

## HEALTH AND NUTRITION LITERACY LEVELS AFFECT DIABETES MELLITUS MANAGEMENT

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### Abstract

World Health Organization - WHO has defined health literacy as: "Health literacy represents the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health". Nutrition literacy, which is parallel to the term of health literacy, could be defined as the capacity to learn, understand and practice nutrition information and skills needed to make suitable nutrition decisions.

Low levels of health and nutrition literacy are associated with poorer use of health care services, poorer health status, failure to comply with medical instructions or suggestions, failure in the management of chronic diseases, lack of self-care, more hospitalizations, increasing in health expenditures and higher mortality rates. Diabetes is complex situation that need participation of patient in disease treatment. Diabetes self-care which comprising carbohydrate counting, regular physical activity, monitoring of blood glucose and use of drug/insulin require to understand and practice complex health information. However, this self-care skills require adequate health and nutrition literacy. A study which conducted with 1399 participants with type 1 diabetes is demonstrated that higher levels of health literacy are associated with lower HbA1c level. Another study which is including 778 patients with type 2 diabetes showed that sufficient health literacy level is associated with increased good self-rated health of participants. In addition, mentioned study is demonstrated that sufficient health literacy is associated with decreased hospitalizations because of diabetes and its related complications.

In the view of such information, the education which involving health and nutrition literacy in treatment of diabetes and in prevention of its complications is important. Dietitians and other health professionals should evaluate level of health and nutrition literacy

level in patients with diabetes and then accordingly determine the content of nutrition education for effective treatment and control of diabetes.

**Key words:** Health literacy, Nutrition literacy, Diabetes mellitus, Glycemic control, Nutrition treatment.

### 1. Introduction

Patients should take part in treatment processes actively for successful management of diseases. Prognosis of the disease is greatly influenced by patient compliance to treatment, especially in the chronic diseases (Duruşu-Tanrıöver *et al.*, [1], Gazmararian *et al.*, [2]). Patients' adherence and maintenance of treatment is only possible by understanding and applying the treatment, education, and recommendations correctly. At this point, the term of "health literacy" was first proposed by Scott Simonds in 1974. The term of "health literacy" has been defined by many health authorities. It is defined by the Institute of Medicine (IOM) in 2004, [3], as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions". Based on this definition, participation of the patient in the treatment of chronic diseases is thought to be possible by increasing the level of health literacy. In addition to this, the term of "nutrition literacy" which is recently taken place in literature, is an important factor in the management of diseases which is particularly requiring medical nutrition therapy (such as: diabetes, metabolic syndrome, obesity, and end-stage renal failure).

Low levels of health and nutrition literacy are associated with: poorer use of health care services, poorer health status, failure to comply with medical instructions or

suggestions, failure in the management of chronic diseases, lack of self-care, more hospitalizations, increasing in health expenditures and higher mortality rates. Diabetes is complex situation that need participation of patient in disease treatment. Diabetes self-care which is comprised by: carbohydrate counting, regular physical activity, monitoring of blood glucose and use of drug/insulin, require to understand and practice complex health information. However, this self-care skills require adequate health and nutrition literacy. A study which conducted with 1,399 participants with type 1 diabetes is demonstrated that higher levels of health literacy are associated with lower HbA1c level (Olesen *et al.*, [4]). Another study which is including 778 patients with type 2 diabetes showed that sufficient health literacy level is associated with increased good self-rated health of participants. In addition, mentioned study demonstrated that sufficient health literacy is associated with decreased hospitalizations because of diabetes and its related complications (Doubova *et al.*, [5]).

The aim of this review is to provide information about the terms of health literacy and nutrition literacy as well as to emphasize the importance of health literacy and nutrition literacy level in the management of diabetes.

## 2. Definition and assessment of health literacy

Literacy is defined by United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2004, [6], as: "the ability to identify, understand, interpret, create, communicate and compute, using different types of printed and written materials". These abilities enable individuals to participate completely in society, to achieve their personal goals by improving their knowledge and strength. In addition to these abilities also involve the continuous learning. As understood from the definition, literacy is not only a reading and writing skill, but also a complex process of understanding, comprehension, processing and implementation of what has been read (Yalçın Balçık *et al.*, [7]).

