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Investigation of the Relationship Between the Level of Health Literacy and Vaccine Hesitancy

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Abstract
Objective: The objective of the study was to investigate the relationship between the level of health literacy and vaccine hesitancy. Furthermore, the dependence of the level of health literacy and vaccine hesitancy on socio-demographic variables were analyzed. **Material and Methods:** The study was conducted with 403 individuals via online and the questionnaire included the socio-demographic questions and two scales. The study was designed as a cross-sectional study and carried out during February- March, 2022 in Turkey. The online survey included a brief information on the study objective, anonymity and confidentiality of the collected data and voluntary participation. Data were collected through Turkish Health Literacy Scale-32 (TSOY-32) which was developed on the basis of the HLS-EU Study Conceptual Framework for Turkey and Vaccine Hesitancy Likert Scale. Data were analyzed by using SPSS-25 ve Lisrel 8.80. **Results**: The study suggested that there was a positive weak association between the level of health literacy and vaccine hesitancy, meaning as health literacy of participants increased the vaccine hesitancy of participants decreased. In terms of socio-demographic factors, both health literacy average index scores and vaccine hesitancy average scores were found to be differing in relation with education and income status of participants. **Discussion and Conclusion:** According to the recent European Health Literacy Survey study conducted in Europe, the findings indicated that 12% of the people who participated in in survey had insufficient general health literacy, and 35% had problematic health literacy. Our findings showed that 43% of respondents fell into a problematic category, and 30% were in the insufficient category. There is a need to conduct new studies using multiple measurement tools that are specific to vaccine literacy and those used to measure general health literacy.
Keywords: Health literacy, Vaccine hesitancy, Turkish health literacy scale-32
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1. Introduction

Strategic Advisory Group of Experts on immunization from the World Health Organization (WHO) stated that "vaccine hesitancy is an increasing challenge for immunization programs" in August 2015 (WHO, 2015). Furthermore, vaccine hesitancy could be a major threat to public health.

Vaccines provide prevention from illness, disability, and death diseases that vaccine can prevent. In these days there are many vaccine treatments under development for certain types of cancer. Although there is a wide range of evidence supporting vaccination and immunization, some people still challenge the evidence and refuse vaccinations in some geographical areas of the world. (Ratzan, 2011*)*. Rapid global sharing of public concerns and sometimes uncertainty around vaccines (Larson,2011*)* are leading to an increase in the number of people questioning vaccines and seeking alternative variations schedules, and sometimes delaying or refusing vaccination (Gust, et all, 2008).

Health literacy is defined as the ability to obtain, process, and understand basic health information and services in order to make the right health decisions (Ratzan, 2001). Health literacy is a multifactorial concept that deals with the capacities of people to overcome the challenge of healthcare services in a modern society (Kickbusch, 2001).

Considering the availability of few studies conducted in middle& low income countries, this study would help us understand the relationship between level of health literacy and vaccine hesitancy in a middle-income country, Turkey.

2. Conceptual Framework

2.1 Vaccine Hesitancy

Over the years significant progress has been made in the development of new vaccines, along with increasing access to new and underused vaccines in the low income countries. Although vaccines are being considered as an important public health interventions, people in some countries have become hesitant towards vaccine treatment due to many reasons. Some vaccine experts describe the problem as a "crisis of public confidence" and a "vaccination backlash" (Shetty, 2010). The World Health Organization has pointed out vaccine hesitancy as one

of the 10 major threats to public health (WHO, 2019), and the need to further studies to understand the underlying issues about hesitancy to vaccination

The first task of the SAGE Working Group on Vaccine Hesitancy (WG) (SAGE Working Group*, 2012)* was to propose a definition of hesitancy and its scope and to develop a model to categorize factors that influence the behavioral decision to accept a vaccine. While acceptance of vaccination is the expected outcome among the majority of populations globally, a smaller portion of population may refuse some vaccines but agree to others and some delay vaccination or accept vaccination but are unsure in doing so (Benin, et al 2006; Opel, et al 2011). In some situations where vaccination uptake is low due to out of vaccine stocks, limited vaccination services (time, place, etc.), shortage of vaccine services in the presence of conflict or natural disaster, vaccine hesitancy is not the major explanation of unvaccinated or under-vaccinated population (Mc Donald,2015). Low health literacy skills may also affect the communication. In order to minimize vaccine hesitancy, the use of internet and social media are often recommended but those have limited capability in attracting vaccine hesitant and could exclude those who do not have internet and low literacy level (Biasio, 2017). Vaccine hesitancy and its determinants are explained in the "3 Cs" model that was first proposed to the WHO EURO Vaccine Communications Working Group in 2011 (WHO EURO Working Group on Vaccine Communications, 2011). The model presented three categories; those were complacency, convenience and confidence (Fig. 1). This model was viewed as being the most readily understandable and the concepts were incorporated into definition. In the "3 Cs" model, confidence is defined as trust in (i) the effectiveness and safety of vaccines; (ii) the system that delivers them, including the reliability and competence of the health services and health professionals and (iii) the motivations of policy-makers who decide on the vaccines needed most (Mac Donald, 2015).

Vaccination complacency can be viewed as where perceived risks of vaccine-preventable diseases are low and vaccination is not considered as a necessary preventive action. Complacency about a particular vaccine or about vaccination in general is influenced by multiple factors, including other life/health responsibilities that may to be more important at that point in time. The success of the immunization program may result in complacency and ultimately, hesitancy, as individuals weigh risks of vaccination with a particular vaccine against risks of the disease the vaccine prevents that disease is no longer common. Self-efficacy also influences the degree to which complacency determines hesitancy. (Mac Donald,2015).

The convenience of vaccination is an important factor when the following points are taken into consideration: physical availability, affordability and willingness-to-pay, geographical accessibility, ability to understand (language and health literacy) and effectivity of immunization services. The quality of the service (real and/or perceived) and the degree to which vaccination services are delivered at a time and place and in a cultural context that is convenient and comfortable also affect the decision to be vaccinated and could lead to vaccine hesitancy. (Mac Donald,2015).

