal score, performance score, total score), learning difficulty related variables (total mistakes in reading, mixed letters in reading, reading text questions, reading time, number of written alphabet letters, mixed sequence of alphabet letters, letter reversal, mixed letters), behavioral problems (SDQ total score), and depression (CDI total score).

3.3.1 Differences among the Levels of Parental Education in terms of WISC-R Scores, and Variables Related to Learning Difficulties, Behavioral Problems, and Depression in IDDM Sample

Variance analysis with IDDM sample revealed a significant effect of maternal education on children's WISC-R similarity scores, $F(5, 63) = 2.38$, $p < .05$. According to Tukey post hoc analyses results, children of mothers who were not literate had lower scores ($M = 7.20$, $SD = 3.35$) than children of mothers who graduated from elementary school ($M = 10.98$, $SD = 2.30$) and children of high-school graduate mothers ($M = 11.58$, $SD = 3.23$) from WISC-R similarity subtests. ANOVA results did also show that the effect of maternal education was significant on WISC-R vocabulary scores of the children, $F(5, 63) = 3.35$, $p < .01$. As compared to children of mothers who were high-school graduates ($M = 10.75$, $SD = 2.60$), the children with illiterate mothers had lower scores on vocabulary subtest of WISC-R ($M = 6.20$, $SD = 1.10$). Education levels of the fathers had significant effect on WISC-R information scores of the children, $F(5, 63) = 3.05$, $p < .05$. Children of fathers who were university graduates had higher WISC-R information scores ($M = 6.20$, $SD = 1.10$) than children of elementary school graduate fathers ($M = 11.00$, $SD = 3.16$). These results revealed the positive effect of higher levels of parental education on cognitive functioning of children with IDDM. However, there was no significant effect of parental education on variables related to learning difficulties, behavioral problems, and depression in IDDM sample.

3.3.2 Differences among the Levels of Income in terms of WISC-R Scores, and Variables Related to Learning Disability, Behavioral Problems, and Depression in IDDM Sample

One-way ANOVAs were conducted to examine the effect of income on WISC-R scores, and the variables related to learning difficulties, behavioral problems, and depression. According to the results, there was a significant effect of income on WISC-R digit span scores, $F(4, 62) = 3.03$, $p < .05$. The children of families with income between 500 TL and 1000 TL had higher scores in digit span subtest ($M = 9.51$, $SD = 1.98$) than the children of families with income less than 500 TL ($M = 7.84$, $SD = 1.86$). Verbal scores ($M = 98.19$, $SD = 13.00$) and total scores ($M = 100.30$, $SD = 13.64$) of the children of families with low incomes between 500 TL and 1000 TL were higher than the verbal scores ($M = 88.42$, $SD = 11.96$) and total scores ($M = 89.53$, $SD = 12.77$) of the children of families with less than 500 TL monthly income. Results revealed that higher family income is associated with higher cognitive functioning in children.

3.3.3 The Effect of School Achievement on WISC-R Scores, and Variables Related to Learning Disability, Behavioral Problems, and Depression in IDDM Sample

The effect of school achievement on cognitive functioning, learning difficulties, behavioral problems, and depression were examined by conducting separate one-way ANOVAs. According to the ANOVA results, school achievement had significant effect on total SDQ scores of the children with IDDM, $F(2, 63) = 7.02$, $p < .01$. Children with average school achievement had higher SDQ scores ($M = 17.35$, $SD = 5.32$) than children with high school achievement ($M = 10.88$, $SD = 5.32$) and very high school

achievement (M = 10.51, SD = 6.48). There was also a significant effect of school achievement on total CDI scores, $F(2, 63) = 5.44$, $p < .01$. As compared to children with high school achievement (M = 7.17, SD = 3.95), children with average school achievement had higher scores on CDI (M = 13.28, SD = 8.54). These findings suggested that children with better school achievement may have less behavioral problems and lower depression levels.

School achievement had significant effect on WISC-R arithmetic scores, $F(2, 63) = 5.45$, $p < .01$. Children with very high school achievement had higher arithmetic scores (M = 10.12, SD = 2.89) than children with average school achievement (M = 7.00, SD = 3.46). In addition, reading time ($F(2, 63) = 5.44$, $p < .01$) and number of written alphabet letters ($F(2, 63) = 5.44$, $p < .01$) in learning disability scale were significantly affected by school achievement. According to Tukey post hoc results, children with very high school achievement were faster in reading (M = 161.56, SD = 57.80) than the children with high school achievement (M = 230.71, SD = 88.48) and children with average school achievement (M = 247.08, SD = 72.84). Post hoc results revealed that children with very high school achievement wrote more letters of alphabet in writing test (M = 23.79, SD = 7.81) than the children with high school achievement (M = 17.50, SD = 9.41). These findings revealed that children with IDDM who had lower levels of school achievement had more difficulties in arithmetic, writing, and reading.

3.3.4 The Effect of Adherence on WISC-R Scores, and Variables Related to Learning Disability, Behavioral Problems, and Depression in IDDM Sample

According to the results of variance analysis, there was a significant effect of children's adherence to IDDM on their total SDQ scores, $F(3, 60) = 5.89$, $p < .001$. Children with high adherence to IDDM had lower SDQ scores ($M = 8.72$, $SD = 4.27$) than children with moderate adherence ($M = 16.52$, $SD = 6.21$) and children with low adherence ($M = 18.00$, $SD = 2.45$). Adherence levels did also have a significant effect on total CDI scores of children, $F(3, 60) = 8.11$, $p < .001$. As compared to children with low adherence ($M = 7.98$, $SD = 6.32$), moderate adherence ($M = 9.54$, $SD = 4.74$), and high adherence ($M = 8.12$, $SD = 4.77$), children with no adherence to IDDM had higher CDI scores ($M = 21.75$, $SD = 7.14$). Accordingly, it may be suggested that behavioral problems and depression were more common among children with lower levels of adherence to IDDM.

3.3.5 The Effect of Parental Education on WISC-R Scores, and Variables Related to Learning Disability, Behavioral Problems, and Depression in Control Sample

The effects of mother and father education on WISC-R scores, variables related to learning difficulties, behavioral difficulties, and depression were examined by conducting separate ANOVAs. According to ANOVA results, level of maternal education had significant effect on WISC-R digit span scores, $F(5, 60) = 4.46$, $p < .01$. Tukey post hoc analyses revealed that mothers who were university graduates had children with higher digit span scores ($M = 14.50$, $SD = 2.12$) than children of middle school graduate mothers ($M = 9.73$, $SD = 1.68$), children of mothers graduated from

elementary school (M = 9.17, SD = 2.24), and children of mothers who were only literate (M = 7.20, SD = .84). Variance analysis did also reveal that maternal education had significant effect on children's WISC-R verbal scores ($F(5, 60) = 2.81$, $p < .05$) and WISC-R total scores ($F(5, 60) = 2.76$, $p < .05$). Children of mothers with university degrees had higher WISC-R verbal scores (M = 122.5, SD = .71) and WISC-R total scores (M = 124.0, SD = 4.24) than children of mothers who were only literate (M = 91.8, SD = 14.9; M = 93.4, SD = 13.67, respectively). The results revealed no significant effect of maternal education on behavioral problems or depression levels of physically healthy children. However, the cognitive functioning of children was positively associated with education of their mothers. Variance analysis on education levels of fathers did not reveal any significant results.

3.3.6 The Effect of School Achievement on WISC-R Scores, and Variables Related to Learning Disability, Behavioral Problems, and Depression in Control Sample

Variance analysis calculated with the control sample revealed that there was a significant effect of school achievement on mixed letters in reading, $F(3, 59) = 11.94$, $p < .001$. According to Tukey post hoc comparison, children who had low school achievement mixed more letters (M = 5.00, SD = 4.24), than those who had average school achievement (M = .83, SD = 1.6), high school achievement (M = .60, SD = .89), and very high school achievement (M = .56, SD = .58). In addition, there was a significant effect of school achievement on digit symbol scores, $F(3, 59) = 11.94$, $p < .001$. Tukey post hoc comparison results revealed that children with very high school achievement (M = 12.52, SD = 1.94) had higher digit symbol scores than children with high school achievement (M = 10.88, SD = 2.64) and low school achievement (M =

7.50, *SD* = .71). These results revealed that children with higher levels of school achievement were better at reading and memory tasks compared to children with lower school achievement.

In summary, one-way ANOVA results revealed significant differences among the levels of parents' education, income, school achievement, and children's adherence to IDDM in terms of cognitive functioning, learning difficulties, behavioral problems, and depression. For the IDDM group, the results showed that as the maternal education level increased, WISC-R digit span scores in children increased as well. Compared to the children of fathers with lower education levels, WISC-R information subscale scores were higher in children of fathers with higher education level. Results did also reveal that children of parents with higher incomes had higher WISC-R digit span scores than did children of parents with lower incomes. Higher levels of school achievement had significant effect on emotions and behaviors in children with IDDM. As compared to children with lower school achievement, children with higher school achievement scored lower on SDQ and CDI. Children with lower school achievements also had lower WISC-R arithmetic scores as well as writing less alphabet letters correctly, compared to the children with higher school achievements. In addition, as compared to children with poor adherence to IDDM, children with higher levels of adherence had less emotional and behavioral problems. For control group, results revealed that children of mothers with higher education levels had higher WISC-R digit span and verbal scores. Also, compared to children with lower school achievement, children with higher school achievement had better performance in WISC-R digit symbol subtest and had fewer mistakes in mixed letters subtest of the reading test.

3.4 Comparison of IDDM and Control Groups on WISC-R scores, Variables Related to Learning Difficulties, Behavioral Problems, and Depression by Using Independent Samples T-Test

T-test for independent samples was conducted in order to examine the mean differences between children with and without IDDM in terms of WISC-R scores, and the variables related to learning difficulties, behavioral problems, and depression.

