Original Article

Genetics and Nutrigenetics: Involvement, Confidence and Knowledge of Turkish Dietitians

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Abstract

Background: The relationship between nutrition and genes has been on the agenda in recent years. Today's nutrition science now adopts the integrated approach of complex cell and molecular biology, biochemistry, and genetic science technologies. The "Human Genome Project" makes a great contribution to the science of nutritional genomics. This helps scientists to discover multiple interactions between diseases, nutrition and genes.
Objective: This study was conducted to evaluate the genetics and nutrigenetics information, attitudes and perceptions of the dietitians working in the hospital.
Design: A total of 94 dieticians were interviewed during visits to the hospitals for which permission was obtained. 62 of the dieticians interviewed agreed to participate in the study voluntarily. Questionnaire method was used to collect the data, and research data was collected by face to face interview method. The survey form consists of 5 parts.
Results and Conclusion: Results of this study showed that most dietitians do not have sufficient genetic and nutrigenetic knowledge. To improve knowledge level of dieticians It is thought that there should be lessons related to genetics and nutrigenetics during undergraduate education.

Key Words: Genetics, Nutrigenetics, Dietician, Knowledge

Introduction

Understanding nutrients interact and affect molecular mechanisms that regulates physiological functions is a revolution in the field of nutrition. Today's nutrition science now adopts the integrated approach of complex cell and molecular biology, biochemistry, and genetic science technologies, rather than researching epidemiological studies (Mutch et al.,2005). For many years, it has been thought that nutrients are used only as energy or as a cofactor. Nowadays, it has been understood that since molecular biology methods related to the physiology of nutrition and metabolism become available in laboratories, nutritional elements affect direct or indirect gene expression and consequently proteins (Corthesy-Theulaz et al., 2007). The "Human Genome Project" makes a great contribution to the science of nutritional genomics. This helps scientists to discover multiple interactions between diseases, nutrition and genes (El-Sohemy, 2007). The human genome sequence reveals the importance of

genetic heterogeneity in the human population. Millions of single nucleotide polymorphisms (SNPs) reveal a relationship with nutrition (Corella et al.,2007). If there is accumulation of SNPs in the genes involved in the metabolism of dietary components, environmental agents, or drugs, they highly affect the individual response to the diet content (Fenech,2010).

There are two effective ways in the relationship between human genome and nutrition. These pathways define and show gene expression and metabolic response (Gregori et al.,2011). The interaction between nutrition and the human genome has led to the formation of new sub-terms such as nutrigenetics and nutrigenomics (Debusk,2010). The presence of genetic variations among individuals affects their nutritional requirements, nutritional status, and hence their health status (Darnton-Hill et al.,2004). Moving from this point; "Who is susceptible to chronic diseases?" and "Who will respond better to dietary regulations?" questions began to be asked (Burton and Stewart, 2005). Epidemiological studies have pointed out the relationship between diet and chronic diseases for a long time. The ability to manage and change gene mutations that affect nutritional metabolism through nutrition indicates that genetics and nutrition are not independent from each other (Nugent, 2004). The detection of genetic changes that have a role in diseases or make responses to nutritional adjustment approaches are expected to increase effectiveness in prevention and treatment of chronic diseases. It is a discipline that examines how nutritional genomics, diet and lifestyle choices affect individuals' functions at the cell, tissue and molecular level and at the community level (Ferguson, 2006;Castle, 2003).

The relationship between nutrition and genes has been on the agenda in recent years. However, the relationship between diseases and genes and nutrition has not been explained yet. Nutrigenetics is a very new field for our country, and it is not yet known whether dietitians who have been trained on diseases have knowledge or are interested in this issue. This study was conducted to evaluate the genetics and nutrigenetics, attitudes and perceptions of the dietitians working in the hospital. In addition, with this study, it is aimed to increase the knowledge and awareness of nutritional dietitians working in hospital about nutrigenetics and genetics.