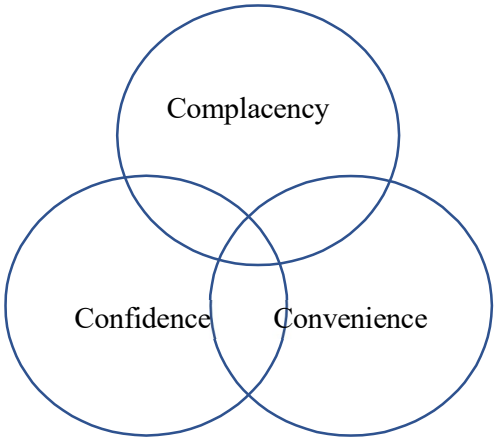

Fig. 1. "Three Cs" model of vaccine hesitancy
(N.E. MacDonald / Vaccine 33 (2015) 4161–4164 4163)

Some factors may affect individuals' decisions on whether or not to getting vaccinated. Literally, those factors could be religious, scientific and political (Larson, et al 2014). Vaccine hesitancy has become the major issue and various factors may potentially influence someone's decision making whether or not to seek out or accept vaccination for themselves or their child (MacDonald, 2014; Larson, et al, 2014*)*. The information about vaccines tends to be complex and confusing. Processing this information requires certain literacy and numeracy skills, which is why communicating the information to patients a challenge, particularly if the patients have low HL (Rowland, 2014*)*. Moreover, individuals should have certain skill sets such as critical thinking (Ratzan*,*2011) to seek out the right information, especially considering the excessive amount of information available in the media,

particularly on the Internet (Nutbeam, 2000; University of California, San Francisco Medical Center, 2017).

2.2 Health Literacy

The term of health literacy has been used in the health literature for at least 30 years (Ad Hoc Committee on Health Literacy, 1999). In the United States the term is used to describe and explain the relationship between the levels of patients' literacy and those patients' ability to comply with prescribed regimens (Ad Hoc Committee on Health Literacy, 1999). In reality, the sufficient level of health literacy may help individuals understand, comprehend and process the information they obtain from health-related materials, such as prescriptions, health booklets, appointment cards, and medicine labels (Parker et al., 1995).

Health literacy not only affects an individual ability to understand and the use of healthcare services and but also affects his or her interactions with healthcare providers. When an individual has low health literacy skills he or she is less likely to use preventive healthcare services. (Nielsen, et al., 2004). Health literacy means the ability to access, understand, evaluate, and apply health-related information. Problematic or insufficient literacy may result in lack of protective behaviors such as immunization, and adoption of vaccination (Castro-Sanchez, et al, 2016).

The Sørensen Integrated Model states: "health literacy is linked to literacy and entails people's knowledge, motivation, and competence to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention, and health promotion to maintain or improve quality of life during the life course" (Sørensen, et al.,2012).

Health literacy can lead to undesired health outcome including worsening general health status (Berkman, et al., 2011), mortality rates (Bostock & Steptoe, 2012) and healthcare costs (Weiss & Palmer, 2004). Weak health literacy can cause less healthy choices, riskier behavior, poor health choices, less self-management, and more hospitalization. Various studies have shown that up to half of the adult American and European population have limited health literacy, with the consequent risk of social inequalities and higher health costs (Sørensen, et al.,2015).

According to the WHO, the definition of health literacy more broadly means as follows: 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. Health literacy means more than being able to read pamphlets and successfully make appointments. By improving people's access to health information and their capacity to use it effectively, health literacy is critical to empowerment of people (Nutbeam, 1998). Hence, the improvement of health literacy is necessary to develop a new type of relationship between individuals and the healthcare system.

Health literacy was first defined in 1974, but the importance of this concept has been understood in Turkey in recent years.

2.3. The relationship between health literacy and vaccine hesitancy

Health literacy is highly relevant in the light of measuring vaccination preferences, since measuring preferences usually requires respondents to interpret and value risk information (e.g., risk of side effects). Previous research shows that, specifically, individuals with a lower educational level and lower health literacy have difficulties processing such information (Galesic & Garcia-Retamero, 2010; McCaffery et al,.2012; Waters, et al., 2006).

According to the literature review by Lorini et al. (2018), health literacy is sometimes a predictor or a mediator for vaccination. An understanding of health literacy is also important for those developing and delivering healthcare programs, especially vaccination programs, as both the information and the actions required to use the information are complex requiring sophisticated health literacy skills beyond the capacity of a significant proportion of the population (Rowlands, 2014).

According to the Canadian Childhood Immunization Coverage Survey, the results show that there was a reversed association between educational attainment and concerns over vaccine safety with respect to education (Carpiano, et al., 2019). Similar findings were revealed from a study conducted with Greek parents where paternal education of high school or higher uniquely predicted age-appropriate immunization (Danis, et al., 2010). Lower education levels may deter individuals from vaccinating due to gaps in knowledge about the effectiveness and safety of vaccines or due to inflexible anti-vaccine attitudes (Larson, et al.,2016). Health knowledge, in general, is associated with more favorable attitudes toward vaccination (Vikram, et al., 2012)]. Specifically, low health literacy skills might cause vaccine hesitancy when people access limited and contradictory information about the vaccine on the internet (Biasio, 2017).

In light of the studies mentioned above, there is a need to determine the association between health literacy and vaccine hesitancy. For this purpose, the following research hypotheses were developed.