3.4.1 WISC-R Scores

According to the t-test results, there were significant differences between two groups in terms of several subtests of WISC-R, and WISC-R total score. Children without IDDM had higher scores on WISC-R information subtest (M = 8.59, SD = 2.32) than did children with IDDM (M = 7.43, SD = 2.80), $t(136) = 2.65$, $p = .01$, as well as showing higher performance on WISC-R similarities subtest (M = 12.39, SD = 2.36) than did the children with IDDM (M = 10.78, SD = 2.77), $t(136) = 3.68$, $p = .001$. As compared to the children with IDDM (M = 9.06, SD = 3.10), children without IDDM had higher scores (M = 10.26, SD = 2.51) in WISC-R arithmetic subtest, $t(136) = 2.51$, $p = .05$. In addition, compared to children with IDDM (M = 97.00, SD = 13.95), WISC-R total score was higher in children without IDDM (M = 102.69, SD = 12.42), $t(134) = 2.51$, $p = .05$. All these findings are in line with the expectation, suggesting that IDDM negatively effects cognitive functioning in children (See Table 9).

Table 9 WISC-R Subtest Means Comparison of Children with and without IDDM

Variables	IDDM Sample		Control Sample			
	M	***SD***	***M***	***SD***	***t***	***df***
WISC-R information	7.43	2.80	8.59	2.32	2.65**	136
WISC-R similarities	10.78	2.77	12.39	2.36	3.68***	136
WISC-R arithmetic	9.06	3.10	10.26	2.51	2.51*	136
WISC-R total score	97.00	13.95	102.69	12.42	2.51*	134

Note. * $p < .05$; ** $p < .01$, *** $p < .001$

3.5.2 Arithmetic Test Scores

T-test results showed that there were significant differences between multiplication table scores of two groups. Children without IDDM had lower achievement on multiplication table questions with average score of 4.47 for basis 2 (*SD* = 1.18), $t(136) = 3.03$, $p = .01$, 4.18 for basis 3 (*SD* = 1.35), $t(136) = 2.86$, $p = .01$, 3.88 for basis 4 (*SD* = 1.46), $t(136) = 4.11$, $p = .001$, 3.75 for basis 5 (*SD* = 1.61), $t(136) = 4.96$, $p = .001$, 3.85 for basis 6 (*SD* = 1.13), $t(136) = 5.99$, $p = .001$, 3.16 for basis 7 (*SD* = 1.21), $t(136) = 6.16$, $p = .001$, 3.16 for basis 8 (*SD* = 1.23), $t(136) = 6.61$, $p = .001$, and 2.81 for basis 9 (*SD* = 1.17), $t(136) = 9.04$, $p = .001$, than children without IDDM with average score of 4.92 for basis 2 (*SD* = .31), 4.73 for basis 3 (*SD* = .87), 4.71 for basis 4 (*SD* = .82), 4.80 for basis 5 (*SD* = .72), 4.73 for basis 6 (*SD* = .48), 4.23 for basis 7 (*SD* = .80), 4.33 for basis 8 (*SD* = .83), and 4.30 for basis 9 (*SD* = .71). These results revealed that as expected, children with IDDM had difficulties in arithmetic compared to physically healthy children (See Table 10).

Table 10 Multiplication Table Means Comparison of Children with and without IDDM

	IDDM Sample		Control Sample			
Variables	***M***	***SD***	***M***	***SD***	***t***	***df***
Multiplication basis 2	4.47	1.18	4.92	.31	3.03**	136
Multiplication basis 3	4.18	1.35	4.73	.87	2.86**	136
Multiplication basis 4	3.88	1.46	4.71	.82	4.11***	136
Multiplication basis 5	3.75	1.61	4.80	.72	4.96***	136
Multiplication basis 6	3.85	1.13	4.73	.48	5.99***	136
Multiplication basis 7	3.16	1.21	4.23	.80	6.16***	136
Multiplication basis 8	3.16	1.23	4.33	.83	6.61***	136
Multiplication basis 9	2.81	1.17	4.30	.71	9.04***	136

Note. ** $p < .01$; *** $p < .001$

3.5.3 Reading Test Scores

T-test results yielded significant differences between two groups in terms of reading test scores. Children with IDDM had more mistakes of spelling words in reading (M = .42, SD = .48) than children without IDDM (M = .23, SD = .41), $t(136) = -2.46$, p = .05. As compared to the control group (M = .33, SD = .79), the mistake of adding letters to the words was more common in IDDM group (M = .62, SD = .83), $t(136) = -2.04$, p = .05. Children with IDDM skipped more letters (M = .94, SD = 1.22) while reading the text than children without IDDM (M = .55, SD = .86), $t(136) = -2.18$, p = .05. Skipping syllables in reading was more common in IDDM sample (M = 1.75, SD = 1.93) than in the control group (M = 1.02, SD = 1.48), $t(136) = -2.52$, p = .05. Children with IDDM made up more words in reading text (M = 1.63, SD = 1.78) than did children without IDDM (M = .88, SD = 1.11), $t(136) = -2.98$, p = .01. The reading time of children with IDDM were significantly longer (M = 209.75, SD = 82.01) than the reading time of

children without IDDM (*M* = 173.31, *SD* = 76.35), *t*(136) = -2.70, *p* = .01. Number of words read correctly by children without IDDM (*M* = 82.66, *SD* = 73.02) was more than the number of words read correctly by children with IDDM (*M* = 73.02, *SD* = 28.26), *t*(136) = -2.20, *p* = .05. In addition, children with IDDM made more mistakes in reading (*M* = 8.23, *SD* = 6.59) than did children without IDDM (*M* = 4.75, *SD* = 4.66; *t*(136) = -3.58, *p* = .001). As it was hypothesized, all these results indicated that children with IDDM had more difficulties in reading than children without IDDM (See Table 11).

Table 11 Reading Tests Means Comparison of Children with and without IDDM

	IDDM Sample		Control Sample			
Variables	***M***	***SD***	***M***	***SD***	***t***	***df***
Spelling words	.42	.48	.23	.41	-2.46*	136
Adding letters	.62	.83	.33	.79	-2.04*	136
Skipping letters	.94	1.22	.55	.86	-2.18*	136
Skipping syllables	1.75	1.93	1.02	1.48	2.52*	136
Making up words	1.63	1.78	.88	1.11	-2.98**	136
Reading time	209.75	1.21	173.31	76.35	-2.70**	136
Number of words read	73.02	28.26	82.66	73.02	-2.20*	136
Number of mistakes	8.23	6.59	4.75	4.66	-3.58***	136

Note. * $p < .05$; ** $p < .01$, *** $p < .001$

3.5.4 Writing Test Scores

T-test results revealed significant differences between two groups in writing tests. Children without IDDM wrote significantly more alphabet letters (*M* = 24.02, *SD* = 7.58) than did children with IDDM (*M* = 19.48, *SD* = 8.87), *t*(136) = 3.23, *p* = .01. There was a significant difference for skipping letters in writing, *t*(136) = -2.79, *p* = .01, with physically healthy children skipping less letters (*M* = .21, *SD* = .40) than children with IDDM (*M* = .73, *SD* = 1.52). Significantly more children with IDDM wrote the

letters reversed (*M* = .11, *SD* = .46) than did children without IDDM (*M* = .00, *SD* = .00), *t*(136) = -1.99, *p* = .05. There was a significant difference in mixing letters, *t*(136) = -3.28, *p* = .001, with children with IDDM mixing more letters (*M* = 2.83, *SD* = 3.86) than children without IDDM (*M* = 1.22, *SD* = 1.30). Compared to physically healthy children (*M* = .63, *SD* = .98), children with IDDM made more punctuation mistakes (*M* = 1.53, *SD* = 1.49), *t*(136) = -4.17, *p* = .001. In addition, the mistake of mixing capital and small letters was more common among children with IDDM (*M* = 2.16, *SD* = 4.25) than children without IDDM (*M* = .74, *SD* = .98), *t*(136) = -2.70, *p* = .01. All these findings are in line with the expectations, suggesting that there is an association between IDDM and writing difficulties in children (See Table 12).

Table 12 Writing Test Means Comparison of Children with and without IDDM

	IDDM Sample		Control Sample			
Variables	***M***	***SD***	***M***	***SD***	***t***	***df***
Number of alphabet letters	19.48	8.87	24.02	7.58	3.23**	136
Skipping letters	.73	1.52	.21	.40	-2.79**	136
Reverse writing	.11	.46	.00	.00	-1.99*	136
Mixing letters	2.83	3.86	1.22	1.30	-3.28***	136
Punctuation mistakes	1.53	1.49	.63	.98	-4.17***	136
Mixing capital and small letters	2.16	4.25	.74	.98	-2.70**	136

Note. * $p < .05$; ** $p < .01$, *** $p < .001$

In addition, t-test results indicated that children with IDDM had more absent days at school (*M* = 8.77, *SD* = 8.13) than did children without IDDM (*M* = 3.60, *SD* = 3.50).

In summary, t-test results revealed significant mean differences between children with and without IDDM in terms of cognitive functioning, learning, behaviors, and depression. As compared to control group, number of absent days at school was significantly higher in IDDM group. Children without IDDM had higher scores in WISC-R information, similarities, and arithmetic subtests than did children with IDDM. In addition, the WISC-R total score was significantly higher in control group compared to IDDM group. In terms of Specific Learning Disability Scale subtest scores, multiplication table scores were higher in children without IDDM compared to the scores of the children with IDDM. Reading test revealed that children with IDDM had more mistakes than did children without IDDM, such as adding letters to the words, skipping letters, skipping syllables, and making up words. Also, the reading time of IDDM group was longer than control group; and the children with IDDM read less words correctly than did children without IDDM. As expected, there were also significant mean differences between children with and without IDDM in writing test scores. Children with IDDM had more mistakes in writing than did children without IDDM, such as skipping letters, reverse letters, mixing letters, mixing capital and small letters, and punctuation mistakes. In addition, children without IDDM wrote more alphabet letters correctly than did children with IDDM.