Material and Methods

This study was conducted to evaluate the genetics and nutrigenetics information, attitudes and perceptions of the dietitians working in the hospital. The universe of the research is public hospitals located in the center of Ankara. All dieticians working in the hospitals formed the study sample. Ethical approval was obtained from instutions. A total of 94 dieticians were interviewed during visits to the hospitals for which permission was obtained. 62 of the dieticians interviewed agreed to participate in the study voluntarily. Questionnaire method was used to collect the data, and research data was collected by face to face interview method. The survey form consists of 5 parts.

The first part includes demographic information, and the second part contains information about the workplace. In the third part, there are questions about determining “Genetic Interest and Trust Status”, in the fourth part, the questions about determining “Genetics Information” and in the fifth section, questions about determining “Genetic Education Status” are included. A total of 11 questions were asked in order to determine the participants' interest and confidence in genetics. A 5-point Likert-type scale was included to evaluate “Yes” or “No” for each question and to be sure about these answers. The statements in the scale were classified as "I am not sure at all", "I am not sure", "Medium", "I am sure" and "I am absolutely sure". While evaluating these responses, individuals' confident status was handled as 3 groups as "Low", "Medium" and "High". While “I am not sure at all” and “I am not sure” options are classified as “Low”, “I am sure” and “I am absolutely sure” are classified as “High”. The “medium” option used as “Medium”. The questions in this section were used with reference to HuGEM study of Whelan et al (Whelan et al.,2011).

In order to measure the “Knowledge of Genetics” of the participants, 12 questions each with 5 lights were asked. In this section, total information scores were calculated by giving 1 point for correct answers, 0 points for wrong answers and "I don't know" option. According to this score, minimum 0 and maximum 12 points can be obtained from this section. In this section, the level of knowledge was classified according to the scores received. In this classification; 0-3 points; “Insufficient Knowledge Level”, 4-8 points; “Intermediate Knowledge Level” and 9-

12 points accepted as “Good Level of Knowledge”. In the last part of the questionnaire, 3 questions were asked to dieticians to evaluate “Status of Genetic Education”. First in this section; "Education status about genetics while in college" was questioned. There are 4 options in this question and the trainings of the participants about genetics were evaluated. In the second question status of reading literature related to genetics and nutrigenetics and/or participating to meetings such as seminars, conferences, congresses, etc. within last year were questioned. For participants whose answer is “Yes”, the number of literature reading and the number of meetings attended were taken. Last, "The importance of nutritionists' genetic information in practice" was asked. In this question, the answers were evaluated according to the 5-point Likert scale, ranging from “Not important at all” to “Very important”.

SPSS package program was used to evaluate the data. Two group comparisons were evaluated with “Chi-quare (x2)”, and multiple group comparisons were "Indepented Sample T Test" or "One Way ANOVA" test. The differences between the subgroups are determined by “Tukey’s Post Hoc Correction”. Also for quantitative data; “Number (n), Percentage (%), Average, Standard Deviation (SD)” values were examined and presented in tables.

Results

Demographic characteristics of the participants are given in Table 1. 64.5% of dietitians BSc, 25.8% MSc, 9.7% PhD. The most common disease among are; “Diabetes” (30.1%), “Obesity” (19.0%), “Hypertension” (13.5%) and “Cardiovascular Diseases” (11.6%). The average age of the participants is 35.6 ± 11.21. The average age of men is higher than women. Based on the duration of the profession and the working year in the clinic, it is seen that women are higher than men, and this difference was not statistically significant (p> 05). Average duration of all participants in the profession is12.3 years, mean working time in the clinic is 9.3 years. However, it is seen that the average working year of women and the duration of working in the clinic is higher than that of men (table 2).

As can be seen in the table 3, the participants mostly responded “Yes” for the question “Getting information about hereditary diseases from patients” (72.6%). This was followed by the statement "Discussion of genetic diseases with patients" (56.5%). In the statements about nutrigenetics, the most frequently stated answer “Yes” for the question “Interviewing patients with both dietary and genetic basis of hereditary disease” (46.8%).