H1: There is a significant and negative relationship between Health literacy and vaccine hesitancy.
H2: Health literacy level is differed according to sociodemographic characteristics of the respondents
H3: Vaccine hesitancy is differed according to sociodemographic characteristics of the respondents

3. Material and Methods

The study was conducted via online during February- March 2022 in Turkey. The questionnaire was developed by using Survey Monkey application. The survey included three sections. In the first section of the survey there were questions related to socio-demographic characteristics, the second and the third part included the Turkish Health Literacy Scale (TSOY-32) and Vaccine Hesitancy Scale (VHS), respectively. The inclusion criteria of the research were: the respondents should be at least 18 years old and above and participants should voluntary participate in this study. The exclusion criteria for the study were; being healthcare professionals (e.g., medical doctor, pharmacist, nurse, dentist) and younger than 18 years old. Before proceeding with the questionnaire, a consent form expressing the purpose of the research was presented to the participants. They were asked to mark whether they agreed to participate in this research and if they accepted, they continued with the questionnaire. It had been promised to the participants the information obtained from this research will be used only for scientific purposes and their personal information will be kept confidential. Individuals were recruited through social media (e.g., whatsup groups) and personal network. Total sample size consisted of 403 individuals whose age was 18 years old or above. In order to determine the appropriate sample size, Gpower 3.1.9.2. program (Faul, et al, 2007) was used. For this purpose, the correlation coefficient (effect size) with r=0.19 was taken into consideration based on previous studies (Gode & Ertas 2021). According to the results of the analysis, the minimum number of samples to be reached for 95% statistical power, α=0.05 margin of error and r=0.19 effect size was calculated as 354. Considering the case of missing data, it was aimed to reach 400 participants in total. The questionnaire started with socio-demographic questions, followed by two scales. Those scales were Turkish Health Literacy Likert Scale (TSOY - 32) and Vaccine Hesitancy Likert Scale. Both scales have been tested for validity and reliability in Turkey and were found valid and reliable. The ethical approval of the study was received from Toros University (27.01.2022/5282).

3.1. Data Collection

3.1.1. Vaccine Hesitancy Scale

The "Vaccination Hesitancy Scale" was used to evaluate the participants' hesitations about the vaccine. This scale, which was developed by the AGE working group and whose validity and reliability was studied by Shapiro et al. (2018), was used to evaluate hesitation in childhood vaccines. Luyten et al. (2019) adapted the scale to measure hesitation in all vaccines and conducted a validity and reliability study. In this study, the scale adapted by Luyten et al. (2019) was used, since it was aimed to evaluate the hesitations of the society towards all available vaccines. The scale had 2 dimensions with total of 9 items. First dimension was the lack of confidence (7 items) and the second dimension was the risks (2 items). Responses to the scale were evaluated in a 5-point Likert type scale (1=strongly disagree-5=strongly agree). Two items in the risks dimension of the scale were scored inversely. The score obtained from the scale and the dimensions was obtained by adding the scores obtained from the related items, and the increase in the score indicated that the hesitation towards vaccines has decreased. Although the scale did not have a cut-off point, the score that could be obtained was between 9-45 points.

According to the research conducted in Turkey, it has been concluded that the Vaccine Hesitation Scale was valid and reliable, and it can easily be used to measure the level of vaccine hesitancy in Turkey (Yilmaz & Karakaya, 2021).

3.1.2. Turkish Health Literacy Scale-32 (THLS) (TSOY-32)

Turkish Health Literacy Scale-32 (THLS) (TSOY-32)" was a new 32-item health literacy scale developed on the basis of the HLS-EU Study Conceptual Framework, whose reliability and validity were evaluated by Okyay et al. (2016).

The conceptual framework covered the two health-related dimensions (treatment, disease prevention and health promotion) and health-related decision-making and it included four information acquisition processes (access, understanding, evaluation, and using/not using) about applications. Each item was rated as very easy, easy, difficult, very difficult, and no idea. According to the answers given to the questions, values between 0-50 can be taken from the scale. 0; lowest health literacy, 50; shows the highest health literacy. Health literacy level can be evaluated in four categories according to the value obtained.

0-25: insufficient health literacy,
>25-33: problematic / limited health literacy
>33-42: sufficient health literacy
>42-50: excellent health literacy

3.2 Data Analysis

Data were collected from 406 participants who voluntarily participated in the survey and scales applied within the scope of the research. Three participants were excluded from the data set because they left most of the measurement tools blank. Analyzes were made based on the data obtained from 403 participants. The data was analyzed by

using SPSS-25 and Lisrel 8.80 statistical package programs. In order to determine the analysis method to be used in this study, the normality and homogeneity of the distributions of the dependent variables were tested. In order to determine the normality, the skewness and kurtosis of the distributions were examined. These values generally vary between -2 and +2. The variation of these values within the range of ±2 was generally interpreted as a normal distribution (Hair, et al, 2010). Levene test was used to determine homogeneity. After testing the assumptions regarding the normality and homogeneity of the distributions, it was decided to use parametric tests. For this purpose, "Independent sample t-test" was used in cases where the independent variable consisted of two groups, while the "One-way analysis of variance (ANOVA) method was used when the independent variable was more than two groups. In cases where the independent variable consisted of more than two groups, the LSD method, one of the post-hoc tests, was used to determine the source of the difference. Pearson Product Moments Correlation coefficient was used to determine the relationships between scale scores. While interpreting the correlation value, values below r=0.30 were considered as low-level correlation, while correlation values between r=0.30-0.70 were interpreted as moderate, and correlation values above r=0.70 were interpreted as high-level correlation (Buyukozturk, 2010). The Confirmatory Factor Analysis (CFA) method was used to provide proof for the validity of the measurements obtained from the scales used in the research. While performing the Confirmatory Factor Analysis, the assumption of multivariate normality was checked and it was observed that in general, the Multivariate skewness and kurtosis values were deviated from normality (Relative Multivariate Kurtosis (RMK)>1.0) (Mardia, 1970). For this reason, the Robust Maximum Likelihood (MLR) estimation method, which was used in cases where there were deviations from normality, was used while performing CFA. Within the scope of the research, chi-square / degree of freedom, RMSEA (Root Mean Square Error of Approximation), SRMR (Standardized Root Mean Square Residua), CFI (Comparative Fit Index), NFI (Normed Fit Index) and Values such as NNFI (Non-Normed Fit Index) were reported (Forza & Filippini,1998; Schermelleh-Engel, et al,, 2003). Cronbach Alpha and McDonald's Omega reliability coefficients were calculated in order to provide evidence for the reliability of the measurements obtained from the Health Literacy Scale used in the research, and the results are given in Table 1. Reliability values of 0.70 and above obtained from these tests were considered as a criterion for the reliability of the measurements (George & Mallery, 2016).