The term of health literacy was first defined by Scott Simonds in 1974 in a study called "Health Education as Social Policy" (Simonds, [8]). In this study minimum standards of health literacy were determined at all school levels (Selden *et al.*, [9]). However, its widespread use in the literature started after the National Assessment of Adult Literacy (NAAL) study in America in 2003 (Egbert and Nanna, [10]).

Awareness of the relation between health and literacy is increasing nowadays. Studies and interventions about this relation have examined literacy not only as a means of reading information, but also as an ability to implement knowledge (Pignone *et al.*, [11], Coulter

and Ellins, [12], and Rootman and Gordon-El-Bihbety, [13]). Being literate does not mean that having only the adequate level of health literacy. Health literacy also includes listening, speaking and conceptual knowledge (Sezgin, [14]).

World Health Organization in 2013, [15], defined the health literacy as: "the motivation and ability of individuals to understand health related information and messages, to decide on issues related to health services, access to health-related information resources, so as to maintain and improve their health and the quality of life". In general, health literacy is described as the motivation and ability of individuals to access, read and understand information about health and health protection, and making right decision and implementing them to improve the quality of life (Bilir, [16], Sorensen *et al.*, [17]). In addition, health literacy includes the ability to access and uses the right information and services in order to improve not only the health of the individual, but also the health of society. Thus, the lifestyle can be changed and the effects on the health of the individual and society increase (Mancuso, [18]). For the quality healthcare, patients should be able to explain and speak about their complaints correctly, to ask questions about the issue and to understand the medical recommendations. The inadequate health literacy level adversely affects these requirements and affect people both individually, socially and culturally, as well as cause to misimplementation of treatment, health deterioration and increase in health expenditures (Sezgin, [14], Rudd *et al.*, [19]).

Health literacy may be influenced by the level of basic literacy, individual characteristics, disease experiences and factors related to: healthcare system, demographic, cultural, psychological and social characteristics (Sorensen *et al.*, [17]). Basic literacy is an important factor in determining the level of health literacy, but it does not mean there is adequate health literacy level (Australian Commission on Safety and Quality in Health Care, [20]). The studies in this direction has shown that the individuals who are literate may be inadequate in health literacy (Gazmararian *et al.*, [21], Pelikan *et al.*, [22]).

Individual characteristics include: memory, interpretation, visual, hearing, speaking skills and physical, social, and cognitive skills (Sorensen *et al.*, [17]). Disease experiences include: duration and type of disease, complexity of treatment, severity of the disease, complication and other disease situations (Inoue *et al.*, [23], Berkman *et al.*, [24]). The factors related to health care system include: the level of access to health care, the complexity of healthcare system, health insurance and the relationship between healthcare professionals and patients (Kanj and Mitic, [25]). Examining the relation between demographic characteristics and health literacy, it is known that the level of health literacy is lower in the elderly, women, singles, and ones with low

education level and low income (Paasche-Orlow *et al.*, [26], Cho *et al.*, [27], and Morris *et al.*, [28]). However, according to Centers for disease control and prevention (CDC) from 2009, there is no direct relation between the level of health literacy and the education level of the individual. The psychosocial factors affecting health literacy consist of self-sufficiency, social support and understanding of the health problems (Ussher *et al.*, [29]).

Inadequate and problematic health literacy levels may lead to various problems. These problems include as follows: the use of preventive health services at low rates, delay in checking in the healthcare organization, the lack of poor health awareness, the failure to follow medical recommendations, inadequate self-care, and even increase in mortality (Tokuda *et al.*, [30], Uğurlu [58]), more unhealthy life (Berkman *et al.*, [24]), failure in the chronic diseases management of (Gazmarian *et al.*, [2], Williams *et al.*, [31], and Bailey *et al.*, [32]), increased hospitalization (Baker *et al.*, [33]), and the increase in health expenditures (Weiss and Palmer, [34]). These results show how important it is to increase the health literacy level of individuals.