3.5 Multiple Regression Analysis

Hierarchical multiple regression analyses were conducted in order to test the effect of IDDM-related variables on cognitive functioning, learning, and behaviors of the children. In all regression analyses, predictors were entered in two steps. In both steps, enter method was employed. The first block consisted of three variables: absent

days at school, age of the child, and CDI total score. In the second step, IDDM-related variables were entered into the equation (average hemoglobin level, duration of IDDM, age of IDDM onset). For cognitive functioning, it was hypothesized that IDDM will have negative impact on several dimensions of cognitive functioning (memory, attention spans, visual-spatial skills) in children. Longer duration of IDDM was hypothesized to increase the risk of deficits in cognitive functioning. In addition, it was hypothesized that late onset (>5 years) IDDM will increase the risk for reading difficulties, as well as early onset (<5 years) IDDM increasing the risk for arithmetic difficulties in children.

3.5.1 Cognitive Functioning

After controlling for the effect of absent days at school, age of the child, and depression (CDI total score), the effect of IDDM on cognitive functioning (WISC-R subtests, and verbal, performance, and total scores) was tested by performing hierarchical multiple regression analysis. First regression analysis was conducted for WISC-R information. When the variables of the first step were entered, it was revealed that absent days at school, age of the child, and CDI total score explained 13% of the variance in WISC-R information scores (R^2= .13., F(3, 65) = 3.26, p <.05). Age of the child was negatively associated with WISC-R information scores (β = -.32, p <.01). However, absent days at school (β = -.17, p= .16) and CDI total score (β = -.03, p= .80) were not significantly related to cognitive functioning. Similarly, in the second step, average hemoglobin level (β = -1.33, p= .19), duration (β = -.81, p= .42), and age of onset (β = -.54, p= .59) did not explain any variance (R^2= .07, F(3, 62) = 1.94, p= .13) (See Table 13).

In the regression analysis of WISC-R similarities, the variables did not explain any variance of the similarities scores of children with IDDM in the first step (R^2= .03, F(3, 65) = .76, p= .52) or the second step (R^2= .07, F(3, 62) = 1.65, p= .19). In the first step, age of child (β = .15, p= .88), CDI total score (β = -.40, p= .69), and absent days at school (β = -1.39, p= .17) were not significantly associated to the similarities scores. The variables of the second step; average hemoglobin level (β = -1.98, p= .06), duration (β = -.08, p= .93), and age of onset (β = .02, p= .98) also were not significantly related to similarities scores (See Table 13).

In another regression analysis, WISC-R arithmetic score was the predicted variable (See Table 14). The variables entered in the first step explained only 10% of the variance in arithmetic scores of the children with IDDM (R^2= .10, F(3,65) = 2.52, p= .06). Arithmetic scores and CDI scores were negatively associated (β = -2.29, p <.05). However, age of child (β = -.27, p= .79) and absent days at school (β = -.40, p= .69) were not significantly associated with arithmetic scores. Also average hemoglobin level (β = -.50, p= .62), duration of IDDM (β = -.06, p= .95), and age of onset (β = -.13, p= .90) did not explain any variance (R^2= .01, F(3,62) = .12, p= .95).

In the present study, another predicted variable was WISC-R vocabulary score (See Table 14). The variables in the first step (R^2= .06, F(3,65) = 1.38, p= .26) or the second step (R^2= .04, F(3,62) = .90, p= .45) did not predict vocabulary scores of the children with IDDM. The variables of the first step, age of child (β = -1.84, p= .07), CDI total score (β = -.09, p= .46), and absent days at school (β = -.45, p= .66) were not significantly related to vocabulary scores. Similarly, average hemoglobin level (β = -

1.22, p= .23), duration of IDDM (β = -1.02, p= .31), and age of onset (β = -1.09, p= .28) were not significantly associated with WISC-R vocabulary scores.

The regression analysis of WISC-R comprehension revealed that the variables in the first step (R^2= .02, F(3,65) = .53, p= .67) and second step (R^2= .01, F(3,62) = 1.38, p= .87) did not predict comprehension scores of the children with IDDM (See Table 15). In the first step, age of child (β = -.60, p= .63), CDI total score (β = -.50, p= .62), absent days at school (β = -.12, p= .33) were not significantly related to comprehension scores. In addition, average hemoglobin level (β = .07, p= .60), duration of IDDM (β = -.44, p= .58), and age of onset (β = -.54, p= .61) did not explain any variance of the comprehension scores.

In the regression analysis of WISC-R digit span, the variables did not explain any variance of the digit span scores of children with IDDM in the first step (R^2= .01, F(3, 65) = .31, p= .82) or the second step (R^2= .07, F(3, 62) = 1.64, p= .19). In the first step, age of child (β = -.08, p= .55), CDI total score (β = -.10, p= .44), and absent days at school (β = -.01, p= .93) were not significantly associated to the digit span scores. Similarly, in the second step, average hemoglobin level (β = -.28, p= .03), duration (β = .03, p= .97), and age of onset (β = .00, p= .99) were not significantly related to digit span scores (See Table 15).

The regression analysis of WISC-R picture completion indicated that the variables in the first step (R^2= .01, F(3,65) = .10, p= .96) or second step (R^2= .01, F(3,62) = .18, p= .91) did not predict picture completion scores of the children with IDDM (See Table 16). In the first step, age of child (β = -.03, p= .82), CDI total score (β

= -.02, p= .87), absent days at school (β = -.06, p= .65) were not significantly related to picture completion scores. In addition, average hemoglobin level (β = -.04, p= .79), duration of IDDM (β = .54, p= .50), and age of onset (β = .58, p= .52) did not explain any variance of the picture completion scores.

Another predicted variable was WISC-R picture arrangement score (See Table 16). The variables in the first step (R^2= .03, F(3,65) = .66, p= .58) or the second step (R^2= .09, F(3,62) = 2.05, p= .12) did not predict picture arrangement scores of the children with IDDM. The variables of the first step; age of child (β = -.08, p= .52), CDI total score (β = .03, p= .82), and absent days at school (β = -.15, p= .22) were not significantly related to picture arrangement scores. Also, average hemoglobin level (β = -.01, p= .92), duration of IDDM (β = -1.73, p< .05), and age of onset (β = -2.05, p< .05) were not significantly associated with WISC-R picture arrangement scores.

The regression analysis of WISC-R block design revealed that the variables in the first step (R^2= .06, F(3,65) = 1.27, p= .29) or second step (R^2= .09, F(3,62) = 2.13, p= .11) did not predict block design scores of the children with IDDM (See Table 17). In the first step, age of child (β = -.02, p= .90), CDI total score (β = -.20, p= .11), and absent days at school (β = -.11, p= .38) were not significantly related to block design scores. In addition, average hemoglobin level (β = .01, p= .92), duration of IDDM (β = .08, p= .92), and age of onset (β = .43, p= .61) did not explain any variance of the block design scores.

Another regression analysis was conducted on WISC-R object assembly score (See Table 17). Results showed that the variables did not explain any variance of the

object assembly scores of children with IDDM in the first step (R^2= .10, F(3, 65) = 2.29, p= .09) or in the second step (R^2= .07, F(3, 62) = 1.70, p= .18). In the first step, age of child (β = -.18, p= .13), CDI total score (β = -.22, p= .07), and absent days at school (β = -.11, p= .34) were not significantly associated to the object assembly scores. Similarly, in the second step, average hemoglobin level (β = -.05, p= .68), duration (β = -.12, p= .87), and age of onset (β = .15, p= .86) were not significantly related to WISC-R object assembly scores.

The regression analysis of WISC-R digit symbol indicated that the variables in the first step (R^2= .00, F(3,65) = .00, p= 1.00) or second step (R^2= .00, F(3,62) = .06, p= .98) did not predict picture completion scores of the children with IDDM (See Table 18). In the first step, age of child (β = .00, p= .99), CDI total score (β = .01, p= .97), absent days at school (β = .01, p= .97) were not significantly associated with WISC-R digit symbol scores. In addition, average hemoglobin level (β = -.03, p= .80), duration of IDDM (β = -.15, p= .85), and age of onset (β = -.14, p= .88) did not explain any variance of the digit symbol scores.

In addition to the analyses on the subsets of WISC-R, regressions were conducted on verbal, performance, and total scores. In the regression analysis of WISC-R verbal score, the variables did not explain any variance of the verbal scores of children with IDDM in the first step (R^2= .06, F(3, 65) = 1.47, p= .23) or the second step (R^2= .03, F(3, 62) = .65, p= .59). The variables of the first step; age of child (β = -.14, p= .26), CDI total score (β = -.12, p= .31), and absent days at school (β = -.16, p= .18) were not significantly related to verbal scores. Similarly, average hemoglobin level (β = -.15, p= .25), duration of IDDM (β = -.29, p= .71), and age of onset (β = -.26, p= .76) were not

significantly associated with WISC-R verbal scores (See Table 18). Similarly, the variables in the first or second step did not explain any variance of the performance scores (See Table 19). In the first step, age of child (β = -.06, p= .65), CDI total score (β = -.10, p= .41), absent days at school (β = -.09, p= .48) were not significantly related to WISC-R performance scores (R^2= .02, F(3, 65) = .51, p= .68). In addition, average hemoglobin level (β = -.03, p= .79), duration of IDDM (β = .58, p= .45), and age of onset (β = 91, p= .30) did not explain any variance of the performance scores (R^2= .06, F(3, 65) = 1.38, p= .26). Regression analysis on WISC-R total score revealed that the variables did not explain any variance of the total scores of children with IDDM in the first step (R^2= .05, F(3, 65) = 1.03, p= .39), or in the second step (R^2= .04, F(3, 62) = .79, p= .50). In the first step of the regression analysis, age of child (β = -.10, p= .42), CDI total score (β = -.12, p= .32), and absent days at school (β = -.13, p= .28) were not significantly associated to the total scores. In the second step, average hemoglobin level (β = -.10, p= .44), duration (β = .15, p= .84), and age of onset (β = .33, p= .70) were not significantly related to WISC-R total scores (See Table 19).