According to this table 4; the average knowledge score of all participants is 5.2 ± 2.14. It was found that the mean level of knowledge of men was higher than women, but this difference was not statistically significant (p: .38). The mean knowledge level of individuals graduated from college is about 0.8 points lower, but this difference is also not statistically significant (p: .15). The average knowledge level score is highest in the PhD group, followed by undergraduate and graduate groups, respectively. A significant difference was found between the PhD group and the graduate group as well as between the undergraduate group. The knowledge level average score of individuals with professional experience <5 years is approximately 0.6 points higher than individuals with professional experience of 5 and more years, but this difference was not statistically significant (p: .25). It is seen that the group with the highest average knowledge level (6.0) of individuals is the individuals who responded “I have taken courses with some genetic content”. None of the groups in this question showed a statistically significant difference (p> .05). According to the participation to genetic or nutritional genomic related congress or reading literature results, it is seen that the average of the individuals' knowledge level score is higher in the individuals who answered “Yes” but this difference between the groups does not show statistical significance (p: .17). Finally, in this table, "The importance of dietitians' genetic information in practice" and their knowledge levels are given. When the groups in this question were compared among themselves, a statistically significant difference was found only between the groups that responded "No matter" and "Important" (p: .02).

According to this table 4, “Chromosome” (85.5%) was the term that dieticians answered most accurately among genetic-related terms. This was followed by the terms "Polymorphism" (64.5%), "Genotype" (53.2%) and "Gene" (43.5%). The least correct answer among the genetic terms was “PCR” (25.8%). Among the terms related to nutritional genomics, the most correct answers given by dieticians are “Diet Oil and Cardiovascular Disease” (35.5%) and

"Nutrigenetics" (25.8%). The least correct answer was "MTHFR 677T → T polymorphism (16.1%).

Among the 7 genetic related applications, the most "Yes" answer was for "Getting information about patients with hereditary diseases" (72.6%). It was seen that 80% of 45 dieticians who said "Yes" to this activity were in the middle knowledge level. Among the genetic-related expressions of dietitians, the phrase "obtaining written consent for advanced genetic information from patients" was the most frequently stated "No" answer. it is seen that there are no individuals with a good level of knowledge in this group. Among the activities related to nutrigenetics, the most frequently answered "Yes" was the expression "Discussing patients with both dietary and genetic basis of hereditary disease". It was found that 79.3% of the dietitians who answered "Yes" to this statement had a medium level of knowledge. The statement that dietitians answered minimally "Yes"; " Suggesting a place / center where patients can evaluate both genetic and diet information of the disease ". In this group; It was observed that 6 dieticians (83.3%) had a medium level of knowledge, while 16.7% had a good level of knowledge.

Table 1. Distribution of Individuals According to Their General Characteristics (n: 62)

Specifications	N	%
Education Status		
BSc	40	64.5
MSc	16	25.8
PhD	6	9.7
Experience in the profession (year)		
< 5 years	22	35.5
≥ 5 years	40	65.5
Most Seen Diseases		
Diabetes	49	30.1
Hypertension	22	13.5
Cardiovascular diseases	19	11.6
Kidney Diseases	10	6.1
Obesity	31	19.0
Cancer	12	7.4
Liver Diseases	6	3.7
Psychiatric Diseases	1	0.6
Pediatric Diseases	13	8.0
Total	**62**	**100.0**

Table 2. Average Age of Individuals, Duration in the Job and Clinical Working Times

Variables	Male	Female	Total
	Mean±SD	**Mean ±SD**	**Mean ±SD**
Age	36.6±12.21	35.5±11.23	35.6±11.21
Profession Period (month)	132.0±66.03	148.4±18.29	147.1±137.65
Duration of working (month)	104.6±57.80	112.2±14.93	111.6±112.98

Table 3. Dieticians' Genetic and Nutrigenetic Interventions and Confidence (n: 62)