In Turkey's Health Literacy Survey from 2014, 4,924 participants with mean age of 41.4 year has replied to Health Literacy Survey-Europe (HLS-EU) scale. As a result of this survey, 64.6% of the population were found to be in "inadequate" (24.5%) or "problematic" (40.1%) health literacy level (Durusu Tanriöver *et al.*, [1]). HLS-EU scale was applied to the participants in the European health literacy survey involving 7,795 participants in eight countries. As a result of the survey, 12% (1 out of 10 people) of the participants were found to have inadequate health literacy, and 47% (1 out of 2 people) were found to have inadequate or problematic health literacy levels (Sorensen *et al.*, [35]).

The studies are carried out to determine and to standardize the level of health literacy (Baker, [36], McCormack *et al.*, [37], and Ishikawa *et al.*, [38]). However, the ideal way to evaluate this level has not determined yet. Additionally, there are many different opinions as well as different definitions (Sezgin, [14], Thompson, [39]).

Most commonly used scales which prioritize reading and comprehension status of individuals are "Rapid Estimate of Adult Literacy in Medicine - REALM" (Gwynn *et al.*, [40]) and "The Test of Functional Health Literacy in Adults - TOFHLA" (Parker *et al.*, [41], Baker *et al.*, [42]). There are also following tests: "Newest Vital Sign Test - NVS (McCormack *et al.*, [37])", "Health Activities Literacy Scale - HALS", "The eHealth Literacy Scale - eHEALS" (Ishikawa *et al.*, [38]), "The Mini-Mental State Examination - MMSE", "The Wide-Range Achievement Test - WRAT-3", "The Medical Terminology Achievement Test - MART", "One-or Two Question Tests", and "The Slosson Oral Reading Test-Revised - SOFT-R" (Thompson,

[39]). When considered the differences of these tests, all these measurement tools are evaluated to the four main dimensions as: word recognition, reading comprehension, functional health literacy and informal tests (Peiravian *et al.*, [43]).

Considering the importance of health literacy, the efficiency and reliability of these tests have not been fully established; so, there is a need the standardized tests and screening tools which are highly-reliable, easy to use and easy-to-understand for all age groups and genders.

## 2.1 Nutrition literacy and affecting factors

Nutrition literacy can be defined as the stage in which individuals learn and apply of basic nutrition information and make aware decisions about nutrition (Silk *et al.*, [44], Gibbs, [45]). It is also expected that an individual with the adequate level of nutritional literacy will be knowledgeable about food preparation and cooking techniques (Gibbs and Chapman-Novakofski, [46]).

Health literacy is not paying the necessary attention to the nutrition literature yet. In order for the nutrition education to be effective and to be understood the nutrition recommendations by individuals, it is necessary to take into consideration the individual's level of health literacy by the dietitians. Planning of the nutrition education content in this context will be beneficial. Practical, easy-to-understand, short, and rapid measurement tests are required for dietitians to measure health literacy and nutritional literacy of patients. However, due to the reason that present health literacy tests are not adequate, their use in measuring nutrition literacy will not be accurate (Keser and Çiracioglu, [47]).

Education level is one of the main factors affecting the health and nutrition literacy of individuals. The education in health protection and improvement is essential for nutrition which is an important area of healthcare (Gibbs and Chapman-Novakofski, [48]). Increase in chronic diseases with the inadequate and unbalanced nutrition is ascending and this situation shows the importance of nutrition education. However, nutritional information may be complex for some individuals as it requires cognitive and social skills (Gibbs and Chapman-Novakofski, [46]).