Table 13 Hierarchical Regression Models Predicting WISC-R Information and Similarities Scores of Children with IDDM

Variables in Set	WISC-R Information						WISC-R Similarities					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	3.26*	3,65				.13	.76	3,65				.03
Absent days at school		65	-1.42	-.17	-.17			65	-1.39	-.17	-.18	
Age of child		65	-2.75	-.32**	-.32			65	.15	.02	.02	
CDI Total Score		65	-.25	-.03	-.04			65	-.40	-.05	-.07	
Step 2	1.94	3,62				.07	1.65	3,62				.07
Average Hemoglobin Level		62	-1.33	-.16	-.23			62	-1.98	-.25	-.27	
Duration of IDDM		62	-.81	-.58	-.28			62	-.08	-.06	-.13	
Age of Onset		62	-.54	-.44	.04			62	.02	.02	.12	

Note. * $p<.05$, ** $p < .01$

Table 14 Hierarchical Regression Models Predicting WISC-R Arithmetic and Vocabulary Scores of Children with IDDM

Variables in Set	WISC-R Arithmetic						WISC-R Vocabulary					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	2.52	3,65				.10	1.38	3,65				.06
Absent days at school		65	-1.22	-.14	-.18			65	-.45	-.05	-.07	
Age of child		65	-.27	-.03	-.02			65	-1.84	-.22	-.22	
CDI Total Score		65	-2.29	-.27	-.29			65	-.75	-.09	-.09	
Step 2	.12	3,62				.01	.90	3,62				.04
Average Hemoglobin Level		62	-.50	-.06	-.04			62	-1.22	-.15	-.16	
Duration of IDDM		62	-.06	-.04	.03			62	-1.02	-.77	-.02	
Age of Onset		62	-.13	-.11	-.05			62	-1.09	-.93	-.14	

Note. * $p<.05$, ** $p < .01$

Table 15 Hierarchical Regression Models Predicting WISC-R Comprehension and Digit Span Scores of Children with IDDM

Variables in Set	WISC-R Comprehension						WISC-R Digit Span					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	2.52	3,65				.02	.31	3,65				.01
Absent days at school		65	-.99	-.12	-.13			65	.09	.01	-.00	
Age of child		65	-.49	-.06	-.06			65	-.61	-.08	-.07	
CDI Total Score		65	-.50	-.06	-.07			65	-.78	-.09	-.09	
Step 2	.12	3,62				.01	1.64	3,62				.07
Average Hemoglobin Level		62	.52	-.07	.06			62	-2.12	-.28	-.26	
Duration of IDDM		62	-.56	-.44	.02			62	.04	.03	-.03	
Age of Onset		62	-.61	-.54	-.09			62	.01	.00	-.02	

Note. * $p<.05$, ** $p < .01$

Table 16 Hierarchical Regression Models Predicting WISC-R Picture Completion and Picture Arrangement Scores of Children with IDDM

Variables in Set	WISC-R Picture Completion						WISC-R Picture Arrangement					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	.10	3,65				.01	.66	3,65				.03
Absent days at school		65	-.45	-.06	-.06			65	-1.24	-.15	-.15	
Age of child		65	-.23	-.03	-.03			65	-.64	-.08	-.08	
CDI Total Score		65	-.45	-.02	-.03			65	.22	.03	.01	
Step 2	.18	3,62				.01	2.05	3,62				.09
Average Hemoglobin Level		62	-.27	-.07	-.03			62	-.10	-.01	-.05	
Duration of IDDM		62	.68	-.44	.02			62	2.30	1.73	-.09	
Age of Onset		62	.64	-.54	-.03			62	2.42	-.01	.07	

Table 17 Hierarchical Regression Models Predicting WISC-R Block Design and Object Assembly Scores of Children with IDDM

Variables in Set	WISC-R Block Design						WISC-R Object Assembly					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	1.27	3,65				.01	2.29	3,65				.10
Absent days at school		65	-.88	-.11	-.13			65	-.96	-.11	-.14	
Age of child		65	-.13	-.02	-.01			65	-.1.54	-.18	-.17	
CDI Total Score		65	-1.62	-.20	-.21			65	-1.82	-.22	-.22	
Step 2	2.13	3,62				.01	1.70	3,62				.07
Average Hemoglobin Level		62	.51	-.07	-.03			62	-.41	-.05	-.09	
Duration of IDDM		62	.08	-.44	-.29			62	-.17	-.12	-.28	
Age of Onset		62	.64	-.54	.25			62	.18	.15	.14	

Table 18 Hierarchical Regression Models Predicting WISC-R Digit Span and Verbal Scores of Children with IDDM

Variables in Set	WISC-R Digit Symbol						WISC-R Verbal Score					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	.00	3,65				.00	1.47	3,65				.03
Absent days at school		65	.04	.01	.01			65	-1.34	-1.34	-.18	
Age of child		65	.01	.00	.00			65	-1.14	-1.14	-.13	
CDI Total Score		65	.04	.01	.01			65	-1.02	-1.02	-.14	
Step 2	.06	3,62				.00	.65	3,62				.09
Average Hemoglobin Level		62	-.26	-.03	-.04			62	-1.17	-.01	-.17	
Duration of IDDM		62	-.19	-.15	-.04			62	-.38	1.73	-.11	
Age of Onset		62	-.15	-.14	.03			62	-.31	-.01	.01	

Table 19 Hierarchical Regression Models Predicting WISC-R Performance and Total Scores of Children with IDDM

Variables in Set	WISC-R Performance Score						WISC-R Total Score					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	.51	3,65				.02	1.03	3,65				.05
Absent days at school		65	-.72	-.09	-.10			65	-1.10	-.13	-.15	
Age of child		65	-.46	-.06	-.05			65	-.81	-.10	-.09	
CDI Total Score		65	-.82	-.10	-.11			65	-.99	-.12	-.13	
Step 2	1.38	3,62				.06	.04	3,62				.04
Average Hemoglobin Level		62	-.27	-.03	-.07			62	-.79	-.10	-.13	
Duration of IDDM		62	.76	.58	-.22			62	.20	.15	-.17	
Age of Onset		62	1.04	.91	.18			62	.39	.33	.10	

3.5.2 Learning Difficulties

The effects of IDDM on learning difficulties in children were also examined using hierarchical multiple regression analysis. Regression analyses were conducted for the variables related to reading difficulties (reading text questions, reading time, arithmetic difficulties (summation score), and number of words read correctly), and writing difficulties (number of written alphabet letters, reverse letters, and mixed letters). Again, the first block consisted of three variables: age of the child, and CDI total score; and the second step consisted of IDDM-related variables: average hemoglobin level, duration of IDDM, age of IDDM onset.

In the regression analysis of reading text questions, the variables in the first or second step did not explain any variance (See Table 20). In the first step, age of child (β = -.09, p< .01), CDI total score (β = .01, p= .92), absent days at school (β = .02, p= .89) were not significantly related to reading text questions score (R^2= .10, F(3, 65) = 2.36, p= .80). In addition, average hemoglobin level (β = -.08, p= .49), duration of IDDM (β = .74, p= .33), and age of onset (β = .94, p= .27) did not explain any variance of the reading text questions scores (R^2= .03, F(3, 62) = .81, p= .50).

In another regression analysis, reading time was the predicted variable. Results showed that the variables did not explain any variance of the reading times in the first step (R^2= .04, F(3, 65) = .86, p= .47) or the second step (R^2= .00, F(3, 62) = .07, p= .98). In the first step, age of child (β = .18, p= .15), CDI total score (β = -.01, p= .93), and absent days at school (β = .08, p= .51) were not significantly associated to the reading times. Similarly, in the second step, average hemoglobin level (β = -.03, p= .83),

duration (β = -.05, p= .95), and age of onset (β = -.11, p= .90) were not significantly related to reading times of the children with IDDM (See Table 20).

Number of words read correctly was predicted by the variables entered in the first step. Results revealed that age of child, CDI total score, and absent days at school explained 40% of the variance (R^2= .40, F(3, 65) = 14.44, p <.001). Age of the child was positively associated with number of words read correctly (β = .63, p <.001). However, CDI total score (β = -.03, p= .74), and absent days at school (β = -.05, p= .62) were not significantly associated to the words read correctly. Also, in the second step, average hemoglobin level (β = .03, p= .81), duration (β = -.04, p= .95), and age of onset (β = .03, p= .97) were not significantly related to number of the words the children with IDDM read correctly in reading text (See Table 21).

The regression analysis of the summation score indicated that the variables in the first step (R^2= .04, F(3,65) = .81, p= .49), or second step (R^2= .01, F(3,62) = .16, p= .92) did not predict summation scores of the children with IDDM. In the first step, age of child (β = .08, p= .51), CDI total score (β = -.17, p= .18), absent days at school (β = .06, p= .65) were not significantly associated with summation scores of the children with IDDM. Similarly, average hemoglobin level (β = .07, p= .57), duration of IDDM (β = -.07, p= .93), and age of onset (β = -.12, p= .89) did not explain any variance of the summation scores (See Table 21).