	Intervention Status			Being Sure					
	Activity	Response : Yes		Low		Medium		High	
		n	%	n	%	n	%	n	%
GENETICS	Getting information about hereditary diseases from patients	45	72.6	2	3.2	13	21.0	47	75.8
	Discussion of genetic diseases with patients	35	56.5	4	6.5	17	27.4	41	66.1
	Consulting a patient for genetic counseling	7	11.3	5	8.1	9	14.5	48	77.4
	Advising patients about hereditary diseases likely to develop	31	50.0	1	1.6	15	24.2	46	74.2
	Suitable counseling for hereditary disease	26	41.9	5	8.1	12	19.4	45	72.5
	Obtaining written permission from patients for advanced genetic information	3	4.8	5	8.1	5	8.1	52	83.8
	Genetic training or practice for students or other healthcare professionals	4	6.5	4	6.5	7	11.3	51	82.2
NUTRIGENETICS	Discussing patients with both dietary and genetic bases of hereditary disease	29	46.8	4	6.5	13	21.0	45	72.5
	Suggesting a place / center where patients can evaluate both genetic and diet information of the disease	6	9.7	4	6.5	12	19.4	46	74.1
	Discussing the subject of how diet interaction with genes affecting disease risks	15	24.2	5	8.1	9	14.5	48	77.4
	Training students or other healthcare professionals about the diet and genetic components of the disease	14	22.6	4	6.5	9	14.5	49	79.0

Table 4 Knowledge Levels of Dieticians on Genetics and Nutrigenetics

	Statement	Right Response	
		n	%
GENETICS	"GENE"	27	43.5
	"CHROMOSOME"	53	85.5
	"ALLEL"	24	38.7
	"GENOTYPE"	33	53.2
	"FENOTYPE"	26	41.9
	"POLYMORPHISM"	40	64.5
	"MUTATION"	21	33.9
	"PCR"	16	25.8
AVERAGE			**48.4**
NUTRISIONAL GENOMIK	"NUTRIGENETICS"	16	25.8
	GENETICS, DIET AND DISEASES	13	21.0
	DIET LIPID AND CARDIOVASCULAR DISEASE	22	35.5
	MTHFR 677T→T POLYMORPHISM	10	16.1
AVERAGE			**24.6**

Table 5. Average Knowledge Scores of Dieticians on Genetics and Nutrigenetics

Variables	Avarage Knowledge Score		
	(n)	Avearge ± SD	p
Gender*			
Male	5	6.0±2.12	0.38
Female	57	5.1±2.15	
Graduation*			
College	26	4.7±1.91	0.15
Faculty	36	5.5±2.26	
Current Education Status**			
BSc	40	5.0±1.78	**0.04**
MSc	16	4.7±2.55	
PhD	6	7.8±1.47	
Professional Experience*			
< 5 years	24	5.6±1.74	0.25
5 years or more	38	4.9±2.35	
Education Status**			
I have not received any courses / training	42	4.8±2.13	0.14
I took the course with some genetic terms	19	6.0±2.05	
I took the related course	1	5.0±0.00	

Status of Attending Genetics or Gene-Diet Related Congress / Literature Reading *			
Yes	17	6.2±2.56	0.17
No	45	4.8±1.84	
The Importance of Dieticians' Genetic Knowledge in Practice **			
Does not matter	4	2.2±1.26	0.02
Not important	3	4.0±2.65	
Somewhat Important	16	5.0±2.53	
Important	33	5.7±1.73	
Very important	6	5.7±2.07	
Total	**62**	**5.2±2.14**	

Table 6. Dieticians' Practices on Genetics and Nutrigenetics According to Knowledge Level