The ability of individuals to read, understand and comprehend health materials is far beyond their literacy skills (Macario *et al.*, [49]). In a study, it was found that overweight and obese individuals had lower nutritional literacy level than individuals with normal weight (Gibbs and Chapman-Novakofski, [48]). In another study, it was found that having knowledge had positive effects on nutritional behaviors and the children whose mothers had adequate nutritional knowledge of had more balanced nutrition (Blaylock *et al.*, [50]). The theory of

“Knowledge-Attitude-Behavior Model” proposed by Bettinghaus in 1986 supports the results of these studies. Based on this theory and these studies, it is possible to say that nutritional attitudes change positively with the increase of knowledge (Bettinghaus, [51]).

Income level is the other factor affecting the nutrition of individuals. Individuals with low levels of education and income were reported to be unhealthier than those with higher levels of education and income (Silk *et al.*, [44]). Individuals with low levels of education and income have failed in purchasing, preparing, and consuming healthy food more than individuals with high socioeconomic level. These individuals were also at risk of malnutrition in pregnancy and lactation and at risk of growth and developmental delay in childhood. For example, in a group with low socioeconomic status, the rate of only breastfeeding for the first six months was found to be lower (Queensland Public Health Forum, [52]).

From this information, it can be said that when what should be done for increasing health and nutrition literacy level has importance for everyone, but it has even more important for the people with low levels of income and education (Keser and Çiracıoğlu, [47]).

Other factors that affect health and nutrition literacy are technology and media. Low level of health literacy and the problems on accessing correct knowledge about health cause use of technological interactive tools. This situation has raised ‘e-health’ applications (Collins *et al.*, [53]). Beside of especially low health, numeracy and literacy level, individuals have difficulty to understand to read food labels, while people with high level of literacy tend to read newspapers and journals for information since food labels do not include enough information about ingredients. When researchers in United States realized that materials and messages did not reach to targeted audiences, they used strategy which is called ‘edutainment’. It aims to increase awareness and knowledge of health problems via fun materials such as songs, shows and games. While the media has important role for spreading these materials, more place needs to be allocated for nutrition literacy (Silk *et al.*, [44]).

World Health Organization in 2014, [54], defined e-health as: “use of information and communication technologies in order to provide low cost and security by supporting health care in health and health related areas, health literacy, health education and health surveillance”. Electronic health applications support the communication between healthcare providers and patients through websites, mobile phones, technological home care and telehealth practices. These applications allow the patient to strengthen their knowledge and manage their own health. Such approaches also contribute to digital health literacy. Digital health literacy

makes it possible to reach and understand health information through a person’s mobile phones. Recently, the importance of digital health literacy has increased with the ease of internet access and increased use of smart phones (Nilsen *et al.*, [55]).

When the literature is examined, in some studies, data collection tools such as “The Newest Vital Sign - NVS” and “Nutrition Literacy Scale - NLS” were used to measure the level of nutrition literacy. However, The Newest Vital Sign is thought to be a test to measure the level of health literacy, although it contains substances related to some food labels (Weiss *et al.*, [56]).

In a study conducted in the United States, the aim was only to develop a data collection tool to measure nutritional literacy, and for that, support from dieticians was asked. According to the type of nutrition treatment, it has been observed that the knowledge and skills required have changed. For instance the conceptual knowledge of macro nutrient and ability to estimate the servings of nutrients with basic mathematics knowledge are needed for the treatment of diabetes. Considering this data, Nutrition Literacy Assessment Instrument - NLAI was developed (Gibbs, [45]).

NLAI is designed to assess print literacy about nutrition, mathematical skill and ability to apply nutritional knowledge and skills. It has been found that this scale is valid and reliable in adults with chronic disease who are receiving primary care (Gibbs *et al.*, [57]).

## 2.2 Role of health and nutrition literacy in the prevention and treatment of chronic diseases

Nowadays, participation of the patient in the treatment is quite important for the successful management of the diseases in health services. Especially in chronic diseases where the disease process is predominantly dependent on adaptation of patients. Health professionals (doctors, dieticians, nurses, etc.) are expecting from these patients to know and understand treatment and care processes and to apply the suggestions [Durusu- Tanrıöver *et al.*, [1], Gazmararian *et al.*, [2]]. For these reasons, health and nutrition literacy levels of individuals with chronic disease or diseases are gaining importance.