Table 1: Reliability coefficient values regarding the reliability of the measurements obtained from the scales

Scale	Sub Scale	Number of Items	Cronbach Alpha (α)	McDonald's Omega
THLS-32 (TSOY-32)	Treatment and Service	16	0.91	0.91
	Prevention of disease	16	0.92	0.92
	Scale in general	9	0.95	0.95

As seen in Table 1, the overall reliability coefficient of the Turkish Health Literacy Scale-32 (TSOY-32) was 0.95, the reliability coefficient for the treatment and service sub-dimension was 0.91, and 0.92 for the disease prevention sub-dimension. These values showed that the measurements obtained from the scale were highly reliable (George & Mallery, 2016).

Cronbach Alpha and McDonald's Omega reliability coefficients were calculated in order to provide evidence for the reliability of the measurements obtained from the VHS used in the research, and the results are given in Table 2.

Table 2: Reliability coefficient values regarding the reliability of the measurements obtained from the scales

Scale	Sub Scale	Number of Item	Cronbach Alpha (α)	McDonald's Omega
VHS	Risks	2	0.57	0.57
	Confidentiality	7	0.87	0.86
	Scale in general	9	0.86	0.85

As seen in Table 2, the reliability coefficient for the overall scale was 0.86 and the reliability coefficient for the trust sub-dimension was 0.87. This value showed that the measurements obtained from the scale were highly reliable. The reliability value obtained in the risks sub-dimension of the scale was 0.57. Considering the general reliability values of the scale, it was thought that the low number of items in these sub-dimensions was effective in the low reliability value (Thorndike & Thorndike-Christ, 2010).

4. Results

Sociodemographic variables of the respondents as in frequencies and percentages were exhibited in Table 3.

Table 3: Socio -demographic variables

Factors	Frequency	%
Gender		
Male	133	33.0
Female	270	67.0
Total	403	100.0
Age		
18-23	75	18.6
24-29	35	8.7
30-35	25	6.2
36-41	22	5.5
42-47	23	5.7
48-53	37	9.2
54-59	52	12.9
60-65	117	29.0
66 and above	17	4.2
Total	403	100.0
Marital Status		
Married	206	51.1
Single	197	48.9
Education		
illiterate	1	0.2
Primary school graduate	0	0.0
Middle school	4	1.0
High school graduate	63	15.6
Associate degree	47	11.7
Bachelor's degree	184	45.7
Undergraduate degree	75	18.6
Doctorate	29	7.2
Total	403	100.0
Profession		
Retired	108	26.8
Employed	193	47.9
Unemployed	65	16.1
Student	37	9.2
Total	403	100.0
Income		
Income less than expenses	94	23.3
Income equals to expenses	164	40.7
Income more than expenses	145	36.0
Total	403	100.0
Suffering from a chronic condition		
Yes	89	22.1
No	314	77.9
Toplam	403	100.0

As seen in Table 3, out of 403 participants, 33% were male, 67% were female 29% of the respondents fell into the age category of 60-65 years old. About half of the respondents were married. In terms of education, 45.7% of the respondents had a university degree while only 4 (1%) respondents had a middle school degree. With regards to profession, 48% of the respondents were actively working and only 9% of the respondents were students. In terms of income, about 41% reported their income equal to their expenditures. With respect to chronic condition, 78% of respondents reported that they were not suffering from any chronic condition. In the analysis, illiterate and middle school participants were excluded due to the small number of participants.

The second section included Turkish Health Literacy Scale (THLS-32: TSOY-32) and the third one Vaccine Hesitancy Scale (VHS). The following table displays the descriptive statistics of the subdimensions of the THLS-

32 (TSOY-32).

Table 4: Descriptive findings of the THLS-32 (TSOY-32)

THLS-32 (TSOY-32)[1]	n	Min.	Max.	$\overline{X}$ ± SS	Insufficient		Problematic		Sufficient		Excellent	
					n	%	n	%	n	%	n	%
Scale in general[2]	403	4.17	50.00	34.33 ± 7.56	27	6.7	175	43.4	121	30.0	80	19.9
Treatment and service[3]	403	5.21	50.00	35.30 ± 7.70	31	7.7	129	32.0	156	38.7	87	21.6
Disease Prevention [4]	403	3.13	50.00	33.36 ± 8.22	57	14.1	157	39.0	120	29.8	69	17.1

[1](0-25): Insufficient SOY; (>25-33): Problematic; SOY; (>33-42): Sufficient; SOY; (>42-50): Excellent SOY
[2] (Item1-Item32); [3](Item1-Item16); [4](Item17-Item32)

As seen in Table 4, the minimum score of the participants in the THLS-32 (TSOY-32) scale was 4.17, while the maximum score was 50 and the average index score was $\overline{X}$= 34.33 ± 7.56. This value showed that the health literacy levels of the participants were found to be sufficient in general. In the following paragraph the abbreviated version of Health literacy (HL) was used.

While 175 (43.4 %) of the participants had a problematic HL level, 121 (30.0 %) had sufficient HL, 80 (19.9%) had excellent HL and 27 (6.7%) had insufficient HL. Considering the sub-dimensions of the THLS-32 (TSOY-32) scale, the average index score of the participants in the treatment and service sub-dimension was $\overline{X}$= 35.30 ± 7.70. This value showed that the participants had sufficient levels of health literacy in the treatment and service sub-dimension of the scale. Considering the sufficiency status of the participants in the treatment and service sub- dimension, 156 (38.7%) had sufficient HL, 129 (32.0%) had a problematic HL, 87 (21.6%) had an excellent HL and 31 (7.7%) insufficient HL level. With respect to the prevention of diseases sub-dimension of the scale, the average index score was $\overline{X}$= 33.36 ± 8.22. Considering the proficiency status of the participants in the dimension of disease prevention, 157 (39.0%) had a problematic HL level, 120 (29.8%) had sufficient HL level, 69 (17.1%) had an excellent HL level, and 57 (14.1%) had insufficient HL level. Table 5 displays the descriptive findings of the Vaccine Hesitancy Scale (VHS).