The regression analysis of number of written alphabet letters indicated that the variables in the first step explained 24% of the variance (R^2= .24, F(3, 65) = 6.95, p <.001). Age of child was positively associated with number of alphabet letters written

correctly (β = .47, p <.001). However, CDI total score (β = -.11, p= .33), and absent days at school (β = -.09, p= .43) were not significantly associated to the alphabet letters written by the children with IDDM. The variables in second step (R^2= .01, F(3,62) = .35, p= .79) did not predict number of written alphabet letters. Average hemoglobin level (β = .07, p= .57), duration of IDDM (β = -.07, p= .93), and age of onset (β = -.12, p= .89) were not significantly associated with the number of written alphabet letters (See Table 22).

In the next regression analysis, mixed letters in writing was the predicted variable. Results showed that the variables in the first step explained only 10% of the variance (R^2= .10, F(3, 65) = 2.51, p= .06). Age of child was positively associated with mixed letters score (β = -.31, p <.01). However, CDI total score (β = -.07, p= .56), and absent days at school (β = -.05, p= .71) were not significantly associated to the mixed letters score of the children with IDDM. In the second step of regression analysis, average hemoglobin level (β = -.01, p= .93), duration (β = -.27, p= .72), and age of onset (β = -.54, p= .52) were not significantly related to reading times of the children with IDDM (R^2= .05, F(3, 62) = 1.13, p= .35) (See Table 22).

The regression analysis of the reverse letter scores indicated that the variables in the first step (R^2= .02, F(3,65) = .35, p= .79), or second step (R^2= .10, F(3,62) = 2.28, p= .09) did not predict reverse letter scores of the children with IDDM. In the first step, age of child (β = .05, p= .66), CDI total score (β = -.09, p= .49), absent days at school (β = .05, p= .66) were not significantly associated with reverse letter scores of the children. Similarly, average hemoglobin level (β = -.18, p= .16), duration of IDDM (β = .99, p=

.19), and age of onset (β = 1.31, p= .13) did not explain any variance of the reverse letter scores (See Table 23).

3.5.3 Behavioral Problems and Depression

In addition to cognitive functioning and learning difficulties, the effects of IDDM on behavioral difficulties was also examined using hierarchical multiple regression analysis (See Table 24). A hierarchical regression analysis was conducted for SDQ total score. Similar to previous regression analyses, the first block consisted of three variables: age of the child, and CDI total score; and the second step consisted of IDDM-related variables: average hemoglobin level, duration of IDDM, age of IDDM onset.

The regression analysis of the SDQ total scores indicated that the variables in the first step (R^2= .08, F(3,65) = .1.98, p= .13), or second step (R^2= .03, F(3,62) = .73, p= .54) did not predict SDQ total scores of the children with IDDM. In the first step, age of child (β = .11, p= .35), CDI total score (β = -.1.85, p= .07), absent days at school (β = .13, p= .28) were not significantly associated with SDQ total scores of the children. Similarly, average hemoglobin level (β = -.12, p= .35), duration of IDDM (β = -.67, p= .38), and age of onset (β = -.86, p= .32) did not explain any variance of the SDQ total score.

Table 20 Hierarchical Regression Models Predicting Reading Text Questions and Reading Time

Variables in Set	Reading Text Questions						Reading Time					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	2.36	3,65				.10	.86	3,65				.04
Absent days at school		65	.15	.02	.02			65	.66	.08	.08	
Age of child		65	2.66	.31	.31			65	1.45	.18	.18	
CDI Total Score		65	.10	.01	.00			65	-.09	-.01	-.01	
Step 2	.81	3,62				.03	.07	3,62				.00
Average Hemoglobin Level		62	-.69	-.08	-.07			62	-.21	-.03	.01	
Duration of IDDM		62	.99	.74	-.05			62	-.06	-.05	.08	
Age of Onset		62	1.12	.94	.25			62	-.13	-.11	.04	

Note. * $p<.05$, ** $p < .01$

Table 21 Hierarchical Regression Models Predicting Number of Words Read Correctly and Summation Scores

Variables in Set	Number of Words Read Correctly						Summation					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	14.44***	3,65				.40	.81	3,65				.04
Absent days at school		65	-.50	-.05	-.05			65	.46	.06	.04	
Age of child		65	6.53	.63***	.63			65	.67	.08	.09	
CDI Total Score		65	-.34	-.03	-.07			65	-1.34	-.17	-.16	
Step 2	.14	3,62				.00	.16	3,62				.01
Average Hemoglobin Level		62	.25	.03	.06			62	.57	.57	.11	
Duration of IDDM		62	-.07	-.04	.04			62	-.09	-.09	.07	
Age of Onset		62	.04	.94	.36			62	-.14	-.14	-.01	

Note. ** *$p < .001$

Table 22 Hierarchical Regression Models Predicting Number of Written Alphabet Letters and Mixed Letters Scores

Variables in Set	Number of Written Alphabet Letters						Mixed Letters					
	ΔF	*df*	*t*	*β*	pr	ΔR^2	*ΔF*	*df*	*t*	*β*	pr	ΔR^2
Step 1	.35	3,65				.02	2.51	3,65				.10
Absent days at school		65	-.72	-.09	-.08			65	-.38	-.05	-.06	
Age of child		65	.44	.05	.05			65	-2.66	-.31*	-.31	
CDI Total Score		65	.70	.09	.07			65	-.59	-.07	-.06	
Step 2	2.27	3,62				.10	1.13	3,62				.05
Average Hemoglobin Level		62	-1.43	-.18	-.21			62	-.09	-.10	.00	
Duration of IDDM		62	1.31	.99	-.18			62	-.36	-.27	.15	
Age of Onset		62	1.54	1.31	.22			62	-.65	-.54	-.33	

Note. ** $p < .01$

Table 23 Hierarchical Regression Model Predicting Reverse Letters Score

Variable in Set	*ΔF*	*df*	*t*	*β*	pr	*ΔR²*
Step 1	.35	3,65				.02
Absent days at school		65	-.72	-.09	-.08	
Age of the child		65	.44	.05	.05	
CDI total score		65	.70	.09	.07	
Step 2	2.28	3,62				.10
Average hemoglobin level		62	-1.43	-.18	-.21	
Duration		62	1.31	.99	-.18	
Age of Onset		62	1.54	1.31	.22	

Note. * $p < .05$; ** $p < .01$, *** $p < .001$

Table 24 Hierarchical Regression Model Predicting SDQ Total Score

Variable in Set	*ΔF*	*df*	*t*	*β*	pr	*ΔR²*
Step 1	1.98	3,65				.08
Absent days at school		65	1.09	.13	-.17	
Age of the child		65	.95	.11	-.32	
CDI total score		65	1.85	.22	-.03	
Step 2	.73	3,62				.03
Average hemoglobin level		62	-.95	-.12	-.23	
Duration		62	-.89	-.67	-.28	
Age of Onset		62	-1.01	-.86	.04	

Note. * $p < .05$; ** $p < .01$, *** $p < .001$

In summary, hierarchical multiple regression analyses were conducted in order to test the effect of IDDM-related variables on cognitive functioning, learning, and behaviors of the children. Absent days at school, age of the child, and CDI total score

were entered in the first step. In the second step, average hemoglobin level, duration of IDDM, and age of IDDM onset were entered into the regression equation. Regression analyses results did not reveal any significant effect of IDDM-related variables on cognitive functioning, learning, and behaviors of the children with insulin dependent diabetes. However, according to the results, age of the child was negatively associated with WISC-R information scores, and positively associated with mixed letters score, number of words read correctly, and number of alphabet letters written correctly. The results did also reveal a negative association between depression level and WISC-R arithmetic scores.

CHAPTER IV

DISCUSSION

The main purpose of the present study was to investigate the effect of IDDM on cognitive functioning, learning difficulties, and behavioral problems in children between the ages of 7 and 12. In order to examine this relationship more precisely, test scores of children with IDDM were compared with the scores of physically healthy children. As the metabolic control was suggested to be an important explanation for the negative effects of IDDM on children, another aim of the study was to examine the effects of metabolic control on cognition, learning, and behavior.

In the preceding sections of this chapter, first the findings will be stated. Second, the limitations of the present study will be presented. After presenting the practical implications of the findings, recommendations for further research will be discussed.

4.1 Discussion of the Main Findings

Considering main hypothesis of the present study, results are discussed under following headings: cognitive functioning, learning difficulties, and behavioral and emotional difficulties in children with IDDM.

4.1.1 Cognitive Functioning in Children with IDDM

The findings of the studies examining the intelligence quotients of the children with IDDM are contradicting each other. Several studies revealed that there is no

significant difference between general intelligence of children with and without IDDM (e.g. Hagen et al., 1990). On the other hand, other researchers stated that these had biased sampling from private hospitals (Holmes, O'Brien, & Greer, 1995). Ack, Miller, and Weil (1961) compared children with IDDM with their siblings on intelligence. Study findings indicated that children with early onset IDDM had significantly lower intelligence quotients than their siblings. In another study that examined the disrupted functioning in children with IDDM, diabetes-related risk factors such as metabolic control, illness duration, and age of onset found to be related to lower overall intelligence quotients (Holmes, Cant, Fox, Lampert, & Greer, 1999). Greer and Holmes (1996) did also suggest that most children with diabetes score four or five points lower than their peers. Consistent with these findings, the present findings suggested that as compared to the control group, WISC-R total scores of children with IDDM were lower.