	Activity		Knowledge Level							
			Insufficient		Medium		Good		Total	
			n	%	n	%	n	%	n	%
BASIC GENETICS	Getting information about hereditary diseases from patients	YES	6	46.2	36	80.0	3	75.0	45	72.6
		NO	7	53.8	9	20.0	1	25.0	17	27.4
	Discussion of genetic diseases with patients	YES	6	46.2	25	55.6	4	100.0	35	56.5
		NO	7	53.8	20	44.4	-	-	27	43.5
	Consulting a patient for genetic counseling	YES	-	-	7	15.6	-	-	7	11.3
		NO	13	100.0	38	84.4	4	100.0	55	88.7
	Advising patients about hereditary diseases likely to develop	YES	7	53.8	22	48.9	2	50.0	31	50.0
		NO	6	46.2	23	51.1	2	50.0	31	50.0
	Counseling suitable for hereditary disease	YES	4	30.8	21	46.7	1	25.0	26	41.9
		NO	9	69.2	24	53.3	3	75.0	36	58.1
	Obtaining written permission from patients for advanced genetic information	YES	1	7.7	2	4.4	-	-	3	4.8
		NO	12	92.3	43	95.6	4	100.0	59	95.2
	Genetic education / practice for students or other healthcare professionals	YES	1	7.7	2	4.4	1	25.0	4	6.5
		NO	12	92.3	43	95.6	3	75.0	58	93.5
NUTRIGENETICS	Discussing patients with both dietary and genetic bases of hereditary disease	YES	3	23.1	23	51.1	3	75.0	29	46.8
		NO	10	76.9	22	48.9	1	25.0	33	53.2
	Suggesting a place / center where patients can evaluate both genetic and diet information of the disease	YES	-	-	5	11.1	1	25.0	6	9.7
		NO	13	100.0	40	88.9	3	75.0	56	90.3

Discussing the subject of how diet interaction with genes affecting disease risks	**YES**	1	7.7	13	28.9	1	25.0	15	24.2
	NO	12	92.3	32	71.1	3	75.0	47	75.8
Training students or other healthcare professionals about the diet and genetic components of the disease	**YES**	2	15.4	10	22.2	2	50.0	14	22.6
	NO	11	84.6	35	77.8	2	50.0	48	77.4

Discussion

This study was conducted to evaluate the knowledge, attitudes and perceptions of dietitians working in hospitals in Ankara about genetics and nutrigenetics. For the study, a total of 94 people were interviewed face-to-face, and 62 agreed to participate in the study. Accordingly, the response rate of the study was found to be 65%. It was found that the average application of genetic activities was 34.8%, and the average of applying nutritional genomic activities was 25.8%. Considering similar studies in the literature, it is seen that both averages are generally lower in our study (Whelan et al., 2011). The main reason for the dieticians' implementation of genetic or nutritional genomic activities was that they have not taken any genetic lessons/courses before. In a study related to this subject, the rate of dietitians to answer “I have not taken any genetic lessons / courses” in their education was found 37.3% (Oosthuizen, 2011). In another study, it is reported that this rate was 45% (Whelan et al., 2011). Our data rates were lower than literature. It is thought that this rate negatively affects both the knowledge level score and the rate of performing activities in the clinic. In many studies it is seen that education on genetics correlated positively with knowledge level (Whelan et al., 2011;Ferguson,2009;Roosen et al.,2006).

The statement that dieticians gave the most "Yes" response about nutritional genomics was "Discussion with patients on both dietary and genetic basis of hereditary disease". Dieticians who answered “Yes” to this statement constitute 46.8% of the participants. Similar results were also found in Whelan et al. as 51%, and Oosthuizen as 48%.

The average rate of correct answers to the questions related to genetics is higher than the questions related to nutrigenetics. One possible reason for this is that, participants responds “Yes” to the phrase "I have taken a course with some genetic related content". Similarly, in most studies in the literature, it was concluded that the knowledge score on genetics was higher than the knowledge on nutrigenetic / nutritional genomics (Whelan et al., 2011; McCarthy et al., 2008).

In our study, the statistical significance was found between knowledge score of “Current educational status” and “The importance of the genetic information of dietitians in practice”. In current educational situations; there is a significant difference between doctorate and graduate (p: .04) and between doctorate and undergraduate (p: .05). Studies in the literature on the subject showed that significant differences were found between those who answered “I have not taken any course / course related to genetics” and those who responded “I have received a course with some genetic related content” and those who responded “I have been trained in a course that is completely genetic” ($p < .05$) (Whelan et al., 2011; Oosthuizen,2011;Weil et al.,2008). From the point of view of the importance of dietitians' genetic information in practice; There was a significant difference between those who answered the answer “not important at all” and those who answered “Important” (p: .02), no significant difference was found between the other groups ($p > .05$). In a study conducted by De Busk in 2009, same results that supporting us was found among the knowledge scores according to the “Importance of the genetic information of dietitians in practice” (Debusk, 2005; Debusk,2009).