Table 5: Descriptive findings of VHS

VHS	n	Min.	Max.	$\overline{X}$ ± SS
Scale in general [1]	403	12.00	45.00	33.91(3.77) ± 5.40
Lack of confidence[2]	403	7.00	35.00	27.16(3.88) ± 4.73
Risks [3]	403	2.00	10.00	6.75(3.38) ± 1.26

[1](Item1, 9); [2](Item 1, 2, 3, 4, 6, 7, 8); [3](Item 5,9)

As seen in Table 5, the minimum score of the participants was 12, the maximum score was 45, and the mean score was $\overline{X}$= 33.91 (3.77) ± 5.40. Higher scores on this scale meant that vaccine hesitancy was low, it could be said that the participants generally had a moderate level of hesitation about vaccination. With regard to the sub-dimensions of the scale, the average scores of the participants were $\overline{X}$= 27.16 (3.88) ± 4.73 in the dimension of lack of confidence and $\overline{X}$= 6.75 (3.38) ± 1.26 in the dimension of risks. The findings showed a moderate level of hesitation in both dimensions of the scale.

Within the scope of the research, the correlation values between the vaccine hesitancy and health literacy levels of the participants were calculated and the results are given in Table 6.

Table 6: The results of Pearson Product-Moment Correlation Analysis according to the relationship between participants' health literacy levels and vaccine hesitancy

Scale	VHS	THLS-32 (TSOY-32)	THLS-32 (TSOY-32) treatment and service	THLS-32 (TSOY-32) prevention of diseases
VHS	1			
THLS-32 (TSOY-32)	.19**	1		
THLS-32 (TSOY-32) treatment and service	.21**	.95**	1	
THLS-32 (TSOY-32) disease prevention	.16**	.95**	.80**	1

As seen in Table 6, there was a low level of positive correlation between the mean scores obtained from the health literacy scale and the mean scores obtained from the vaccine hesitancy scale. (r=.19; p<.01). However, a high mean score on the vaccine hesitancy scale meant a low vaccine hesitancy level. Therefore, it could be concluded that as the health literacy level of the participants increased, the level of hesitation to vaccination decreased.

A similar situation was obtained for the treatment and service (r=.21; p<.01) and disease prevention (r=.16;

p<.01) as sub-dimensions of the THLS -32(TSOY-32) scale. In addition to these findings, there was a positive and significant relationship observed between general level of health literacy of the participants and the sub-dimensions of treatment and service (r=.95; p<.01) and disease prevention (r=.80; p<.01).

Additionally, it was studied whether the level of vaccine hesitancy and health literacy were differed according to socio-demographic factors.

Vaccine hesitancy and health literacy levels of the participants were compared according to their gender to see how average scores were differed and the results analysis are given Table 7.

Table 7: Independent-Sample T-test results of the comparison of participants' vaccination hesitancy and health literacy levels by gender

Scale	Factors	Gender	n	$\bar{X} \pm SS$	t	df	p
THLS-32 (TSOY-32)	Scale, general	Male	133	34.01 ± 7.29	-0.60	401	.551
		Female	270	34.49 ± 7.69			
	Treatment and service	Male	133	34.84 ± 7.71	-0.84	401	.400
		Female	270	35.53 ± 7.70			
	Disease prevention	Male	133	33.19 ± 7.72	-0.31	401	.758
		Female	270	33.45 ± 8.47			
VHS	Scale, general	Male	133	34.49 ± 5.72	1.51	401	.131
		Female	270	33.63 ± 5.22			

As seen in Table 7, the participants' THLS-32 (TSOY-32) scale general index scores (t=-0.60; p>.05) and treatment and service (t=-0.84; p>.05) and disease prevention (t=-0.31; p> .05) sub-dimensions did not show a statistically significant difference according to their gender. The findings indicated that the health literacy levels of male and female participants were similar and sufficient. Similarly, the vaccination hesitancy levels of the participants did not show a statistically significant difference according to their gender (t=1.51; p>.05). The findings showed that the vaccine hesitancy levels of female and male were similar.

Within the scope of the research, the vaccination hesitancy and health literacy levels of the participants were compared according to their ages and the findings were shown in Table 8.

Table 8: The results of One-Way Analysis of Variance (ANOVA) Test for gender

Scale	Factors	Age	n	$\bar{X} \pm SS$	df	F	p
THLS-32 (TSOY-32)	Scale, general	18-23	75	35.06 ± 7.62	8-394	0.66	.729
		24-29	35	34.70 ± 7.64			
		30-35	25	34.23 ± 7.32			
		36-41	22	33.05 ± 7.44			
		42-47	23	33.97 ± 6.06			
		48-53	37	32.93 ± 8.99			
		54-59	52	33.97 ± 7.10			
		60-65	117	35.02 ± 7.69			
		66 and above	17	32.11 ± 6.99			
	Treatment and service	18-23	75	35.90 ± 7.30	8-394	0.60	.779
		24-29	35	35.18 ± 7.27			
		30-35	25	35.08 ± 8.07			
		36-41	22	33.99 ± 7.79			
		42-47	23	34.92 ± 6.31			
		48-53	37	34.32 ± 8.82			
		54-59	52	35.24 ± 7.68			
		60-65	117	36.03 ± 7.92			
		66 and above	17	32.66 ± 7.87			
	Disease prevention	18-23	75	34.21 ± 8.83	8-394	0.67	.715
		24-29	35	34.23 ± 8.70			
		30-35	25	33.37 ± 8,67			
		36-41	22	32.10 ± 8.07			
		42-47	23	33.01 ± 6.47			
		48-53	37	31.53 ± 9.41			
		54-59	52	32.71 ± 7.24			
		60-65	117	34.00 ± 8.14			