Furthermore, in the current study, compared to children without IDDM, the WISC-R information and similarity scores of the children with IDDM were significantly lower. According to the WISC-R categorization of Kaufman (1975), information and similarities subtests are good predictors of the verbal ability. Considering this categorization, results of the current study revealed that the verbal skills of the children with IDDM were lower compared to the control group. Consistent with this result, several studies showed impaired verbal functioning in children with IDDM. According to the study of Hagen et al. (1990), children with IDDM scored lower on WISC-R vocabulary and information subtests. Authors suggested that low scores on information subtest might be an indicator of a deficiency in the verbal area of the brain. Kovacs, Goldston, and Iyengar (1992) conducted a longitudinal study to assess intellectual

development and academic performance of children with IDDM. Authors stated that in the initial diagnosis, school achievement, verbal performance, and nonverbal performance of the children with IDDM were in average levels. However, within 6-year period, school achievement and verbal performance of these children were decreased. This finding is also consistent with findings of the current study indicating a negative correlation between duration of IDDM and information subtest scores.

Results of the current study did also reveal significant correlations between metabolic control and WISC-R scores in children with IDDM. Weekly average number of hyperglycemia was negatively associated with information, similarities, arithmetic, vocabulary, and digit span subtest scores, as well as total verbal score. In addition, average hypoglycemia number in a week was negatively associated with similarities, comprehension, vocabulary scores, and total verbal score. According to Bannatyn's categories of WISC-R (1979), the subtests were categorized in three cognitive groups. First group, spatial ability, was consisted of picture completion, block design, and object assembly subtests. Similarities, vocabulary, and comprehension subtests were included in verbal conceptualization ability. Finally, arithmetic, digit span, and digit symbol were categorized in sequencing memory skills. Considering the categories of WISC-R, the current study findings revealed that frequent hyperglycemia might be associated with decreased verbal conceptualization ability of children with IDDM, as well as impaired memory. Similarly, average hypoglycemia frequency was found to have negative association with verbal abilities, as the children with IDDM had lower scores on vocabulary, similarities, and total verbal scores. Consistent with these findings, in a 7–year prospective study, Rovet and Ehrlich (1999) concluded that children with diabetes

who had hypoglycemic seizures scored lower on verbal learning tasks. Holmes (2004) examined the effect of hypoglycemia on adolescents with IDDM. The results of his study revealed that better metabolic control was associated with better memory skills. The author explained this memory impairment as being associated with disruption of hypoglycemia on the left hemisphere of the brain. According to Bannatyn's (1979) WISC-R categories, arithmetic, digit span, and digit symbol were predictors of memory skills. In current study, hyperglycemia was found to be negatively correlated with arithmetic and digit span subtest scores. Another predictor of metabolic control, average hemoglobin level, was also negatively associated with WISC-R digit span scores. That is to say, as compared to their peers, children with IDDM, who had poor metabolic control, scored lower on memory tasks..

Present study results showed that illness duration was negatively correlated with block design and object assembly scores. According to Bannatyn's (1979) categories of WISC-R, block design and object assembly subtests are predictors of spatial abilities. Thus, results of the present study indicated that longer duration of IDDM was associated with decreased spatial abilities. This result was in line with other studies in the literature. A study, in which children were followed for two-years (Northam, Anderson, Werther, Warne, Adler, & Andrews, 1998), revealed that spatial abilities are decreased after two years of duration. Rovet, Ehrlich, and Hoppe (1998) did also suggest that duration of IDDM predicted children's spatial abilities. According to Holmes, Cant, Fox, Lampert, and Greer (1999), the ability to acquire spatial information was the first area affected by IDDM, as early as the first year of diagnosis.

Regarding the effect of age of onset on the cognitive functioning of children with IDDM, the research findings are contradicting. Rovet, Ehrlich, and Hoppe (1988) compared children with early and late onset IDDM with their siblings on intellectual deficits. According to results, children with early onset IDDM scored lower on verbal ability compared to other groups. Hagen et al. (1990) stated that many children with late onset IDDM will be typified by the deficiency in the verbal area. In addition, early onset children were found to have less efficient use of strategies to organize and recall the information compared to the children with late IDDM onset. On the other hand, in contrast to majority of studies conducted on the effect of metabolic control, age of onset, and duration on cognitive functioning, the regression analysis in current study revealed no significant effect of these factors. A likely explanation for this absence of association may be the small sample size. Also, considering that they were entered in the regression equation in the second step, variables in the first step might have explained a big part of the variance.

Regression results of current study revealed that WISC-R information score was significantly predicted by the age of children with IDDM. In other words, older children were found to perform worse in information subtest compared to the younger children in IDDM sample. Similarly, Sansbury, Brown, and Meacham (1997) suggested that chronological age accounts for a significant amount of variance on cognitive functioning measures. This association between age and cognitive functioning in children with IDDM was suggested to be affected by absent days at school and missed information.

4.1.2 Learning Difficulties in Children with IDDM

The literature suggested that as compared to control group, more children with IDDM have learning problems, and they receive more formal diagnosis of LD (Holmes, Dunlap, Chen, & Cornwell, 1992). Similarly, in the current study, T-test results revealed significant differences between IDDM and control groups in Special Learning Disabilities Scale scores, as well as WISC-R scores.

According to the arithmetic skills assessment with Special Learning Disabilities Scale, all multiplication table scores were significantly higher in control group compared to scores of children with IDDM. Supporting this result, lower WISC-R arithmetic scores were found in IDDM group compared to their peers. In the literature, there are inadequate numbers of studies examining the effects of IDDM on arithmetic problems. Ryan, Longstreet, and Morrow investigated the effects of IDDM on the school achievement of adolescents. The results of their study showed that children with IDDM scored lower on arithmetic achievement tasks, as well as reading tasks, as compared to physically healthy children. Consistent with this finding of impaired reading ability in children with IDDM, in current study children with IDDM did also have lower reading skill scores in several areas compared to control group. Children with IDDM made more mistakes of spelling the words, adding letters to the words, skipping letters and syllables, and making up the words. In addition, compared to the children without IDDM, their reading time was longer. Children in control group read more words correctly, while the number of mistakes was higher in children with IDDM.

Learning disability is suggested to be concerned with the difficulty in associating the sounds with the symbols in reading and writing (Bannatyne, 1979). Especially the short vowels were stated to be confused, such as difficulties in discriminating between the words “pin,” “pan,” and “pen.” Also, children with learning difficulties will reverse the whole letter such as reading or writing “was” for “saw.” Mixing the letters like reversing “b” for “d” is another mistake that children with learning disabilities may experience. Consistent with this information, the current study revealed that children with IDDM had lower achievements in writing compared to physically healthy children. Children in IDDM sample made more mistakes in writing tasks such as skipping letters, reverse writing, mixing letters, punctuation mistakes, and mixing capital and small letters. Moreover, compared to their peers, children with IDDM wrote less alphabet letters correctly. Considering the common characteristics of children with learning disabilities, the results of the current study revealed that children with IDDM had difficulties in reading and writing, as well as arithmetic.

Dykman (1971) conducted a study in order to compare the WISC (Wechsler Intelligence Scale) performances of the children with and without learning disabilities. According to the results, children with specific learning disabilities scored lower than the control group on arithmetic, digit span, information, and similarities. In the present study, three of the subtests that were proposed to be related to learning disabilities (information, similarities, and arithmetic) were higher in children with IDDM than the control group. In other words, results of the current study revealed that children with IDDM had similar WISC-R patterns to the children with LD, which indicated higher risk

of learning difficulties in children with IDDM as compared to physically healthy children.

Poor metabolic control resulting in hypoglycemia was stated to be one of the main symptoms of diabetes that give rise to learning deficiencies (Holmes, O'Brien, & Greer, 1995). Consistent with this finding, current study revealed that frequent hypoglycemia is negatively correlated with some reading and writing tasks such as words read in one minute, reading time, and number of written alphabet letters. Hypoglycemia number was also positively associated with mixing capital and small letters, and mixing letters in writing. Consistent with the hypothesis, metabolic control was significantly associated with achievement in learning-related tasks.

4.1.3 Behavioral and Emotional Difficulties in Children with IDDM

There are few studies investigating the behavioral consequences of IDDM in children. In a comparison study of children with IDDM and their siblings, the results indicated that there were higher levels of behavioral problems in children with IDDM (McCarthy, Lindgren, Mengeling, Tsalikian, & Engvall, 2002). However, two groups did not differ on aggression/opposition, hyperactivity/inattention, depression/anxiety, and physical complaints. Children with IDDM differ from their siblings only on compliance, mood variability, and fatigue. Present study did also reveal that there is no significant difference between IDDM and control groups in SDQ that was used to assess conduct problems/hyperactivity, prosocial behavior, emotional symptoms, and inattention problems. On the other hand, correlational analyses indicated that poor adherence to IDDM was associated with higher SDQ scores, as well as increased CDI

scores. According to ANOVA results, children with high adherence to IDDM scored lower on SDQ compared to children with moderate and low adherence levels. In addition, children with no adherence to IDDM scored higher on CDI compared to their peers with low, moderate, and high adherence rates. In other words, poor metabolic control was found to have negative effect on behaviors and emotions of children with IDDM. However, there were no existing studies found that examined the association of adherence with the behavioral and emotional problems.

In conclusion, t-test results and correlation analysis in current study showed that children with IDDM may have cognitive functioning problems and learning difficulties in several domains. Children with IDDM were also found to be at risk of lower intellectual functioning as compared to the control group. These findings may be explained by the fact that childhood is a critical period for brain development (Rovet et al., 1988). IDDM was suggested to have negative effect on cognitive functioning in children, especially in memory, attention span, information processing speed, and visual-spatial skills (Holmes et al., 1999).

4.2 Limitations of the Present Study

The current study is not without its limitations. For the assessment of school achievement of the children, only parent reports were used. In order to have more reliable information on school achievement, it might be helpful to check the school reports of the children and/or make an interview with the teacher on children's achievements at school. In addition, Strengths and Difficulties Questionnaire was administered only to parents of the children. Behavioral problems would be more effectively assessed if SDQ was also administered to the teachers.