This study showed that most dietitians do not have sufficient genetic and nutrigenetic knowledge. To improve knowledge level of dieticians It is thought that there should be lessons related to genetics and nutrigenetics during undergraduate education.

References

Burton, H. & Stewart, A. (2005) Nutrigenomics: Report of a workshop hosted by The Nuffield Trust and organized by the Public Health Genetics Unit on 5 February 2004. London. The Nuffield Trust 1-26.

Castle, D. (2003) Clinical challenges posed by new biotechnology. The case of nutrigenomics. Postgrad Med J 79:65-66.

Corella, D., Christine, M., Williams, J., Ordova, JM., Lairon, D. & Hesketh, J. (2007) The challenges for molecular nutrition research 1: linking genotype to healthy nutrition. Genes Nutr 3: 41-49.

Corthesy-Theulaz, I., Den Dunnen, JT., Ferre, P., et al. (2007) Nutrigenomics: the impact of biomics technology on nutrition research. Ann Nutr Metab 49: 355-365.

Darnton-Hill, I., Margetts, B. & Deckelbaum, R. (2004) Public health nutrition and genetics: implications for nutrition policy and promotion. Porc Nutr Soc 63: 173-185.

Debusk, RM. (2005) Nutrigenomics and future of dietetics. Nutr Diet 62: 63-65.

Debusk, RM. (2009) Diet-related disease, nutritional genomics and food and nutrition professionals. J Am Diet Assoc 109: 410-413.

Debusk, RM. (2010). Nutritional Genomics in Practice: Where Do We Begin?. J Am Diet Assoc 105: 589-598.

El-Sohemy, A. (2007) Nutrigenetics. Forum Nutr 60: 25-30.

Fenech, M. (2010) Genome health nutrigenomics and nutrigeneticsdiagnosis and nutritional treatment of genome damage on an individual basis. Food Chem Toxicol 46:1365-1370.

Ferguson, L. (2006) Nutrigenomics. Integrating genomic approaches into nutrition research. Mol Diag Ther 10: 101-108.

Ferguson, LR. (2009) Nutrigenomics approaches to functional foods. J Am Diet Assoc 109: 452-458.

Gregori, D., Foltran, F., Verduci, E., Ballali, S., Franchin, L., Ghidina, M., et al. (2011) A Genetic Perspective on Nutritional Profiles: Do We Still Need Them? J Nutrigenet Nutrigenomics 4: 25-35.

McCarthy, S., Pufulete, M. & Whelan, K. (2008) Factors associated with knowledge of genetics and nutritional genomics among dietitians. J Hum Nutr Diet 32: 547-554.

Mutch, DM., Wahli, W. & Williamson, G. (2005). Nutrigenomics and nutrigenetics: the emerging faces of nutrition. FASEB J 19:1602-1616.

Nugent, AP. (2004) Nutrigenomics. Tailor-made foods for a genetic era? Nutr Bull 29: 82-83.

Oosthuizen, L. (2011) Aspects of the involvement, confidence and knowledge of South African registered dietitians regarding genetics and nutritional genomics. Theses of Master of Nutrition at the University of Stellenbosch 79

Roosen, R., Earthman, C., Marquart, L., et al. (2006). Continuing education needs of registered dietitians regarding nutrigenomics. J Am Diet Assoc 8:1242-1245

Weil, SD., Lafferty, L., Keim, KS., et al. (2008). Registered dietitian prescriptive practices in hospitals. J Am Diet Assoc 108: 1688-1692.

Whelan, K, McCarthy, S, & Pufulete, M. (2011) Genetics and diet-gene interactions: involvement, confidence and knowledge of dietitians. Br J Nutr 99: 23-28.