Scale	Factors	Age	n	$\overline{X} \pm SS$	df	F	p
		66 and above	17	31.56 ± 7.03			
VHS	Scale, general	18-23	75	32.60 ± 5.27	8-394	1.84	.069
		24-29	35	32.40 ± 5.98			
		30-35	25	33.28 ± 5.63			
		36-41	22	34.59 ± 6.12			
		42-47	23	34.74 ± 5.38			
		48-53	37	33.05 ± 6.12			
		54-59	52	34.88 ± 5.11			
		60-65	117	34.81 ± 4.72			
		66 and above	17	34.41 ± 5.92			

As seen in Table 8, the participants' index scores obtained from THLS-32 (TSOY-32) (F=0.66; p>.05), subdimensions of treatment & service (F=0.60; p>.05) and disease prevention (F=0.67; p>.05) did not show a statistically significant difference according to the age of the participants. The findings showed that, in general, the health literacy levels of the participants of different ages were similar and sufficient.

Similarly, the vaccination hesitancy levels of the participants did not show a statistically significant difference according to their age (F=1.84; p>.05).

Within the scope of the research, the vaccination hesitancy and health literacy levels of the participants were compared according to their educational status (One -way ANOVA), and the findings are displayed in Table 9.

Table 9: Results of One-Way Variance Analysis (ANOVA) Test for educational status

Scale	Factors	Education	n	$\overline{X} \pm SS$	Df	F	p	η^2	Diff.
THLS-32 (TSOY-32)	Scale, general	High school	63	34.43 ± 7.39	4-393	5.19	.000**	0.05	4>1 5>1
		Associate degree	47	32.25 ± 7.14					
		University degree	184	33.29 ± 7.34					
		Master's degree	75	36.98 ± 6.85					
		Doctorate	29	37.03 ± 9.57					
	Treatment and Service	High School	63	35.19 ± 7.10	4-393	6.05	.000**	0.06	4>1 5>1
		Associate degree	47	32.62 ± 7.55					
		University degree	184	34.36 ± 7.54					
		Master's degree	75	38.03 ± 7.03					
		Doctorate	29	38.61 ± 9.49					
	Disease prevention	High School	63	33.68 ± 8.43	4-393	3.71	.006**	0.04	4>1 5>1
		Associate degree	47	31.87 ± 7.50					
		University degree	184	32.21 ± 8.05					
		Master's degree	75	35.93 ± 7.40					
		Doctorate	29	35.45 ± 10.39					
VHS	Scale, general	High School	63	32.67 ± 5.25	4-393	4.68	.001**	0.05	4>1 5>1
		Associate degree	47	32.17 ± 5.07					
		University degree	184	33.78 ± 5.21					
		Master's degree	75	35.25 ± 5.19					
		Doctorate	29	36.17 ± 6.52					

As seen in Table 9, the average score of participants obtained from the HLS (F=5.19; p<.01) as well as from subdimensions of treatment & service (F=6.05; p<.01) and disease prevention (F=3.71; p<.01) shows a statistically significant difference according to the educational status of participants. LSD from multiple comparison tests was used to determine the source of the difference. According to the findings, it was concluded that the health literacy levels of the participants with master's and doctoral education levels were higher than the participants with high school education in both the general THLS-32 (TSOY-32) and the sub-dimensions of treatment, service and disease prevention. In general, as the level of education increased, the level of health literacy increased as well.

When the vaccination hesitancy levels of the participants were taken into account, a statistically significant difference was obtained according to their educational status (F=4.68; p<.01).

According to the results of the LSD test performed to determine the source of the difference, the vaccine hesitancy levels of the participants with master's and doctoral education were lower than the participants with high school degree (A high score from the scale indicates that vaccine hesitancy is low). The findings generally showed that as the education level of the participants increased, the level of hesitancy about getting vaccinated decreased.

Within the scope of the research, vaccine hesitancy and health literacy levels of the participants were

compared according to their employment status (ANOVA Test) and the findings are given in Table 10.

Table 10: Results of One-Way Variance Analysis (ANOVA) Test for employment status

Scale	Factors	Employment Status	n	$\bar{X} \pm SS$	Df	F	p	η^2	Diff.
THLS-32 (TSOY-32)	Scale, general	Retired	108	33.61 ± 6.51	3-399	0.95	.416	---	---
		Employed	193	34.77 ± 8.13					
		Unemployed	65	34.88 ± 8.06					
		Student	37	33.16 ± 6.22					
	Treatment and Service	Retired	108	34.69 ± 7.06	3-399	0.71	.546	---	---
		Employed	193	35.70 ± 8.33					
		Unemployed	65	35.74 ± 7.69					
		Student	37	34.21 ± 6.00					
	Disease Prevention	Retired	108	32.53 ± 6.82	3-399	1.00	.388	---	---
		Employed	193	33.85 ± 8.81					
		Unemployed	65	34.02 ± 8.94					
		Student	37	32.12 ± 7.37					
VHS	Scale, general	Retired	108	34.78 ± 4.49	3-399	3.23	.022*	0.02	
		Employed	193	34.13 ± 5.83					1>3
		Unemployed	65	32.40 ± 5.34					2>3
		Student	37	32.89 ± 5.03					

*p <.05; Criteria: 1: Retired 2: Employed 3: Unemployed; 4: Student

As seen in Table 10, according to the participants' THLS-32 (TSOY-32) scale general index scores (F=0.95; p>.05) and the scores obtained from sub-dimensions of treatment & service (F=0.75; p>.05) and disease prevention (F=1.00; p>.05) did not show a statistically significant difference according to their employment status. The findings showed that, in general, the health literacy levels of the participants did not differ according to the employment status. The scores were found similar and sufficient.

Considering the vaccination hesitancy levels of the participants, a statistically significant difference was obtained according to their employment status (F=3.23; p<.05). According to the results of the LSD test conducted to determine the source of the difference, the vaccination hesitancy levels of the retired and working participants were lower than the participants who did not work at all (A high score from the scale indicates that vaccine hesitancy is low).