Insufficient glucose in blood is suggested to have negative effect on children's cognitive functioning, which may affect the assessments of intelligence and learning. WISC-R and Special Learning Disability Scale were administered to the children at different times of the day. Considering the possible decrease in blood glucose levels, researcher did not administer the tests at times close to children's lunch time, and new appointments were given after lunch. However, there might still be differences between levels of blood glucose at times the tests were administered. Therefore, a blood glucose test would be required to make sure that the glucose levels of the children were in normal ranges before administering the questionnaires.

In the present study, the demographics such as age, sex, SES, parental education, and marital status of the parent were similar in IDDM and control groups, which lead reliable comparison of the two samples. However, it must be noted that the IDDM and control samples were representing children only from low SES. Thus, it may not be possible to generalize the results to the children from other socioeconomic statuses.

4.3 Implications for Practice

IDDM is the most common endocrine disease in childhood. Growing number of studies revealed deficits in learning and cognitive functioning problems among children with IDDM (Holmes, O'Brien, & Greer, 1995; Holmes et al., 1999). In addition, several authors suggested that that IDDM has negative impact on behaviors in children (i.e. Northam, Matthews, Anderson, Cameron, & Werther, 2004). However, inadequate numbers of research conducted worldwide in order to examine the relationship between IDDM and the cognitive functioning deficiencies, learning difficulties, and behavioral

problems in children. Furthermore, there is no study in Turkey that investigated the effect of IDDM on children, or the possible reasons of this impact.

The present study investigated the effect of IDDM on cognitive functioning, learning, and behaviors in children. It was revealed that as compared to children without IDDM, the children with IDDM had lower scores on several writing, reading, and arithmetic related learning tasks. In addition, as compared to physically healthy children, the children with IDDM showed lower scores on some WISC-R subtests, as well as scoring lower on overall intelligence quotient. Furthermore, children with IDDM who had poor metabolic control showed higher levels of behavioral and emotional problems than the control sample. Therefore, it is possible to conclude that IDDM does not only affect the physical well being of the children, but it may also have important implications on cognitive functioning, learning, and emotional and behavioral well being of children. The findings of the current study revealed that good metabolic control was associated with better cognitive functioning and learning, as well as lower levels of behavioral problems and depression. According to Gatchel and Oordt (2003), diabetes education should be an important part of diabetes treatment. In order to minimize the possible complications, children with IDDM should be assisted to understand the disease, its complications, and methods of good metabolic control. Thus, parents, teachers, and health care providers should be aware of possible impact of IDDM in children, and help them to take necessary action to control their blood glucose levels. In addition, the present study underscored the need for ongoing monitoring of the cognitive functioning, learning difficulties, and behavioral problems in children with IDDM.

4.4 Suggestions for Future Research

Future research would benefit from longitudinal studies that could provide more information on the predicting factors of cognitive functioning, learning, and behaviors in children with IDDM. Duration of IDDM was proposed by several researchers to have negative impact especially on cognitive functioning in children (e.g. Sansbury, Brown, & Meacham, 1997). Longitudinal studies would be more effective to examine the possible negative changes in cognitive functioning, learning, and behaviors of children with IDDM, as the duration of illness increases.

Previous studies suggested that school absence may have negative influence on the cognitive functioning and learning of children with IDDM (i.e. Ryan, Longstreet, & Morrow, 1985). Therefore, in the present study absent days at school was controlled in order to examine the effect of duration and onset on the proposed difficulties children with IDDM may experience. However, considering that as compared to children without IDDM, children with IDDM have significantly higher rates of absenteeism (Glaab, Brown, & Daneman, 2004), the impact of absent days at school on cognitive functioning and learning would be investigated in more details in the future researches.

In the present study, the number of absent days at school was significantly higher in children with IDDM compared to their peers. Even though the regression analysis did not reveal a significant effect of absences on cognitive functioning and learning, it may be important to consider the educational and cognitive implications that may result from frequently missed classes. Baird and Ashcroft (1984) stated the need to find solutions for the negative impact of school absences on academic experiences and learning of the chronically ill children. Authors suggested that hospital school programs are the most efficient and applicable means of providing education for these children. However, this

important need of chronically ill children is only met in a few children's hospitals in Turkey. The number of elementary schools at the hospitals was only 26 in 2002 (Kılıç, 2003). In the study of Kılıç (2003), 61.22% of the children who continued their education in hospital schools stated that they were able to catch up with their school works by the help of hospital schools. The effects of the present hospital schools on cognitive functioning, learning, and behavioral and emotional problems in chronically children would be examined in future research. Research results related to the effectiveness of the hospital schools will lead the government and health care providers to take appropriate actions in order to decrease the possible negative impact of school absences in children with chronic illnesses.

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APPENDICES

APPENDIX A

Demografik Bilgi Formu

Formu dolduran kişi: ( ) Anne ( ) Baba

1. Adınız soyadınız:.....

2. Yaşınız: .....

3. Eğitim Durumunuz:

( ) 1. Okur-yazar ( ) 2. İlkokul mezunu ( ) 3. Ortaokul mezunu

( ) 4. Lise ve dengi okul mezunu ( ) 5. Üniversite veya yüksek okul mezunu

( ) 6. Yüksek lisans ve üstü

4. Medeni durumunuz:

( ) 1. Evli ve eşiyle yasıyor ( ) 3. Dul ( ) 2. Boşanmış ( ) 2. Boşanmamış, ayrı yaşıyor

5. Boşanmış veya eşinizden ayrı yaşıyor iseniz çocuğunuz kiminle yaşıyor?

( ) Anne ( ) Baba ( ) Diğer ……..

6. Kaç çocugunuz var? …….

7. Aşağıda çocuklarınızın cinsiyet ve yaşını belirtiniz.

1. Çocuk: Cinsiyet ( ) Kız ( ) Erkek Yaşı:…….

2. Çocuk: Cinsiyet ( ) Kız ( ) Erkek Yaşı:…….

3. Çocuk: Cinsiyet ( ) Kız ( ) Erkek Yaşı:…….

4. Çocuk: Cinsiyet ( ) Kız ( ) Erkek Yaşı:…….

8. Aylık eve giren para miktarı ne kadardır?

( ) 500 milyondan az ( ) 500 milyon-1 milyar arası ( ) 1 milyar – 1,5 milyar arası

( ) 1,5 milyar – 2 milyar arası ( ) 2 milyar ve üstü

9. İş: ( ) 1. Çalışmıyorum ( ) 2. Çalışıyorum ( ) 3. Diğer (Belirtiniz).....

10. Ne tür bir işte çalışıyorsunuz? ( ) 1. Serbest ( ) 3. İşçi ( ) 2. Memur

( ) 4. Emekli ( ) Ev Hanımı

11. Mesleğinizi belirtiniz:.....

12. Diğer Ebeveynin Yaşı: .....

13. Diğer Ebeveynin Eğitimi: ( ) 1. Okur-yazar ( ) 2. İlkokul mezunu

( ) 3. Ortaokul mezunu ( ) 4. Lise ve dengi okul mezunu

( ) 5. Üniversite veya yüksek okul mezunu ( ) 6. Yüksek lisans ve Üstü

14. Diğer Ebeveynin İş Durumu: ( ) 1. Serbest ( ) 3. İşçi ( ) 2. Memur

( ) 4. Emekli ( ) Ev Hanımı

15. Çocuğunuz daha önce ruhsal (psikolojik) bir rahatsızlık geçirdi mi?

( ) Evet (rahatsızlığın ne olduğunu belirtiniz) …….

( ) Hayır

16. Geçirdiyse tedavi gördü mü? ( ) Evet – İlaç tedavisi ( ) Evet – Terapi ( ) Hayır

Tedavisi devam ediyor mu? ( ) Evet ( ) Hayır

17. Çocuğunuzun önemli fiziksel bir rahatsızlığı var mı?

( ) Evet…….(Rahatsızlığın ne olduğunu belirtiniz) ( ) Hayır

18. Çocuğunuz hiç sınıfta kaldı mı? ( ) Evet ( ) Hayır

Kaldıysa kaçıncı sınıfta/sınıflarda kaç kere kaldı? ……..

19. Çocuğunuzun ders başarısını nasıl değerlendiriyorsunuz?

( ) Çok kötü ( ) Kötü ( ) Orta ( ) İyi ( ) Çok iyi

20. Çocuğunuzun zayıf olduğunu düşündüğünüz dersler (varsa) hangileri ve genellikle bu derslerden 5 üzerinden kaç alıyor?

1. Ders adı: …… Notu: ……..

2. Ders adı: …… Notu: ……..

3. Ders adı: …… Notu: ……..

4. Ders adı: …… Notu: ……..

21. Çocuğunuz bir dönem boyunca ortalama kaç gün okula gitmiyor/gidemiyor?

….. gün

22. Evde veya yakın çevrede çocuğunuza ders çalıştıran biri var mı?

( ) Evet ( ) Hayır

Cevabınız evet ise uygun olanları işaretleyiniz (birden fazla işaretleme yapılabilir);

( ) Zorlandığı konularda yardımcı olunuyor

( ) Her gün okulda işlediği konulara birlikte bakılıyor

( ) Soru sorduğu zaman yardımcı olunuyor

( ) Ödevleri kontrol edilip yapamadıklarına tekrar bakılıyor

23. Çocuğunuz kreşe ve/veya anaokuluna gitti mi? ( ) Hiçbirine gitmedi

( ) Anaokuluna gitti ( ) Kreşe gitti ( ) Her ikisine de gitti

24. Çocuğunuz spor yapıyor mu?

( ) Hayır

( ) Evet, düzenli olarak spor yapıyor. Haftada kaç kere yaptığını belirtiniz: …….

( ) Evet, ara sıra spor yapıyor.

Bu kısım yalnızca diyabet hastalığı olan çocukların ebeveynleri tarafından doldurulacaktır

25. Çocuğunuzun diyabet hastalığı kaş yaşında başladı? ……..