As it was said before, inadequate and limited health literacy levels can lead to various problems. Adequate level of health literacy is required for establishing dialogue and discussion, being able to read health information, interpret tables, use medical tools (such as thermometer) in health care of individual or family member, to calculate the time and dose of the drug correctly, etc. (Institute of Medicine, [3]). As the health literacy level improved, it is stated that the health of individuals is also affected positively (Pelikan *et al.*, [22]). 220 research articles between 1948 - 2012 were

examined and there was a positive correlation between health literacy level and treatment compliance (Miller, [59]). Poor health literacy is associated with: problems in the use of health services and compliance with medical recommendations, poor health of the patient, insufficiency in self-care, delay in health-seeking behavior, increase in health expenses and mortality rates (Tokuda *et al.*, [30]). According to the study of Zarcodoolas *et al.*, [60], inadequate health literacy may lead to: misuse of drugs, pointless or improper use of health services, poor self-management in chronic diseases, inadequate intervention in emergencies, poor health outcomes, lack of self-sufficiency and confidence, financial difficulties on the individual and society and social inequality. In addition, patients with inadequate health literacy are more likely to be hospitalized than those with adequate health literacy (Aslantekin and Yumrutaş, [61]). In the United States, a study was conducted to determine the effect of inadequate health literacy level on patients and doctors and to define the methods and research subjects that need to be followed in order to raise the level of health literacy. As a result of this study, it was stated that patients with inadequate health literacy had communication problems that would affect the disease status. In addition, it was stressed that patients with inadequate health literacy were unsuccessful in expressing their health status, and did not understand their medical condition and treatment adequately. In the same study, it was determined a positive relationship between inadequate health literacy level and increased hospitalization risk (Davis *et al.*, [62]). Scales of disease-specific dietary information, Newest Vital Sign Test - NVS, nutritional behavior and adherence to medical treatment were made for children, adolescents and young adults with chronic renal failure and hypertension; Nutrition information was found to be significantly higher in individuals with adequate health literacy levels. A positive correlation was found between adherence to medical treatment and nutritional knowledge-nutrition attitude. It was also stated that the level of health literacy and nutrition knowledge-attitude were the main determinants of the dependence to medical treatment (Patel *et al.*, [63]).

Considering the above mentioned results of low level of health literacy, further studies and actions are needed across the world to enhance and improve the levels of health and nutrition literacy. And most of the work is on healthcare providers (Yalçın Balçık *et al.*, [7], Willis *et al.*, [64]). Health care professionals who communicating with patients in a simple language, preferring the method they understand best, giving feedback by questioning whether the patient understands will raise health literacy level. In addition, nutrition and exercise education given to the patient will be effective to raise this level (Stiles, [65]). It should be pointed that increasing the level of health literacy of individuals is not solely the responsibility of health professionals

and health institutions. An inter-sectoral approach in the development of health literacy is recommended. It is stated that these sectors are: society, educators, health communicators, written and visual media, government institutions, adult educators and literacy educators, non-governmental organizations, academic circles, business world, health service providers and health professionals (World Health Organization, [15]). Education should be provided not only to patients, but also to healthcare professionals. Various training materials (brochures, manuals and guidelines) should be developed by principally responsible managers, politicians and system designers (Weiss, [66]).

### 2.3 Effect of health and nutrition literacy on diabetes management

Most studies on the impact of health and nutrition literacy on the management of chronic diseases are related to type 2 diabetes. For this reason in this review, it is aimed to answer the question whether health and nutrition literacy levels of individuals with diabetes affect diabetes management.

Diabetes (Diabetes mellitus) is a chronic disease with an increase in blood glucose levels due to insufficient production or ineffectiveness or lack of insulin hormone in the body (International Diabetes Federation, [67]). It is classified as: type 1 diabetes, type 2 diabetes, gestational diabetes and some specific types of diabetes (maturity-onset diabetes of the young - MODY, etc.) (American Diabetes Association, [68]).