Within the scope of the research, vaccination hesitancy and health literacy levels of the participants were compared according to whether they had a chronic disease or not (ANOVA Test) and the findings are displayed in Table 11.

Table 11: Results of One-Way Variance Analysis (ANOVA) Test for Chronic diseases

	Factors	Chronic diseases	n	$\bar{X} \pm SS$	t	df	p
THLS-32 (TSOY-32)	Scale, general	Yes	89	33.66 ± 6.61	-1.05[1]	164.13	.296
		No	314	34.52 ± 7.80			
	Treatment and Service	Yes	89	35.05 ± 7.18	-0.34	401	.736
		No	314	35.37 ± 7.85			
	Disease prevention	Yes	89	32.26 ± 7.11	-1.59[1]	166.03	.113
		No	314	33.68 ± 8.49			
VHS	Scale, general	Yes	89	34.28 ± 5.86	0.73	401	.464
		No	314	33.81 ± 5.26			

[1]Equal variances not assumed

As seen in Table 11, the participants' THLS-32 (TSOY-32) scale general index scores (t=-1.05; p>.05) and the sub-dimensions of treatment and service (t=-0.34; p>.05) and disease prevention (t=-1.59; p> .05) did not show a statistically significant difference according to whether they had a chronic disease or not. The findings showed that the health literacy levels of the participants were similar and sufficient, regardless of whether they had a chronic disease or not.

Similarly, the vaccination hesitancy levels of the participants did not show a statistically significant difference according to their chronic disease status (t=0.73; p>.05). The findings showed that the level of hesitancy about vaccination was similar, regardless of whether the participants had a chronic disease or not.

Within the scope of the research, vaccine hesitancy and health literacy levels of the participants were compared according to their income status and the findings are given in Table 12.

Table 12: Results of One-Way Variance Analysis (ANOVA) Test for Income

Scale	Factors	Income Status	n	$\bar{X} \pm SS$	Df	F	p	η^2	Diff.
THLS-32 (TSOY-32)	Scale, general	Income less than expenditures	94	32.92 ± 7.77	2-400	4.04	.018*	0.02	3>1
		Income equals to expenditures	164	33.98 ± 7.23					
		Income more than expenditures	145	35.64 ± 7.62					
	Treatment and Service	Income less than expenditures	94	33.93 ± 7.80	2-400	4.11	.017*	0.02	3>1
		Income equals to expenditures	164	34.86 ± 7.36					
		Income more than expenditures	145	36.67 ± 7.85					
	Disease Prevention	Income less than expenditures	94	31.91 ± 8.70	2-400	3.23	.040*	0.02	3>1
		Income equals to expenditures	164	33.10 ± 7.84					
		Income more than expenditures	145	34.60 ± 8.20					
VHS	Scale, General	Income less than expenditures	94	32.77 ± 5.20	2-400	3.03	.050	---	---
		Income equals to expenditures	164	34.06 ± 5.31					
		Income more than expenditures	145	34.48 ± 5.54					

As seen in Table 12, the participants' scale general index scores (F=4.04; p<.05) and sub-dimensions of treatment and service (F=4.11; p<.05) and disease prevention (F=3.23; p<.05) showed a statistically significant difference according to their income status. According to the results of the LSD test, which was conducted to determine the source of the difference, it was concluded that the health literacy levels of the participants whose income was higher than their expenses were higher than the participants whose income was lower than their expenses, both in the overall THLS-32 (TSOY-32) and in the sub-dimensions of treatment, service and disease prevention. In general, as the income level of the participants increased, their health literacy levels increased.

Considering the vaccination hesitancy levels of the participants, a statistically significant difference was obtained according to their job status (F=3.23; p<.05). According to the results of the LSD test conducted to determine the source of the difference, the vaccination hesitancy levels of the retired and working participants were lower than the participants who were unemployed (high score from the scale indicates that the vaccine hesitancy is low). Table 13 shows One-Way Analysis of Variance on the comparison of participants' vaccination hesitancy levels according to THLS-32 (TSOY-32) proficiency categories.

Table 13: Comparison of participants' vaccination hesitancy levels according to THLS -32 proficiency categories

THLS-32 (TSOY-32)	n	$\bar{X} \pm SS$	df	F	p	η^2	Difference
Insufficient	27	30.66 ± 6.03	3-399	5.41	.001**	0.04	3>1
Problematic	175	33.48 ± 4.84					4>1
Sufficient	121	34.55 ± 4.57					4>2
Excellent	80	34.98 ± 6.86					

**p <.01; Criteria: 1: Insufficient; 2: Problematic-limited; 3: Sufficient; 4: Excellent

As seen in Table 13, the vaccination hesitancy levels of the participants showed a statistically significant difference according to the THLS-32 (TSOY-32) proficiency categories (F=5.41; p<.01).

According to the results of the LSD test conducted to determine the source of the difference, the average scores of the participants with Excellent and Sufficient health literacy from the vaccine hesitancy scale were higher than the average scores of the participants with insufficient health literacy. However, since high scores from the vaccine hesitation scale showed that hesitancy was low, the findings showed that as the health literacy levels of the participants increased, their hesitations about vaccination decreased.

5. Discussion and Conclusion

This study showed that there was a weak positive relation between health literacy and vaccine hesitancy considering the average general scores of both scales with subdimensions. However, a high mean score on the vaccine hesitancy scale meant low vaccine hesitancy. Therefore, it could be concluded that as the health literacy level of the participants increased, the level of hesitation to vaccination decreased. A similar situation was obtained between subdimensions of THLS-32 (TSOY-32) (treatment and service ($r=.21$; $p<.01$), disease prevention ($r=.16$; $p<.01$)) and vaccine hesitancy. In addition to the weak relationship between health literacy and vaccine hesitancy, another analysis was done to compare the participants' vaccine hesitancy according to the level of proficiency of health literacy. According to this analysis, we found that health literacy was negatively associated with vaccine hesitancy. So far, the relationship between health literacy and vaccination has been investigated only to a limited extent. The studies focused on the topic were all fairly new. Although any specific vaccine was not mentioned in this study, the participants might have considered the Covid-19 vaccine when answering the questions due to on-going concern of Covid-19 pandemic.