26. Çocuğunuza günde kaç defa kan şekeri kontrolü yapılıyor? ……

27. Çocuğunuza insülin iğnesi yapılma sıklığı nedir? ……..

28. Çocuğunuz daha önce hastanede yattı mı? ( ) Evet ( ) Hayır

29. Çocuğunuz daha önce hastanede yattıysa;

Nedeni……..

Hastanelerin adlarını…….

Yatış tarihleri…….

Hastanede kalış süreleri ……..……

30. Ailede veya akrabalar arasında diyabet hastalığı olan başka biri var mı?( ) Evet ( ) Hayır

Varsa kim olduğunu işaretleyiniz;

( ) Anne ( ) Amca ( ) Kuzen ( ) Hala ( ) Baba ( ) Dayı ( ) Teyze

( ) Ağabey Yaş: Hastalığın başlangıç yaşı: …

( ) Abla Yaş:… Hastalığın başlangıç yaşı: ……

( ) Erkek kardeş. Yaş: ….. Hastalığın başlangıç yaşı: ……

( ) Kız kardeş Yaş: ….. Hastalığın başlangıç yaşı: ……

31. Çocuğunuzda haftada kaç kez hipoglisemi görülüyor?

( ) 5 kere ( ) 4 kere ( ) 3 kere ( ) Hiç görülmüyor ( ) Diğer: ……

32. Çocuğunuzda haftada kaç kez hiperglisemi görülüyor?

( ) 5 kere ( ) 4 kere ( ) 3 kere ( ) Hiç görülmüyor ( ) Diğer: ……

33. Çocuğunuz doktor tarafından belirlenen beslenme tavsiyelerine ne kadar uyuyor?

( ) Hiç uymuyor ( )Bazen uyuyor ( )Genellikle uyuyor ( ) Tamamen uyuyor

APPENDIX B

Çocuklar için Depresyon Ölçeği

Aşağıda gruplar halinde bazı cümleler yazılıdır. Her gruptaki cümleleri dikkatlice okuyunuz. Her grup içinden, bu gün de dahil olmak üzere, son iki haftadır yaşadıklarınızı en iyi şekilde tanımlayan cümleyi seçip, yanındaki numarayı daire içine alınız.

A 0.Kendimi arada sırada üzgün hissederim

1. Kendimi sık sık üzgün hissederim.

2.Kendimi her zaman üzgün hissederim.

B 0.İşlerim hiçbir zaman yolunda gitmeyecek.

1.İşlerimin yolunda gidip gitmeyeceğinden emin değilim.

2.İşlerim yolunda gidecek.

C 0.İşlerimin çoğunu doğru yaparım.

1.İşlerimin çoğunu yanlış yaparım.

2.Her şeyi yanlış yaparım.

D 0.Bir çok şeyden hoşlanırım.

1.Bazı şeylerden hoşlanırım.

2.Hiçbir şeyden hoşlanmam.

E 0.Her zaman kötü bir çocuğum.

1.Çoğu zaman kötü bir çocuğum.

2.Arada sırada kötü bir çocuğum.

F 0.Arada sırada başıma kötü bir şeylerin geleceğini düşünürüm.

1.Sık sık başıma kötü şeylerin geleceğinden endişelenirim.

2.Başıma çok kötü şeylerin geleceğinden eminim.

G 0.Kendimden nefret ederim.

1.Kendimi beğenmem.

2.Kendimi beğenirim.

H 0.Bütün kötü şeyler benim hatam

1.Kötü şeylerin bazıları benim hatam.

2.Kötü şeyler genellikle benim hatam değil.

I 0.Kendimi öldürmeyi düşünmem.

1.Kendimi öldürmeyi düşünürüm ama yapamam.

2.Kendimi öldürmeyi düşünüyorum.

İ 0.Her gün içimden ağlamak gelir.

1.Bir çok günler içimden ağlamak gelir.

2.Arada sırada içimden ağlamak gelir.

J 0.Her şey her zaman beni sıkar.

1.Her şey sık sık beni sıkar.

2.Her şey arada sırada beni sıkar.

K 0.İnsanlarla beraber olmaktan hoşlanırım.

1. Çoğu zaman insanlarla birlikte olmaktan hoşlanmam.

2. Hiçbir zaman insanlarla birlikte olmaktan hoşlanmam.

L 0.Her hangi bir şey hakkında karar verememem.

1.Her hangi bir şey hakkında karar vermek zor gelir.

2.Her hangi bir şey hakkında kolayca karar veririm.

M 0.Güzel / yakışıklı sayılırım.

1.Güzel / yakışıklı olmayan yanlarım var.

2.Çirkinim.

N 0.Okul ödevlerimi yapmak için her zaman kendimi zorlarım.

1.Okul ödevlerimi yapmak için çoğu zaman kendimi zorlarım.

2.Okul ödevlerimi yapmak sorun değil.

O 0.Her gece uyumakta zorluk çekerim.

1.Bir çok gece uyumakta zorluk çekerim.

2.Oldukça iyi uyurum.

Ö 0.Arada sırada kendimi yorgun hissederim.

1.Bir çok gün kendimi yorgun hissederim.

2.Her zaman kendimi yorgun hissederim.

P 0.Hemen her gün canım yemek yemek istemez.

1.Çoğu gün canım yemek yemek istemez.

2.Oldukça iyi yemek yerim.

R 0.Ağrı ve sızılardan endişe etmem.

1.Çoğu zaman ağrı ve sızılardan endişe ederim.

2.Her zaman ağrı ve sızılardan endişe ederim.

S 0.Kendimi yalnız hissetmem.

1.Çoğu zaman kendimi yalnız hissederim.

2.Her zaman kendimi yalnız hissederim.

Ş 0.Okuldan hiç hoşlanmam.

1.Arada sırada okuldan hoşlanırım.

2.Çoğu zaman okuldan hoşlanırım.

T 0.Birçok arkadaşım var.

1.Birkaç arkadaşım var ama daha fazla olmasını isterdim.

2.Hiç arkadaşım yok.

U 0.Okul başarım iyi.

1.Okul başarım eskisi kadar iyi değil.

2.Eskiden iyi olduğum derslerden çok başarısızım.

Ü 0.Hiçbir zaman diğer çocuklar kadar iyi olamıyorum.

1.Eğer istersem diğer çocuklar kadar iyi olurum.

2.Diğer çocuklar gibi iyiyim.

V 0.Kimse beni sevmez.

1.Beni seven insanların olup olmadığından emin değilim.

2.Beni seven insanların olduğundan eminim.

Y 0.Bana söyleneni genellikle yaparım.

1.Bana söyleneni çoğu zaman yaparım.

2.Bana söyleneni hiçbir zaman yapmam

Z 0.İnsanlarla iyi geçinirim.

1.İnsanlarla sık sık kavga ederim.

2.İnsanlarla her zaman kavga ederim.

APPENDIX C

GÜÇLER VE GÜÇLÜKLER ANKETİ (SDQ-Tur)

Her cümle için, Doğru Değil, Kısmen Doğru, Tamamen Doğru kutularından birini işaretleyiniz. Kesinlikle emin olamasanız ya dasize anlamsız görünse de elinizden geldiğince tüm cümleleri yanıtlamanız bize yardımcı olacaktır. Lütfen yanıtlarınızı çocuğunuzun son 6 ay içindeki davranışlarını göz önüne alarak veriniz.

Çocuğunuzun Adı: .....
Kız / Erkek
Doğum Tarihi: .....

	Doğru	**Kısmen Doğru**	**Kesinlikle Doğru**
Diğer insanların duygularını önemser.	□	□	□
Huzursuz, aşırı hareketli, uzun süre kıpırdamadan duramaz.	□	□	□
Sıkça baş ağrısı, karın ağrısı ve bulantıdan yakınır.	□	□	□
Diğer çocuklarla kolayca paylaşır. (yiyecek, oyuncak, kalem v.s.)	□	□	□
Sıkça öfke nöbetleri olur yada aşırı sinirlidir.	□	□	□
Daha çok tek başınadır, yalnız oynama eğilimindedir.	□	□	□
Genellikle söz dinler, erişkinlerin isteklerini yapar.	□	□	□
Birçok kaygısı vardır. Sıkça endişeli görünür.	□	□	□
Eğer birisi incinmiş, morali bozulmuş yada kendini	□	□	□

kötü hissediyor ise ona yardımcı olur.			
Sürekli elleri ayakları kıpır kıpırdır yada oturduğu yerde kıpırdanıp durur.	□	□	□
En az bir yakın arkadaşı vardır.	□	□	□
Sıkça diğer çocuklarla kavga eder yada onlarla alay eder.	□	□	□
Sıkça mutsuz, kederli yada ağlamaklıdır.	□	□	□
Genellikle diğer çocuklar tarafından sevilir.	□	□	□
Dikkati kolayca dağılır. Yoğunlaşmakta güçlük çeker.	□	□	□
Yeni ortamlarda gergin yada huysuzdur. Kendine güvenini kolayca kaybeder.	□	□	□
Kendinden küçükler iyi davranır.	□	□	□
Sıkça yalan söyler yada hile yapar.	□	□	□
Diğer çocuklar ona takarlar yada onunla alay ederler.	□	□	□
Sıkça başkalarına (anne baba, öğretmen, diğer çocuklar) yardım etmeye istekli olur.	□	□	□
Bir şeyi yapmadan önce düşünür.	□	□	□
Ev,okul yada başka yerlerden çalar.	□	□	□
Erişkinlerle çocuklardan daha iyi geçinir.	□	□	□
Pek çok korkusu var. Kolayca ürker.	□	□	□
Başladığı işi bitirir, dikkat süresi iyidir.	□	□	□