The main objectives of the treatment of diabetes are as follows: provide glycemic control, reduce the risk of developing acute complications, prevent microvascular and macrovascular chronic complications, treat other accompanying health problems and thus improve the quality of life of individuals with diabetes (Cooke and Plotnick, [69]). For these purpose, diabetes management requires medical nutrition treatment and regular physical activity along with drug treatment. Therefore the cooperation of different health professionals such as physicians, dieticians, nurses and psychologists specialized in the treatment of diabetes is necessary (American Diabetes Association, [70]).

In the literature, scientific data on the relationship between health and nutrition literacy and diabetes more common than other diseases. This is because diabetes treatment requires self-care, self-sufficiency and self-effectiveness. The strong effect of nutrition education on treatment still more increases the importance of health and nutrition literacy in diabetes (Gibbs, [45]). Diabetes self-care consists of four basic sections; (i) nutrition management, (ii) regular exercise, (iii) monitoring blood glucose, and (iv) using drug/insulin (Fransen *et al.*, [71]). According to the American Dietary Association (ADA), [72], the most important part of the

education required for medical nutrition treatment of diabetes treatment and diabetes management. With this education it is possible to interpret the blood glucose result correctly and to make the correct intervention with insulin if necessary. In addition these, self-care, including controlled carbohydrate consumption, low fat diet consumption, regular exercise and foot care, is also required (American Diabetes Association, [73]). The patient needs to understand and apply complex health information to create these self-care skills (Bowen *et al.*, [74]). For the optimal level of self-care, which is the basis of diabetes treatment, people with diabetes should have the ability to decide and apply conceptual information for more than one issue (Fransen *et al.*, [71], Cavanaugh *et al.*, [75]). It is necessary to reach adequate level of health and nutrition literacy to have these skills.

In 11 studies examined with meta-analysis, the relationship between the level of health literacy and the self-care of diabetes were reviewed. In three of these studies, it was determined positive relationship between health literacy and diabetes self-care. And in 10 of these studies, there was positive relationship between health literacy, knowledge level, self-confidence and social support management as well (Fransen *et al.*, [71]). In populations with inadequate health literacy, it is stated that type 2 diabetes is more common and poor glycemic control, and more complications develop in these patients. In another study, the relationship between health literacy level and health behaviors (cigarette, alcohol, physical activity and diet) was investigated in 1,685 diabetic individuals over the age of 25 years. As a result of the research, it has been reported that individuals who have difficulty in understanding health-related information have a more sedentary life and unhealthy nutrition (Friis *et al.*, [76]). In light of this information, the importance of education in the treatment of diabetes and prevention of complications is remarkable. This education should be related to health, number and nutrition literacy. Studies on this subject are insufficient and more studies are needed. In the review of Keser and Çiracıoğlu, [47], it is reported that those with adequate nutrition literacy and health literacy reflect their nutrition behavior. In the study conducted by Speirs *et al.*, [77], that investigated the relationship between health literacy and nutritional behavior and was concluded that only less than half of the participants read the food label.

As a result, for an effective treatment patients should be able to express themselves correctly, ask questions, understand and apply medical recommendations. Inadequate health and nutrition literacy level will affect negatively patients both personally, socially and culturally, as well as misuse of treatment, worsening health and increasing health charges (Sezgin, [14], Rudd *et al.*, [19]). Accordingly, applicable activities

should be developed to increase the levels of health and nutrition literacy of patients and considering that treatment efficacy is not only patient-dependent, it is also necessary to plan training for health care providers. It should also be noted that the adequate level of health and nutrition literacy is essential not only for diabetes but also for management of other diseases.

### 3. Conclusions

- Education which involves health and nutrition literacy in treatment of diabetes and prevention of its complications is important.

- Dietitians and other health professionals should evaluate level of health and nutrition literacy level of patients with diabetes and then determine the content of nutrition education for effective treatment and control of diabetes accordingly.

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