According to a systematic review on health literacy and vaccination, the relationship between health literacy and vaccinations remained unclear. The reasons for this was the lack of published studies, and the differences in the research tools used in research studies to assess health literacy, the target populations, and the outcome measures (Lorini, et al, 2018). The evidence suggested that more people have limited health literacy than it was assumed. In light of weak positive relationship between health literacy and vaccine hesitancy, it could be suggested that as health literacy level of the participants increased, the level of hesitation to vaccination decreased. Therefore, we accepted Hypothesis 1. According to population data from the US, nearly half of the American adult population may have difficulties in acting on health information (Nielsen- Bohman, 2004). In Europe, the findings from the recent European Health Literacy Survey (Sorensen, et al.2015) indicated that 12% of the people who participated in in survey had insufficient general health literacy, and 35% have problematic health literacy. Although the prevalence of problematic health literacy varied widely between countries (between 2% insufficient health literacy in the Netherlands versus 27% in Bulgaria) and between groups within populations, it was clear that health literacy was not just a problem of a small minority (Kitcbush, et, al, 2013). Our study was conducted among the Turkish population and the results showed that the index score of health literacy fell into a sufficient category of health literacy.

According to the classification of health literacy average index scores, in this study while 43% of the respondents fell into a problematic category, 30% were in the sufficient and about 20% were in the excellent categories. However, according to the study conducted in 2019 using the THLS-32 (TSOY-32) scale, the results showed that 57.9% of the participants had insufficient health literacy level (Ozdemir, et, al, 2020).

In terms of socio-demographic factors in this study, the findings indicated that the health literacy levels of male and female participants were similar and sufficient. On contrary to our findings, in another study health literacy was affected by the gender factor. Considering the effects of women's health behaviors on the health of family members, improving women's health literacy would be meaningful in terms of community health promotion strategies (Janicke, et al, 2001). Similar to the findings of health literacy, there was no statistically significant difference between genders in terms of vaccine hesitancy in our study. The findings of our research showed that, in general, the health literacy levels of the participants of different ages were similar and sufficient. Similarly, the vaccination hesitancy levels of the participants did not show a statistically significant difference according to their age. Regarding the level of education, it was concluded that the health literacy levels of the participants with master's and doctoral education levels were higher than the participants with high school education in both the general THLS-32 (TSOY-32) and the sub-dimensions of treatment, service and prevention of diseases of the scale. In general, as the level of education increased, the level of health literacy increased as well. In this study, the findings showed that, in general, the health literacy levels of the participants did not differ according to their employment status. The scores were found similar and sufficient. In terms of patients having a chronic condition, the findings showed that the health literacy levels of the participants were similar and sufficient, regardless of whether they had a chronic disease or not. In terms of income status, it could be concluded that the health literacy levels of the participants whose income was higher than their expenses were higher than the participants whose income was lower than their expenses, both in the overall THLS-32 (TSOY-32) and in the sub-dimensions of treatment, & service and disease prevention. Therefore, it could be concluded that some of socio-demographic factors such as education and income were differed according to the level of health literacy. Therefore, Hypothesis 2 was partially accepted.

In order to measure the level of health literacy in European countries, the study was carried out in Germany, Austria, Bulgaria, Netherlands, Ireland, Spain, Poland and Greece. According to the results, 47.6% of the participants of the European Health Literacy (HLS-EU) multinational study, which used the Health Literacy Survey - European Union (HLSEU) survey, showed limited level of health literacy in Spain, Poland and Greece as opposed to other countries. As a result of the study, it was found that overall health literacy was low and there were differences in health literacy between countries. The number of studies conducted in middle and low income

countries was somewhat limited. Most of studies involving health literacy were conducted in high income countries. Similar to the findings of health literacy, the vaccination hesitancy levels did not differ according to the most of socio-demographic factors. With respect to vaccine hesitancy, among all the socio-demographic factors only, education and employment status were differed. The vaccine hesitancy levels of the participants with master's and doctoral education were lower than the participants with high school degree. Higher education may be associated with both lower and higher levels of vaccine acceptance (Larson, et al, 2014). Vaccine hesitancy levels of the retired and working participants were lower than the unemployed participants. In light of these findings, we partially accepted the Hypothesis 3. According to the study conducted in Egypt, elderly people and those with chronic diseases reported more positive attitude towards vaccination (Hussein, et al, 2022). However, the findings from our research were not in consensus with the findings of the study conducted in Egypt. In another study that was conducted among the students of medicine faculty, it was found that there was no statistically significant relationship between the students' attitudinal scores toward vaccination and their socio-demographic characteristics such as gender, income status, and educational status of their parents (Alicilar, et al, 2022). However, we found that vaccine hesitancy level differed according to education and employment status of participants.

There is a greater need to conduct new studies using multiple measurement tools that are specific to vaccine literacy and those used to measure general Health Literacy. The need for improvement of health literacy is essential for all countries to minimize vaccine hesitancy. Government efforts should be directed to increase the education level of population. As education level increases the level of health literacy will increase, leading to higher vaccination acceptance among the population.

Limitations

When interpreting the results we had to be aware of the limitations of the study. The first one was this was only one time survey conducted during the Covid-19 pandemic. Perceptions about Covid-19 vaccine might have influenced the respondents when answering the scale questions, even though there were no specific questions related to Covid-19 vaccine in the scales. Another limitation of this research was that the higher percentage (29%) of the respondents whose ages were between 60-65. This might have prevented representation of other age groups.

Conflict of Interest

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Short Biographies

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She started her career in the microbiology quality control department of pharmaceutical companies. After completing her degree in the International Business Specialization which was equivalent to MBA at the Institute of Business and Economics in the Istanbul University, she moved into marketing department in the pharmaceutical industry and led the teams of product managers specializing in gynecology, radiology, and cancer. She launched many pharmaceutical products into Turkish pharmaceutical market and all achieved the category leadership